FACULTY OF SCIENCE
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Contaminated sites review

STAGE TWO INTERIM REPORT

Stage Two of Review of the New South Wales Environment Protection Authority's (NSW EPA) Management of Contaminated Sites—the NSW EPA's past and future management of PFOS/PFOA

Review authors

Professor Mark Patrick Taylor, BSc (Hons), PhD
Independent Reviewer of the NSW EPA's Management of Contaminated Sites
Department of Environmental Sciences
Faculty of Science and Engineering
Macquarie University, Sydney 2109,
New South Wales, Australia

Isabella Cosenza, BA, LLB (Hons I), LLM, Grad Dip Legal Practice, Dip Book Editing and Publishing
Consultant to Review of the NSW EPA's Management of Contaminated Sites

Review email: contamsitesreview@mq.edu.au

DEPARTMENT OF
ENVIRONMENTAL SCIENCES
Faculty of Science and Engineering

Macquarie University
NSW 2109 Australia
T: +61 (2) 9850 8382
F: +61 (2) 9850 8420
mq.edu.au

ABN 90 952 801 237

MACQUARIE University
SYDNEY·AUSTRALIA

28 April 2016

The Hon Mark Speakman
Minister for the Environment
GPO Box 5341
Sydney NSW 2001

Dear Minister

Review of the New South Wales Environment Protection Authority's Management of Contaminated Sites

On 16 September 2015 you issued Terms of Reference for a Review of the New South Wales Environment Protection Authority's (NSW EPA) management of contaminated sites. The reporting dates in the Terms of Reference were subsequently extended.

The Review is pleased to present you with its Stage Two Interim Report on the NSW's EPA's past and future management of sites contaminated with perfluorooctane sulfonate/perfluorooctanoic acid (PFOS/PFOA) pursuant to the fourth Term of Reference.

Yours sincerely

Professor Mark Patrick Taylor, BSc (Hons), PhD
Independent Reviewer of the NSW EPA's Management of Contaminated Sites
Dept of Environmental Sciences
Faculty of Science & Engineering
Macquarie University, Sydney
Tel: 0422 940 916

Isabella Cosenza, BA, LLB (Hons I), LLM, Grad Dip Legal Practice, Dip Book Editing and Publishing
Consultant to Review of the NSW EPA's Management of Contaminated Sites

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List of Interim Findings and Interim Recommendations

Sections 6 and 7 of this Interim Report set out the Interim Findings and Interim Recommendations together with supporting facts and reasons. The list below should be read in conjunction with those sections.

Interim Findings

General findings on PFOS/PFOA

1. Since at least 2000, there has been growing acceptance by government, industry and science that PFOS/PFOA are persistent, bioaccumulative and toxic to both wildlife and humans. The 'safe' level of exposure and its specific causal link to human health outcomes remain under debate.

2. The status of PFOS and PFOA as emerging contaminants has not deterred international environmental regulators from setting relevant guidelines for soil and water for these contaminants.

3. The absence of Australian PFOS/PFOA guidelines has not deterred Victorian and Western Australian environmental regulators from setting interim guidelines for soil and water for these contaminants.

The NSW EPA's past management of PFOS/PFOA contaminated sites, both known and unknown

4. In the absence of an express regulatory requirement under the *Contaminated Land Management Act 1997* (NSW) or the *Protection of the Environment Operations Act 1997* (NSW), industry in NSW has voluntarily added PFOS/PFOA to the suite of contaminants to be tested during site assessment.

5. The absence of Australian guidelines has led government bodies and industry to utilise a range of PFOS/PFOA criteria for contaminated site investigations including those conducted in NSW.

6. The absence of Australian guidelines has prompted government bodies and industry to initiate projects to develop PFOS/PFOA screening criteria for contaminated site investigations including those conducted in NSW.

7. A lack of guidelines may have meant that sites potentially contaminated with PFOS/PFOA have not been notified because there are no national trigger values upon which the NSW EPA can rely.

8. The NSW EPA could have acted earlier in developing or adopting interim guidelines for the assessment of PFOS/PFOA in the environment to promote a consistent approach in NSW.

9. Capability for PFOS analysis was available in Australia since at least 2005. Therefore this was not a limiting factor to developing environmental or ecological effects-based guidelines.

10. The sites known to be contaminated by PFOS/PFOA represent a very small fraction of the total number of contaminated sites notified to the NSW EPA.

11. In relation to the three known sites regulated by the NSW EPA that are contaminated, inter alia, by PFOS/PFOA, there is evidence of the NSW EPA:

    (a) setting clear timeframes for the provision of relevant site information, and taking positive steps in addressing contamination; and
    (b) responding comparatively slowly to notification of contamination and omitting to set clear timeframes for the provision of relevant site information.

12. In some instances the NSW EPA engaged proactively at a comparatively early stage with the issue of emerging contaminants, including PFOS/PFOA.

13. Despite the NSW EPA's early engagement with NSW fire services as early as July 2011 to ascertain the extent of PFOS use in NSW at their sites, it appears that the issue was not followed up until late 2015.

Engagement with Commonwealth sites known to be contaminated by PFOS/PFOA

14. In relation to the Commonwealth sites known to be contaminated by PFOS/PFOA, there is some evidence of the NSW EPA responding in a positive and timely manner to the notification of contamination.

The NSW EPA's ongoing and future management of sites potentially or actually contaminated by PFOS/PFOA

15. In June 2015, the NSW EPA Chair and CEO demonstrated leadership on the issue of PFOS and emerging contaminants at the Senior Officials Group meeting for state and Commonwealth environmental portfolios.

16. The NSW EPA's future PFC program is a structured and appropriate response to addressing the identification and potential risk of harm from PFCs.

17. The absence of NSW or Australian PFOS/PFOA trigger/criteria levels may limit the regulatory traction of the NSW EPA's future PFC program.

18. The absence of guidelines for emerging contaminants other than PFOS/PFOA is a potential constraint for effective future regulatory intervention at contaminated sites.

Knowledge strategies

19. It appears that information on PFOS/PFOA provided by NICNAS (National Industrial Chemical Notification and Assessment Scheme) to the NSW EPA since 2002 did not stimulate any significant early regulatory response.

20. The NSW EPA received the six NICNAS alerts relating to PFOS/PFOA issued between 2002 and 2008. However, some regional NSW EPA officers who were dealing with PFOS/PFOA contamination were not aware of these alerts.

Interim Recommendations

The Review made Interim Recommendations 1 and 2 below in its Stage One Interim Report. However, the Stage Two Interim Findings and supporting facts have reinforced the need for the Review to repeat these Interim Recommendations.

The Review recommends:

1. The NSW EPA, in consultation with relevant government authorities and scientific experts, should set interim guidelines for PFOS/PFOA for a range of environmental samples including soil, sediment and groundwater, as a matter of priority, pending finalisation of national guidelines.

2. The NSW Government should engage with the Commonwealth Government, to consult with other relevant government agencies and scientific experts, to develop and set national guidelines for PFOS/PFOA for a range of environmental samples, including soil, sediment groundwater and surface water.

3. Further to Interim Recommendation 3 in the Review's Stage One Interim Report, the NSW EPA Chair and CEO, together with leaders of other Australian state and territory environment protection authorities, should develop an options paper for consideration by the Meeting of Environment Ministers for regulating Commonwealth agencies that may cause contamination on non-Commonwealth land.

4. The NSW EPA should develop a protocol for the staged escalation of issues where the polluter falls outside the jurisdiction of the NSW EPA or other state agencies and potential exposure pathways exist that could impact the environment or human health.

5. The NSW EPA should be resourced to execute all aspects of its future PFC and emerging contaminants programs.

6. The NSW EPA should consider requiring, at least in the short-term (e.g. 12 months), relevant environment protection licence holders to undertake environmental sampling and analysis for PFCs on- and off-site as part of their licence conditions.

7. The NSW EPA should consider, as part of its future program on PFCs, capturing data relating to NSW PFC environmental sample results in a single data portal.

8. The NSW Government should engage with the Commonwealth Government, to consult with other relevant government agencies and scientific experts, to initiate the process of developing national guidance on emerging contaminants, other than PFCs, such as those listed on the Stockholm Convention.

9. The NSW EPA should consider requiring relevant environment protection licence holders to undertake environmental sampling and analysis for emerging contaminants, other than PFCs, as part of their licence conditions.

10. The NSW EPA should revisit its knowledge strategy and its internal dissemination of relevant regulatory and scientific information about, inter alia, emerging contaminants.

SECTION 1

Introduction to Stage Two Interim Report

Disclaimer: *This Stage Two Interim Report is subject to change. The chronologies, Interim Findings and Interim Recommendations are based on the documents and information the Review has been able to research, obtain, review and analyse in the timeframe leading to the reporting date. The Review will continue to consult and liaise with the New South Wales Environment Protection Authority (NSW EPA) and other relevant stakeholders prior to submitting its final Report.*

1.1 Terms of Reference

The Terms of Reference for the Review are:

1. Review the EPA's implementation of the findings of the Auditor-General's report of 10 July 2014 into managing contaminated sites.
2. Make any recommendations deemed appropriate regarding the EPA's management of contaminated sites.
3. Provide an interim report with any recommendations deemed appropriate regarding the EPA's past management of the Williamtown RAAF base by 14 December 2015.
4. Provide an interim report with any recommendations deemed appropriate regarding the EPA's past and future management of perfluorooctane sulfonate/perfluorooctanoic acid (PFOS/PFOA) contaminated sites, both known and unknown by 14 March 2016.[1]

The Review's Stage One Interim Report of 14 December 2015 was completed pursuant to the third Term of Reference.[2] This Stage Two Interim Report has been completed pursuant to the fourth Term of Reference.[3] The Review's final Report will finalise both interim reports. In addition, it will address the first and second Terms of Reference.

1.2 Review process

The Review process to date has involved:

- conducting research, including in relation to the key milestones involving knowledge about the risks posed by PFOS/PFOA
- requesting information from a number of agencies and organisations including the NSW EPA, the Commonwealth Departments of the Environment and Defence, NICNAS (National Industrial Chemicals Notification and Assessment Scheme), DPI Fisheries, DPI Water, CRC Care, 3M, and NATA (National Association of Testing Authorities, Australia)[4]
- consulting with a number of stakeholders[5]
- seeking specific comments on the Stage One Interim Report, including from the NSW EPA, the Department of Defence, Hunter Water Corporation, DPI Fisheries, DPI Water, NSW Health and the NSW Chief Scientist and Engineer[6]

[1] Hon. Mark Speakman, Minister for the Environment, Media Release 16 September 2015, available at: http://www.epa.nsw.gov.au/resources/MinMedia/EPAMinMedia15091601.pdf (accessed 16 March 2015). The reporting dates initially announced were subsequently extended.
[2] Stage One Interim Report on Williamtown RAAF Base contamination is available at: http://www.epa.nsw.gov.au/MediaInformation/taylor-report-williamtown.htm (accessed 29 February 2016).
[3] There is some overlap between the third and fourth Terms of Reference.
[4] Some of the information provided by DPI Water and the Commonwealth Departments of the Environment and Defence are relevant to the third Term of Reference on Williamtown and will be included in the final Report.
[5] See Appendix A for the list of persons and organisations consulted. The list includes consultations undertaken to date in respect of both the third and fourth Terms of Reference. Information obtained in consultations conducted after 14 December 2015 specifically relevant to the third Term of Reference (contamination at Williamtown) will be incorporated in the final Report.

- providing the opportunity to NICNAS and the NSW EPA to undertake fact checking. The NSW EPA undertook a fact check of Sections 1–5. NICNAS undertook a fact check of the entries in the Section 2 chronology that specifically related to NICNAS.

Information and document production by the NSW EPA

The table below outlines the key dates in relation to Stage 2 that:

- the Review sought information from the NSW EPA; and
- the NSW EPA provided information to the Review.

Date	Event
24 Nov 2015	The Review requested information from the NSW EPA.
23 Dec 2015	The NSW EPA responded to the 24 November 2015 request.
19 Jan 2016	Following analysis of the 23 December 2015 response, the Review requested further information.
12 Feb 2016	The NSW EPA responded to the 19 January 2016 request.
17 Feb 2016	The NSW EPA responded to questions raised by the Review following the Review's consultations with the NSW EPA Chief Environmental Regulator on 19 January 2016 and the NSW EPA's Hunter Regional Office on 21 January 2016.
24 Feb 2016	Following analysis inter alia of the 12 February 2016 response, the Review sought further information.
25 Feb 2016	The NSW EPA responded to the 24 February 2016 request.
29 Feb 2016	The Review requested further information.
29 Feb 2016	The NSW EPA supplied supporting information in response to the 29 February 2016 request.
8 March 2016	The NSW EPA provided further information.
11 Mar 2016*	In response to an opportunity to fact check Section 3 of this Interim Report, the NSW EPA provided the Review with further information.

*The Review was not able to consider the information received from the NSW EPA on 11 March 2016 because it was in its final stages of writing this Interim Report. That information which relates to the Fuchs, Wickham site and The Shell Company of Australia site,[7] will be considered in the drafting of the final Report.

1.3 Acknowledgements

The Review acknowledges the time and effort provided by staff of the agencies and organisations the Review has contacted. In particular, the Review acknowledges the NSW EPA's efforts

[6] The comments on the Stage One Interim Report received from the NSW EPA, the Department of Defence and Hunter Water Corporation will be incorporated in the final Report. Note, however, that *some* of the comments from the NSW EPA on the Stage One Interim Report have been included in this Stage Two Interim Report.
[7] See Section 3 of this Interim Report.

(including the NSW EPA Board) in accommodating its document requests and providing time to explain matters to assist the Review.

1.4 The Interim Report structure

The Interim Report is structured as follows:

Section 1	Introduction to Stage Two Interim Report
Section 2	Background information on PFOS/PFOA
Section 3	Sites regulated by the NSW EPA containing PFOS/PFOA
Section 4	Commonwealth sites known to be contaminated by PFOS/PFOA
Section 5	The NSW EPA's ongoing and future management of sites potentially or actually contaminated by PFOS/PFOA
Section 6	Interim Findings with supporting facts
Section 7	Interim Recommendations with reasons
Appendix A	List of consultations
Appendix B	List of abbreviations.

SECTION 2

Background information on PFOS/PFOA

This section provides an overview of PFOS/PFOA and identifies key milestones illustrating knowledge of their risks to human and natural environments.

2.1 What are PFOS and PFOA?

Perfluorinated chemicals have a wide range of industrial applications because of their resistance to heat, water, and oil. Since the middle of the 20th century the compounds have been used for a myriad of industrial functions and consumer products. The affected products include carpets, clothing, upholstery, food paper wrappings, non-stick cookware, photographic materials, Scotchgard™ (and related goods used to protect fabrics), firefighting[8] foams and metal plating. Perfluorinated chemicals have been found at low levels in the environment (biota, soil and water), in human populations and wildlife in distal parts of the globe such as the Arctic.[9]

International research examining polyfluorinated compounds (PFCs), such as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), along with a number of other related compounds[10] has grown markedly since 2000 (Figure 1a, 1b).[11]

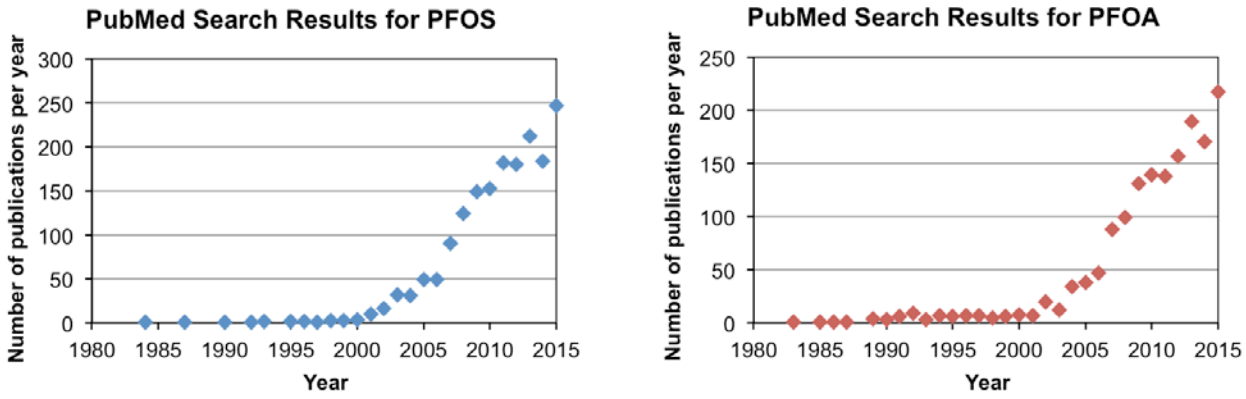

Figure 1. Publication search results from the PubMed database using the terms (a) PFOS and (b) PFOA, as at 29 February 2016.

The available information on PFOS/PFOA is significant and the international knowledge base is continuing to grow (Figure 1a, 1b). The depth of knowledge can be measured by searching research databases for peer-reviewed work on the topic. The Review searched the publicly available PubMed database[12]. The PubMed database 'comprises more than 25 million citations for biomedical literature from MEDLINE, life science journals, and online books.'[13] Searches for the terms 'PFOS', 'PFOA', 'PFOS ' and 'PFOA monitoring' were undertaken. The data returned

[8] The Review uses 'firefighting' unless a variant form namely, 'fire fighting' or 'fire-fighting' is contained within a quotation.
[9] Rigét, F., Bossi, R., Sonne, C., Vorkamp, K., Dietz, R. 2013. Trends of perfluorochemicals in Greenland ringed seals and polar bears: Indications of shifts to decreasing trends, *Chemosphere*, 93(8), 1607–1614.
[10] NICNAS 2016. Per- and poly-fluorinated alkyl substances (PFASs) also known as: per-and poly-fluorinated chemicals (PFCs). Australian Government, Department of Health, National Industrial Chemical Notification and Assessment Scheme (NICNAS). available at: https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/perfluorinated-chemicals-pfcs-factsheet (accessed 9 March 2016).
[11] Lindstrom, A.B., Strynar, M.J., Libelo, E.L. 2011. Polyfluorinated Compounds: Past, Present, and Future. *Environmental Science & Technology,* 45(19), 7954–7961.
[12] Available at: http://www.ncbi.nlm.nih.gov/pubmed (accessed 29 February 2016).
[13] Ibid.

showed a rise in PFOS and PFOA research over the last 15 years, reaching a total number of publications at the date of the search (29 February 2016) of 1794 and 1625, respectively.

Perfluorinated chemicals are known to be persistent, bioaccumulative and toxic. These facts have caused a rising number of national and international government agencies and industry bodies to ban or limit their use.[14] Although PFC compounds are both persistent and pervasive in numerous environmental media, specific human exposure pathways are not well understood and require further research.[15] Similarly, the 'safe' level of exposure and its specific causal link to human health outcomes remain under debate.[16,17]

Further investigation is warranted to assist in setting evidence-based criteria to mitigate environmental and human health harm.[18] Nevertheless, the environmental health literature is replete with examples of suspect chemicals that avoided proper regulation because of what the US National Research Council called the 'untested-chemical assumption'[19] (the absence of research demonstrating adverse effects obviates the requirement for regulatory action). There are recurrent themes in the environmental health research literature that demonstrate early concerns about various toxic chemicals and related compounds were justified—the effects of which only became apparent after extensive environmental and epidemiological research.[20,21,22]

2.2 Key milestones illustrating knowledge of risks posed by PFOS/PFOA to human and natural environments and actions taken

Notes:
1. Publicly available sources and those previously cited in the Review's Stage One Interim Chronology are provided.
2. Asterix (*) beside year in the chronology below indicates the entry is also in the Review's Stage One Interim Chronology.

Date	Event	Source
Since the 1940s	'The perfluorinated chemicals, PFOS and PFOA, and their close analogues, are quite old chemicals, with indications that they may have been used industrially since the 1940s'.	See Submission of National Industrial Chemicals Notification and Assessment Scheme (NICNAS) dated 11 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and

[14] See chronology at Section 2.2 of this Report, for example entries for 16 May 2000, 30 April 2003, 12 December 2006, 26 August 2009.
[15] Lindstrom, A.B., Strynar, M.J., Libelo, E.L. 2011. Polyfluorinated Compounds: Past, Present, and Future. *Environmental Science & Technology, 45*(19), 7954–7961.
[16] US EPA 2014. Health Effects Document for Perfluorooctane Sulfonate (PFOS). US EPA, Office of Water, EPA Document Number: 822R14002. Available at: https://peerreview.versar.com/epa/pfoa/pdf/Health-Effects-Document-for-Perfluorooctane-Sulfonate-(PFOS).pdf (accessed 13 March 2016).
[17] The Danish Environmental Protection Agency, 2015. Perfluoroalkylated substances: PFOA, PFOS and PFOSA. Environmental Project No. 1665, Available at: http://www2.mst.dk/Udgiv/publications/2015/04/978-87-93283-01-5.pdf (accessed 12 March 2016).
[18] Grandjean, P. and Clapp, R. 2014. Changing Interpretation of Human Health Risks from Perfluorinated Compounds, *Public Health Reports*, 129(6), 482–485. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4187289/ (accessed 9 March 2016).
[19] National Research Council, 2009. *Science and decisions: advancing risk assessment*. Washington: National Academies Press. Available at: http://www.nap.edu/catalog/12209/science-and-decisions-advancing-risk-assessment (accessed 25 February 2016).
[20] Lanphear, B. P., Vorhees, C. V., & Bellinger, D. C. 2005. Protecting Children from Environmental Toxins. *PLoS Medicine*, 2(3), e61. Available at: http://doi.org/10.1371/journal.pmed.0020061 (accessed 9 March 2016).
[21] Bellinger, D. C. 2011. The Protean Toxicities of Lead: New Chapters in a Familiar Story. *International Journal of Environmental Research and Public Health*, 8(7), 2593–2628. Available at: http://doi.org/10.3390/ijerph8072593 (accessed 9 March 2016).
[22] Grandjean, P. and Clapp, R. 2014. Changing Interpretation of Human Health Risks from Perfluorinated Compounds, *Public Health Reports*, 129(6), 482–485. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4187289/ (accessed 9 March 2016).

Date	Event	Source
		territory sites. Available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities/Submissions
***1970s to mid-2000s**	AFFF (aqueous film forming foam) containing PFOS/PFOA 'was in general use in fire training activities at the [RAAF Williamtown] base between early 1970s and mid-2000s'.	FAQ attached to letter dated 21 October 2014 from the Department of Defence (Defence) to the Office of Environment and Heritage (OEH).
July 1990	National Industrial Chemicals Notification and Assessment Scheme (NICNAS) established under the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cth) and is administered by the Australian Government Department of Health. The information from NICNAS assessments is widely available and can be accessed by members of the community, relevant industries and industry associations as well as by state, territory and other Commonwealth agencies'. On the commencement of NICNAS in 1990 [PFOS and PFOA] were among those with a history of use in Australia which were 'grandparented' (listed without further assessment) onto the Australian Inventory of Chemical Substances (AICS) … An industrial chemical that is not on AICS is a new chemical. New industrial chemicals including any new PFCs and PFC-related substances must be notified and assessed before being manufactured or imported in Australia … Like all chemicals initially listed on the AICS, 'grandparented' perfluorinated chemicals were unassessed, and there was limited knowledge of the risks associated with these chemicals nationally or internationally.	See Submission of NICNAS dated 11 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
***1991**	The *Protection of the Environment Administration Act 1991* (NSW) was passed, which established the NSW EPA.	Available at: http://www.legislation.nsw.gov.au
***June 1996**	NICNAS *Full Public Report on Amphoteric Fluoroalkyalmide Derivative (5965P*) stated: The fate of [AMF] Derivative (5965P) in fighting 'real fires' is problematical as it will depend on the size of the fire and the amount of water and foam needed to control the fire … For situations in which the AFFF or ATC products are used in training or testing of equipment the resultant foam/water mix would likely be contained in pits or other type of bunding. One situation that might be less well controlled is on airport tarmacs. In this instance the chemical may enter airport drains which could lead to storm water drains. It is the Federal Airports Corporation's responsibility to ensure that airport drains conform to local regulations. In effect, this requires an airport to install drains, traps and interceptor pits to prevent the loss of fuels, oils and other	Available at: https://www.nicnas.gov.au/__data/assets/pdf_file/0013/9004/NA240FR.PDF

Date	Event	Source
	contaminants from the airport in any uncontrolled fashion.	
21 Jan 1999	*3M study on Perfluorooctane Sulfonate: Current Summary of Human Sera, Health and Toxicology Data*. The executive summary stated in part: 3M has prepared this document to summarize the data related to the biological effects of perfluorooctane sulfonate (PFOS). It also presents current thinking on human health risk related to PFOS and includes information about future study plans. 3M Medical Department scientists and physicians, in consultation with outside experts, are the authors … Subchronic studies have been done in rats and primates. PFOS causes liver enzyme elevations and hepatic vacuolization in rats, and hepatocellular hypertrophy at higher doses. Higher doses also cause other GI toxicity, hematological abnormalities, weight loss, convulsions, tremors and death. Monkeys show anorexia, emesis, diarrhea, hypoactivity and at higher doses prostration, convulsions and death. Atrophy of exocrine cells in salivary glands and the pancreas, and lipid depletion in the adrenals is found at high doses in the monkey … Available information therefore suggests that no identifiable health risk to humans would be expected to occur at the PFOS levels found in blood bank or commercial serum samples.	The 3M study was referenced in the following document: http://www.atsdr.cdc.gov/HAC/pha/3M-CGF021805-MN/3M-CGF021805-MN_pt1.pdf The 3M study is available at: https://www.fluoridealert.org/wp-content/pesticides/pfos.fr.final.docket.0007.pdf
16 May 2000	3M announced its voluntary phase out of PFOS and its commitment to finding substitutes. Media release stated: 3M data supplied to [the US] EPA indicated that these chemicals are very persistent in the environment, have a strong tendency to accumulate in human and animal tissues and could potentially pose a risk to human health and the environment over the long term … At present, 3M is the only US manufacturer of PFOS. [The US] EPA will be contacting foreign governments and other chemical manufacturers, both domestically and internationally, to seek their support for a voluntary phaseout of PFOS and related chemicals.	See US EPA media release: http://yosemite.epa.gov/opa/admpress.nsf/0/33aa946e6cb11f35852568e1005246b4
Dec 2000	3M—which was the largest worldwide producer of PFOS chemicals—stopped manufacturing PFOS chemicals in December 2000 because of concerns about their persistence in the environment and long-term health and environmental effects.	See NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet
2002	NICNAS Alert on PFOS stated: The Australian Government Department of Health, through the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) was ***actively involved*** in the Organisation for Economic Co-operation and Development (OECD) assessment of PFOS. From July 2000, the OECD led an international collaboration on	See NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-

Date	Event	Source

	the scientific assessment of PFOS chemicals. ***This involved Australia*** and approximately 40 other parties including Canada, Japan, the US and the European Union (EU) and will facilitate a consistent approach worldwide to the concerns presented by PFOS chemicals.
	
	The OECD assessment of PFOS chemicals addressed the human, animal and environmental hazards of PFOS. It contained environmental exposure and fate, human monitoring and health hazard information. Occupational exposure, non-occupational exposure, epidemiology and animal toxicology studies of PFOS were also addressed.
	
	In November 2002, the OECD finalised the PFOS assessment report and addressed risk-based management of the chemical. NICNAS then considered regulatory actions to be taken on PFOS chemicals in Australia.
	
	In addition to the current OECD assessment of PFOS, NICNAS notes similar international concerns for PFOA and telomer chemistries which are utilised by a number of manufacturers. Both PFOA and telomers may be affected by ongoing reviews of these related chemistries. NICNAS recommends that users consider these comments when investigating PFOS alternatives.
	(Emphasis in bold added.)
	
	NICNAS advised the Review that:
	
	• Since the 2002 it sent Alerts to all state environmental authorities including the NSW EPA and OEH.
	• The NSW EPA has acknowledged receipt of such correspondence from NICNAS and has responded to requests for information on these chemicals.
	• Its alerts were (and continue to be) made public via the following mechanisms:
	  • NICNAS website – www.nicnas.gov.au.
	  • Australian Government Chemical Gazette http://www.nicnas.gov.au/communications/publications/chemical-gazette.
	
	In addition, NICNAS alerts were disseminated to the states and territories (including Occupational Health and Safety (OHS), public health and environmental agencies) via the Memorandum of Understanding (MOU) group (see entry for 12 September 2002) and also via regulatory linkages (see entry for 26 September 2003).
		which-they-are-based-alert-factsheet
		
		OECD link available at: http://www.oecd.org/chemicalssafety/risk-management/perfluorooctanesulfonatepfosandrelatedchemicalproducts.htm
		
		Consultation with NICNAS (Sydney, 8 February 2016) and advice from NICNAS to the Review.

Sept 2002	PFOS-based Scotchgard™ for protecting textiles was phased out in Australia.	See NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet

Date	Event	Source
12 Sept 2002	Annual Report Achievement through teamwork, Annual Report 2001–02 National Industrial Chemicals Notification and Assessment Scheme, which was transmitted to the Parliamentary Secretary to the Minister for Health and Ageing on 12 September 2002 noted: **NICNAS/State and Territory Memorandum of Understanding (MOU)** The MOU which exists between NICNAS and each state and territory allows for exchange of chemical safety information and discussion of chemical management issues. Current membership of the MOU group includes representatives from OHS authorities, which reflects the fact that workers generally have the highest potential for exposure to industrial chemicals and therefore to possible adverse effects. The MOU representatives liaise with their public health and environmental agencies to ensure NICNAS assessment recommendations are appropriately integrated into downstream control arrangements for the safe use of industrial chemicals.	NICNAS 2001–02 Annual Report: https://www.nicnas.gov.au/__data/assets/pdf_file/0008/11420/AR_2001_2002_PDF.pdf
21 Nov 2002	Chemicals Organisation for Economic Co-operation and Development (OECD) Report: *Co-operation on Existing Chemicals — Hazard Assessment of Perfluorooctane Sulfonate (PFOS) and its Salts*. The OECD summary information noted that 'PFOS is persistent, bioaccumulative and toxic to mammalian species	Full hazard risk assessment report: http://www.oecd.org/env/ehs/risk-assessment/2382880.pdf For summary: http://www.oecd.org/chemicalsafety/risk-management/perfluorooctanesulfonatepfosandrelatedchemicalproducts.htm
***2003**	The NSW EPA incorporated with other environment-related agencies including NSW Parks and Wildlife Service into a new Department of Environment and Conservation.	NSW EPA Submission into Inquiry of the NSW EPA Performance (August 2014) available at: https://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/8bb621b4f96a7fccca257d4d00114702/$FILE/0156%20NSW%20Environment%20Protection%20Authority.pdf
***2003–2012**	Time period when the NSW EPA was integrated within other government agencies. The NSW EPA's functions were exercised 'within a succession of larger government agencies that were responsible for administering other government legislation and prioritising actions in line with broader range of responsibilities. This decreased the visibility of the NSW EPA's regulatory profile'. For example, the NSW EPA was part of the Department of Premier and Cabinet during the 2011–2012 reporting year.	NSW EPA Submission into Inquiry of the NSW EPA Performance (August 2014) available at: https://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/8bb621b4f96a7fccca257d4d00114702/$FILE/0156%20NSW%20Environment%20Protection%20Authority.pdf

Date	Event	Source
2003	Defence Specification DEFAUST5706 AFFF. New specification covers the supply and testing of foam concentrates for controlling and extinguishing fires in hydrocarbons. The specification specifically excludes foam concentrate containing PFOS.	Referred to in Part A of Submission of Defence dated 18 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites. Available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities/Submissions
Mar 2003	PFOS-based Scotchgard™ for protecting leather was phased out in Australia.	See NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet
10 Apr 2003	US EPA (Office of Pollution Prevention and Toxics Risk Assessment Division) completed a *Preliminary Risk Assessment of the Developmental Toxicity Associated with Exposure to Perfluorooctanoic Acid and its Salts*: … to understand the health and environmental issues presented by fluorochemicals in the wake of unexpected toxicological and bioaccumulation discoveries with respect to perfluorooctane sulfonates (PFOS). The US EPA risk assessment was unable to determine whether PFOA poses an unreasonable risk because of scientific uncertainties.	Report available at: https://www.nicnas.gov.au/__data/assets/pdf_file/0004/7681/PFOs_Preliminary_Risk_Assessment_PDF.pdf See also NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet
30 Apr 2003	NICNAS released an alert that products containing PFOS/PFOA such as AFFF be restricted to essential use only, and that AFFF should not be used for firefighting training. The Alert stated in full that: **Australian data** Information collected by NICNAS to 2003 indicated that: • PFOS- and PFAS-based chemicals were not manufactured in	See NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': http://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet

Date	Event	Source
	Australia, however products containing these chemicals had been made and were used in Australia. PFOS had been the favoured PFAS chemical used in Australia. • Voluntary phase out agreements by Australian industries since 2000 resulted in a rapid decrease in the use of PFOS chemicals in Australia. • Only two remaining uses of PFOS chemicals existed in Australia. These uses were in some Class B fire-fighting foam, in specialised industrial products used for processing rubber and in the production of paints and coatings. These PFOS products were no longer available in Australia after December 2003. • There was only one other use of a PFAS chemical currently identified by NICNAS in Australia—an adhesive which was expected to be phased out by 2004 when the existing stock was exhausted. The adhesive was used to bond timber for use in the building and construction industry. The timber product could also be used by domestic consumers. • The phase out in Australia meant old stock of PFOS- and PFAS-based products could still be found in Australia or be held by consumers and industrial users. • NICNAS believed it had identified all the applications of PFOS in Australia. It was likely that some importers and users may not have known if products contained these chemicals because PFOS- and PFAS-based chemical ingredients may not have been mentioned on (M)SDSs [Material Safety Data Sheets]. In 2003 NICNAS made a further call for information about the importation, manufacture, use and health effects of the PFOS alternatives PFOA and perfluorinated telomer chemicals and products in Australia. **International activities** PFOS was the subject of an international environmental and human health hazard assessment by the OECD. The OECD hazard assessment concluded that PFOS is persistent, bioaccumulative and toxic to mammals. Due to concerns over PFOS, the PFOS alternatives PFOA and perfluorinated telomers were being investigated internationally to identify potential environmental and health hazards. There were significant concerns that PFOA, like PFOS, was persistent, bioaccumulative and toxic. Little was known about perfluorinated telomers, however international investigations of these telomers were under way and scheduled for completion in 2003 and 2004. The OECD assessment of the hazards of PFOS and a preliminary risk assessment by the US EPA of the developmental toxicity of PFOA were available. **NICNAS recommendations** Because of concerns over PFOS, PFOA and perfluorinated chemicals, NICNAS recommended that: • PFOS- and related PFAS-based chemicals be restricted to only essential uses, for which no suitable and less hazardous alternatives were available such as certain Class B fire fighting foams.	Alert referred to in the May 2003 Report *Environmental Issues Associated with Defence Use of AFFF.*

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	• PFOS-based fire fighting foam not be used for fire training purposes to limit environmental release. • PFOS users exercise caution in selecting PFOA as an alternative, as PFOA may have the same environmental and health concerns as PFOS. • All labels and (M)SDSs include details of the PFAS and PFOS chemicals in the product. • Information on the safe use and handling of all these chemicals of concern be provided to fire fighters in the relevant and most recent (M)SDSs available from the suppliers of these chemicals.	
***May 2003**	*Environmental Issues Associated with Defence Use of AFFF* completed by Environmental Stewardship Directorate, Defence. A key finding was that: 'Both PFOS and PFOA have been implicated with a variety of cancers and toxic health effects in humans that have had long term exposure to products containing PFOS/PFOA.' In addition, the report found that the use and management of AFFF across Defence facilities fell below the management practices of other Australian and international organisations. The report recommended that Defence take appropriate measures to ensure firefighting foam/waste water does not reach streams, creeks, wetland, dams, ground water or storm water drains. The authors said Defence should consider undertaking site testing to determine if its facilities are contaminated by PFOS/PFOA. The report found there was no Australian regulatory action in place for use and disposal of PFOS/PFOA products although regulations were currently being developed by NICNAS. Appendix 2 to the report set out AFFF disposal regulations.	*Environmental Issues Associated with Defence Use of AFFF.* Report available at: http://www.defence.gov.au/FOI/Docs/Disclosures/387_1415_Document.pdf
26 Sept 2003	NICNAS Annual Report 2002–03 Achievement Through Strategic Alliances, which was transmitted to the Parliamentary Secretary to the Minister for Health and Ageing on 26 September 2003 noted: **Regulatory Framework Linkages** NICNAS is one of the four main regulatory assessment and/or registration schemes for chemicals within the Australian Government. The Scheme is designed to be complementary to other regulators (food, medicines, pesticides) and to avoid duplication of assessment and safety regulation. To avoid duplication of assessment activities, NICNAS has the lead in the risk assessment for industrial chemicals and provides these assessments to other federal and state/territory agencies and authorities. NICNAS's assessment partnership with the DEH [Australian Government Department of Environment and Heritage] on environmental issues allows for efficient consideration by the appropriate authorities for downstream control and regulation of chemicals. In general, the control of the supply, use and disposal of chemicals is a matter for state and territory law (page 25). The OECD scientific assessment report of PFOS and its salts was	NICNAS 2002–03 Annual Report: https://www.nicnas.gov.au/__data/assets/pdf_file/0009/11421/AR_2002_2003_PDF.pdf

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	accepted by the OECD member countries. NICNAS was actively involved in the OECD assessment through scientific peer review. The OECD countries agreed that individual governments continue their own assessment work and exchange information. Australia is facilitating the collection of production and use information on PFOS related chemicals in the OECD countries. (page 73).	
Dec 2003	All PFOS-containing products (other than PFOS-based Scotchgard™ for protecting textiles and leather as referred to above, which were phased out earlier) including firefighting foams and industrial additives were phased out in Australia by December 2003.	See NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet
2004	NICNAS adopted a policy on the information requirements for the assessment of the precursors to PFOS and PFOA when introduced as new industrial chemicals. The intention of this policy was to deter the introduction of the precursors unless information was available to show that the breakdown products were significantly less bioaccumulative and toxic than PFOS and PFOA and this has been successful.	See Submission of NICNAS dated 11 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
2004	NICNAS prepared a document for 'Options for Disposal of PFOS Waste'. NICNAS informed the Review that this document was prepared in close consultation with all state and territory environmental protection authorities. In addition, each state provided information on its handling of PFOS waste and had opportunity to comment on the draft document prior to its publication.	NICNAS 2004 Options for Disposal of PFOS Waste. Advice from NICNAS to the Review.
April 2004	NICNAS alert on PFOA and its derivatives stated: Information collected by NICNAS showed the following: **Manufacture** No manufacture of PFOA, PFOA derivatives or fluoropolymers that may degrade to PFOA had been reported in Australia. **Importation and use** • Primer for non-stick metal cookware The import of a liquid fluoropolymer surfactant dispersion product was reported. The importation equated to approximately 50 gm and 25 gm of PFOA in 2003 and 2004, respectively. The factory-applied, oven-baked dispersion coating was used for coating metal cookware and was intended to impart a continuous solid non-stick coating to the metal surface. Volatilisation and destruction of PFOA was reported during the manufacturing process which fuses the fluoropolymer to the metal surface and involves a thermal step at 350-400ºC. • Fluoropolymer dispersion polymer in paints	See NICNAS, 'PFC derivatives and chemicals on which they are based alert Fact Sheet': https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet

Date	Event	Source
	The import of a fluoropolymer dispersion polymer for use in paints was reported. The importation equated to 10 kg annually of PFOA. • Fire-fighting foam The import in the past of two fluorosurfactant products for use in the manufacture of Class B fire fighting foam was reported. The importation equated to approximately 48 gm and 0.6 gm of PFOA in 2002 and 2003, respectively. The importation and sale of the products in Australia was discontinued in 2003. • Textile and carpet protection Textile and carpet protection products containing some fluoropolymers were imported into Australia. Information was received from importers and suppliers that research was being undertaken internationally via the Telomer Research Program (in conjunction with the US EPA) to determine whether these products may degrade to PFOA. • Other uses of telomers Additional polymers that include monomers based on perfluorinated telomers were reported. These chemicals were assessed by the NICNAS New Chemicals program and were in use under certificate. These chemicals had applications in fabric protection, surface coating and printing. Under section 64(2)(e) of the Industrial Chemicals Notification and Assessment Act 1989, there was a requirement that introducers of these chemicals must notify the Director, NICNAS of any additional information that had become available (within 28 days of the occurrence) as to adverse health or environmental effects of these chemicals. **National and international activities** There was ongoing national and international activity in relation to PFOA. The OECD was collating data on the uses of PFOA manufactured and used globally. NICNAS assisted and provided information to the OECD with regard to this activity. The US EPA provided regular updates on their activities for PFOA and fluorinated telomers to NICNAS, and released a revised draft hazard assessment of PFOA and its salts and preliminary risk assessment on PFOA and its salts in 2002 and 2003, respectively. On-going scientific investigations of PFOA and the potential sources and pathways of PFOA in the environment were used to update these assessments. The investigations included studies to determine the potential for generation of PFOA and characterization of release of PFOA from articles such as garments, household cookware, textiles and carpets. **NICNAS advice** Because of concerns over PFOA and fluorinated telomers that may degrade to PFOA, NICNAS advised that: • Importers and users of these chemicals remain vigilant to the ongoing international activities regarding PFOA and related chemicals. Updates about these activities can be accessed from NICNAS. • Information on the safe use and handling of these chemicals be provided to all users in the relevant and most recent (M)SDSs [Material Safety Data Sheets] available from the suppliers of these chemicals.	

Date	Event	Source
	On completion of the scientific investigation of PFOA and potential sources and pathways of PFOA in the environment, NICNAS will, if needed, make recommendations on appropriate regulatory activities.	
28 June–1 July 2004	PFOS was included on the OSPAR List of Chemicals for Priority Action under the Convention for the Protection of the Marine Environment of the North-East Atlantic.	See OSPAR List of Chemicals for Priority Action (Update 2004) Annex 7, available at: http://www.ospar.org/meetings/archive/ospar-commission-7 This outcome was referred to in the NICNAS Alert 5, 2007.
2005	CRC CARE (Contamination Assessment and Remediation of the Environment)[23] developed laboratory methods for the assessment of AFFF.	Information provided by CRC Care to the Review.
2005–2006	CRC CARE Annual Report 2005–06 noted CRC CARE undertook environmental studies of AFFF at legacy sites RAAF Base Williamtown and RAAF Base Edinburgh. The report stated that the study 'data suggested significant accumulation of PFOS in soil with toxic effects on algal growth, earthworm survival and soil enzymes'.	CRC CARE Annual Report 2005–06: http://www.crccare.com/publications/annual-reports
14 Dec 2005	**PFOA environmental contamination** US EPA settlement with E.I. du Pont de Nemours and Company (DuPont) for the largest civil administrative penalty ever obtained under any federal environmental statute in the US—$10.25 million in civil penalties and $6.25 million for Supplemental Environmental projects.	Settlement document available at: https://www.epa.gov/sites/production/files/documents/dupontpfoasettlement121405.pdf See also: https://www.epa.gov/enforcement/ei-dupont-de-nemours-and-company-settlement The 2016 *New York Times Magazine* article detailing the legal case involving DuPont and PFOA, available at: http://www.nytimes.com/2016/01/10/magazine/the-lawyer-who-became-duponts-worst-nightmare.html?_r=0
2006	CRC CARE *Environmental Fate of New Fire Suppressing Products (Ansulite AFFF and 3M RF) Compared to Light Water Project* (a Defence-funded project) (received by Defence in April 2006).	Referred to in Part A of Submission of Defence dated 18 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and

[23] CRC CARE website — www.crccare.com (accessed 19 February 2016).

Date	Event	Source
		territory sites.
***2006**	'Direction was given by Defence to only use AFFF without PFOS/PFOA'.	The answer to the FAQ 'When did Defence stop using foams containing PFOS/PFOA at the Williamtown base?' attached to letter dated 21 October 2014 from Defence to the NSW OEH.[24]
24 Oct 2006	3M Australia Pty Limited Material Safety Data Sheet (MSDS) on Light Water Brand AFFF stated: 'Recommended use: fire fighting for industrial or professional use only'. The MSDS also stated: There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed … 3M's epidemiological study of its own workers indicates no adverse effects.	Material Safety Data Sheet available at: http://www.monarorfs.org.au/index.php?option=com_phocadownload&view=category&download=12:aqueous-film-forming-foam-afff&id=7:msds-documents&Itemid=388
21 Nov 2006	The following perfluorooctane sulfonate (PFOS) risk profile was adopted by the Persistent Organic Pollutants Review Committee (a subsidiary body to the Stockholm Convention): Given the inherent properties of PFOS, together with demonstrated or potential environmental concentrations that may exceed the effect levels for certain higher trophic level biota such as piscivorous birds and mammals; and given the widespread occurrence of PFOS in biota, including in remote areas; and given that PFOS precursors may contribute to the overall presence of PFOS in the environment, it is concluded that PFOS is likely, as a result of its long-range environmental transport, to lead to significant adverse human health and environmental effects, such that global action is warranted. (citations omitted)	Available at: http://chm.pops.int/TheConvention/POPsReviewCommittee/POPRCRecommendations/tabid/243/ctl/Download/mid/10494/Default.aspx?id=40&ObjID=4891
12 Dec 2006	In Directive 2006/122/EC of the European Parliament and the Council: • The Scientific Committee on Health and Environmental Risks concluded that PFOS fulfils the criteria for classification as very persistent, very bioaccumulative and toxic. • The European Union adopted a resolution of restrictions on marketing and use for PFOS and related substances in 2006. The resolution set the maximum concentrations of 0.1% by mass for PFOS-containing semi-finished products or articles, 0.005% by mass for PFOS preparations, and 1 µg/m^2 PFOS for textiles or other coated materials.	Directive 2006/122/EC of The European Parliament and of the Council of 12 December 2006. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32006L0122 Also referred to in: NICNAS Alert 5, 2007: Perfluorooctane Sulfonate (PFOS) and Perfluroalkyl Sulfonate (PFAS).
2007	CRC CARE Annual Report 2006–07 reported a CRC CARE conference presentation on research into the environmental impacts of AFFF: Mallavarapu, M. and Naidu, R. 2007. *Environmental*	CRC CARE Annual Report 2006–07: http://www.crccare.com/publications/annual-reports

[24] Note that in a letter dated 17 May 2013 from Defence to the NSW EPA, Defence stated that it commenced phasing out PFOS/PFOA at Williamtown in 2008.

Date	Event	Source
	impacts of AFFF at long-term contaminated sites. 24–28 June, 2007 Contamination CleanUp 07 & Industrial Summit, Adelaide, Australia. The conference abstract noted the following: … CERAR [Centre for Environmental Risk Assessment and Remediation, University of South Australia] and **CRC CARE are investigating the long term impact of AFFF at 3 legacy sites located at RAAF Base Williamtown (currently in use)** and RAAF Base Edinburgh (one currently in use and the other previously used for 20 years prior to 2002). **PFOS was found to be present in all the 3 sites tested and the concentrations were 0–45 mg/kg soil in RAAF Base Williamtown**, 15–654 mg/kg soil (RAAF Base Edinburgh, site currently in use) and 12–1760 mg/kg soil (RAAF Base Edinburgh previously used site). **Toxicological tests revealed bioaccumulation of PFOS in earthworms incubated with contaminated soils from the above sites and inhibition of soil enzyme activities that are important for maintaining soil health.** (emphasis added)	Conference abstract provided by CRC CARE to the Review.
2007	NICNAS Alert 5, 2007 Pefluorooctane Sulfonate (PFOS) and Perfluoroalkyl Sulfonate (PFAS) stated in part that: In July 2006, NICNAS collected information through a national survey, on production, importation and use of perfluorinated chemicals including PFOS, PFAS and their related substances, and products/mixtures containing these substances for the calendar years 2004 and 2005. Information provided to NICNAS indicated that: PFOS and PFAS related chemicals are not manufactured in Australia. No PFOS or PFOS related substances were imported in the calendar years 2004 and 2005. A PFOS-containing product was imported prior to 2003 and used for the formulation of leather treatment products. The product had been used at volumes of 47 and 13 kg in 2004 and 2005, respectively, and was reported as no longer being used in 2006. The only identified use of PFOS substances in Australia was in Class B fire-fighting foam products. In 2007, about 180,000 litres of Class B fire-fighting foam products containing 0.1–7% PFOS-related substances were held in stock at some end-user sites. NICNAS was advised that these PFOS based fire-fighting products had been purchased prior to 2003 and were to be replaced on reaching the product expiry date. Some non-PFOS based fire-fighting foam products containing fluoroalkyl surfactants or alcohol resistant film-forming fluoroprotein had been imported as replacements. … PFOS was being considered for possible inclusion on the list of the Stockholm Convention on Persistent Organic Pollutants. … NICNAS recommended that: PFOS and related PFAS-based chemicals be restricted to only essential uses, for which no suitable and less hazardous alternatives are available. The existing PFOS-based fire fighting foam not be used for fire	Available at: https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet

Date	Event	Source
	training purposes to limit environmental release. PFOS not be replaced by PFOA as an alternative, as PFOA may have the same environmental and health concerns as PFOS. All labels and (M)SDSs include details of the PFOS and PFAS chemicals in the product. Information on the safe use and handling of all these chemicals of concern be provided in the relevant and most recent (M)SDSs available from the suppliers of these chemicals.	
2007	NICNAS Alert 6, 2007 Perfluorooctanoic Acid (PFOA) and Perfluorocarboxylic Acid (PFCA) stated in part: In July 2006, NICNAS collected information on manufacture, importation and uses of perfluorinated chemicals including PFOA-related substances and products/mixtures containing these substances for the calendar years 2004 and 2005. Information provided to NICNAS indicated that: • No PFOA related chemicals are manufactured in Australia … • PFOA could be present as an impurity in polytetrafluoroethylene (PTFE) products and in some fire-fighting foam products imported into Australia. These products also include industrial painting/coating products, and some wiring products. The concentrations of PFOA in these products are at trace levels ranging from parts per billion (ppb) to less than one part per million (ppm). NICNAS will continue to monitor the importation and use of PFOA-related substances in Australia. … • The US EPA provides regular updates on their activities for PFOA and fluorinated telomers to interested parties globally including NICNAS. The US EPA released a revised report 'Draft risk assessment of the potential human health effects associated with exposure to perfluooctanoic acid and its salts' in January 2005 … **NICNAS advice** Because of concerns over PFOA, certain PFCAs and fluorinated telomers that may degrade to PFCA, NICNAS advised that: • Industry should actively seek alternatives to PFOA and precursors that may degrade to PFOA and aim to phase out the use of these chemicals. • Importers and users of these chemicals remain vigilant of the ongoing international activities regarding PFOA and related chemicals. • Information on the safe use and handling of these chemicals be provided to all users in the relevant and most recent (M)SDSs available from the suppliers of these chemicals.	Available at: https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet
***June 2007**	Defence published *Environmental Guidelines for Management of Fire Fighting Aqueous Film Forming Foam (AFFF) Products.* Defence FAQ stated that these 'guidelines support the AFFF	The Guidelines and AFFF policy are referred to in FAQ attached to letter from Defence to OEH dated 21 October

Date	Event	Source
	policy, which restricts use of AFFF products to those that do not contain PFOS and PFOA'.	2014.
2008	Airservices Australia started site assessment work of firefighting training grounds examining PFCs (including PFOS and PFOA) in soil and groundwater. In the absence of regulatory screening or investigation levels in Australia for PFCs, Airservices Australia adopted the 2008 Minnesota Department of Health guidelines[25] because: • The screening levels covered both water and soil. • Due to the presence of 3M manufacturing sites within Minnesota, the guidelines were developed by a Department that had a reasonable amount of experience in dealing with PFOS and PFOA related issues. • The US EPA had not produced any guidance at that time.	Available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities/Submissions
2008	NICNAS Alert 8, 2008: Perfluorooctane Sulfonate (PFOS) and Perfluoroalkyl Sulfonate (PFAS) stated in part: In May 2008, NICNAS collected information, through a national survey, on production, importation, stocks held and use of PFOS, PFAS and their related substances, and products/mixtures containing these substances for the calendar years 2006 and 2007. Information provided to NICNAS indicated: • PFOS or related chemicals and products were not manufactured in Australia … • PFOS stocks (approximately 7.8 tonnes) were held mostly by the fire fighting industry (97%) and to a lesser extent by the metal plating industry (3%). None of the major hazard facilities that responded reported any PFOS stocks. • Approximately 160,000 litres of class B fire fighting foam products containing between 0.1–7% PFOS formulations (7.6 tonnes) were held in stock in 2007. This was a decrease from those reported for 2005 (9.36 tonnes). • The PFOS fire-fighting foam products had been designated for emergency use only. It was reported that as these products reached the expiry date or are used up, alternative foams would replace them. Some organisations had arranged for safe disposal of these stocks. **Recommendations** NICNAS recommended that: • PFOS-based and related PFAS-based chemicals continue to be restricted to only essential uses, for which no suitable and less hazardous alternatives were available. • Importers should ensure that the alternative chemicals used were less toxic and not persistent in the environment. • Stocks were to be disposed of responsibly on expiry—state and territory environment authorities to advise on disposal options. • All labels and (Material) Safety Data Sheets ((M)SDSs) include details of the PFOS and PFAS chemicals in the product. • Information on the safe use and handling of all these	Available at: https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/pfc-derivatives-and-chemicals-on-which-they-are-based-alert-factsheet

[25] Available at: http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcs/finalreport011508.pdf (accessed 8 March 2016).

Date	Event	Source
	chemicals of concern were to be provided in the relevant and most recent (M)SDSs available from the suppliers of these chemicals. • Importers of these chemicals should remain vigilant of the ongoing international regulatory activities related to PFOS/PFAS compounds. The Alert also stated that PFOS was being considered for possible inclusion on the list of the Stockholm Convention on Persistent Organic Pollutants and outlined other international regulatory activity in the EU, Canada, USA and Japan.	
***2008**	Defence commenced phasing out the use of AFFF products containing PFOS/PFOA.[26]	Letter dated 17 May 2013 from Defence to the NSW EPA.
16 Sept 2008	Airservices Australia Annual Report 2007–2008 stated in part: During 2007–08 Airservices has been undertaking a detailed assessment of soil and groundwater contamination by perfluoroctonate sulphonates (PFOS) and perfluoroctanoic acid (PFOA) at the Brisbane ARFF [aviation rescue firefighting] site and exploratory testing at other locations to determine whether contamination is present elsewhere. (page 19).	Available at: http://www.airservicesaustralia.com/wp-content/uploads/Airservices_Annual_Report_2007-2008.pdf
2009	Australian Government, Regulation Impact Statement for the Consideration of the Addition of Nine Chemicals to the Stockholm Convention on Persistent Organic Pollutants (POPS). The statement identified that: PFOS is an industrial chemical used in a wide variety of manufacturing processes as a flame retardant along with its use in fire fighting foams. PFOS is easily absorbed and bio-accumulative. It is toxic to humans and wildlife especially aquatic organisms, due to its persistency and long range transport in the environment. Stakeholders whose views were sought on the addition of chemicals (including PFOS) are set out in Appendix 1 to the Regulation Impact Statement and included the NSW Department of Environment and Climate Change.	Available at: http://www.environment.gov.au/system/files/resources/32e7f22f-3017-4175-807c-cc86d04bb0bc/files/ris.pdf
8 Jan 2009	The US EPA developed Provisional Health Advisory values for PFOS and PFOA to assess potential risk from exposure to these chemicals through drinking water. These were PFOS (0.2 µg/L) and PFOA (0.4 µg/L). Notwithstanding that the US EPA believed that these levels were 'not of concern' it stated it would soon 'begin groundwater and surface water sampling to determine if PFOA or PFOS has migrated into any private drinking water supplies and ponds in the affected area.'	Available at: http://www.epa.gov/dwstandardsregulations/health-advisories-perfluorooctanoic-acid-and-perfluorooctane-sulfonate

[26] This information is inconsistent with that provided in Defence FAQ attached to the letter dated 21 October 2014 from Defence to the NSW OEH, which stated that in 2006 'Direction was given by Defence to only use AFFF without PFOS/PFOA'.

Date	Event	Source
***26 Aug 2009**	PFOS was added to Annex B of Stockholm Convention on Persistent Organic Pollutants.	Available at: http://chm.pops.int/Implementation/NewPOPs/DecisionsRecommendations/tabid/671/Default.aspx
20 Nov 2009	The US EPA Region 4 set soil screening levels for PFOS (6 mg/kg) and PFOA (16 mg/kg).	Available at: http://archive.epa.gov/pesticides/region4/water/documents/web/pdf/final_pfc_soil_screening_values11_20_09.pdf
2009–2010	Airservices Australia wrote to Commonwealth and State environmental regulators advising them of its PFC concerns in relation to aviation rescue and firefighting facilities.	See Submission of Airservices Australia dated February 2016 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites. Available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities/Submissions
***Aug 2010**	Publication of UNEP booklet, Stockholm Convention on Persistent Organic Pollutants (POPs): *The 9 new POPS*.	UNEP, *Stockholm Convention on Persistent Organic Pollutants: The 9 new POPS.* Available at: http://chm.pops.int/TheConvention/POPsReviewCommittee/Guidance/tabid/345/ctl/Download/mid/2526/Default.aspx?id=5
24 June 2011	CRC CARE wrote to the OEH in relation to the addition of the new 9 POPS to the Stockholm Convention. It stated that 'Aqueous film-forming foams (AFFFs) are used extensively for the suppression of hydrocarbon fuel fires in the aviation and petrochemical industries' and that 'there may well be legacy issues arising from the previous use of AFFF containing PFOS.' CRC CARE offered its assistance in investigating AFFF impacted sites.	Information provided by the NSW EPA to the Review.
22 July 2011	Internal NSW EPA meeting on PFOS. File note of the meeting recorded that 3M stopped using PFOS 'a few years ago', that PFOA was still being manufactured, and that PFOS had been listed on the Stockholm Convention on Persistent Organic Pollutants as one of the new 9 POPs.	Information provided by the NSW EPA to the Review.

Date	Event	Source
25 July 2011	Internal OEH 'Action Sheet – Executive Services' stated that 'We will be meeting shortly with NSW Fire and Rescue to discuss the extent of PFOS use in NSW and implications of its listing on the Stockholm Convention Annexes'.	Information provided by the NSW EPA to the Review.
26 July 2011	OEH wrote to CRC CARE and stated it was aware of the addition of the new 9 POPS to the Stockholm Convention. It stated that OEH was currently liaising with industry and government partners including NSW Fire and Rescue to determine the extent of the use of AFFF in NSW.	Information provided by the NSW EPA to the Review.
11 Sept 2011	The NSW EPA attended a National Foam Forum and Workshop organised by CRC CARE.	Information provided by the NSW EPA to the Review.
29 Sept 2011	Australian researchers published a study on PFCs including PFOS/PFOA: Thompson et al. 2011. Perfluorinated alkyl acids in water, sediment and wildlife from Sydney Harbour and surroundings. *Marine Pollution Bulletin*, 62, 2869–2875. Authors included Anthony Roach from the Office of Environment and Heritage, NSW Government. Abstract from the paper: Perfluorinated alkyl compounds (PFCs) including perfluorooctane sulphonate (PFOS) and perfluorooctanoate (PFOA) were measured in environmental samples collected from around Homebush Bay, an urban/industrial area in the upper reaches of Sydney Harbour and Parramatta River estuary. Water, surface sediment, Sea Mullet (*Mugil cephalus*), Sydney Rock Oyster (*Saccostrea commercialis*) and eggs of two bird species; White Ibis (*Threskiornis molucca*), and Silver Gull (*Larus novaehollandiae*) were analysed. In most samples PFOS was the dominant PFC. Geometric mean PFOS concentrations were 33 ng/g ww (wet weight) in gull eggs, 34 ng/g ww in ibis eggs, and 1.8 ng/g ww and 66 ng/g ww in Sea Mullet muscle and liver, respectively. In sediment the PFOS geometric mean was 1.5 ng/g, in water average PFOS and PFOA concentrations ranged from 7.5 to 21 ng/L and 4.2 to 6.4 ng/L, respectively. In oysters perfluorododecanoic acid was most abundant, with a geometric mean of 2.5 ng/g ww. The study concluded that the low concentrations measured in fish muscle and oysters did not pose a risk to humans if consumed.	Available at: http://www.sciencedirect.com/science/article/pii/S0025326X11004905.
23 Jan 2012	The NSW EPA met with OEH science and discussed emerging contaminants. File note indicates that PFOS and airports were discussed.	Information provided by the NSW EPA to the Review.
30 Jan 2012	OEH sent the NSW EPA comments on CRC CARE summary document 'Contaminants of Emerging Concern'. The OEH's comments on the CRC document did not address PFOS.	Information provided by the NSW EPA to the Review.
31 Jan 2012	CRC CARE teleconference with environmental regulators including the NSW EPA and industry discussed risk and compliance models for contaminants of emerging concern,	Information provided by the NSW EPA to the Review.

Date	Event	Source
	including PFOS.	
***Feb 2012**	NSW Government established the NSW EPA as an independent statutory authority rather than as part of the OEH.	The NSW EPA Submission to Inquiry on Performance of the NSW EPA (August 2014), available at: https://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/8bb621b4f96a7fccca257d4d00114702/$FILE/0156%20NSW%20Environment%20Protection%20Authority.pdf
May 2012	The US EPA published a fact sheet on PFOS and PFOA that noted that the EPA had not 'established a minimal risk level (MRL) for PFOS or PFOA because human studies to date are insufficient to determine with a sufficient degree of certainty that the effects are either exposure-related or adverse.' The fact sheet also advised that in 2009: • The US EPA established 'a provisional health advisory (PHA) of 0.2 micrograms per litre (µg/L) for PFOS and 0.4 µg/L for PFOA to protect against the potential risk from exposure of these chemical[s] through drinking water'. • The US EPA Region 4 'recommended a residential soil screening level of 6 milligrams per kilogram (mg/kg) for PFOS and 16 mg/kg for PFOA'.	Available at: http://www.epa.gov/sites/production/files/documents/emerging_contaminants_pfos_pfoa.pdf
2013	The NSW EPA developed a package of initiatives addressing mercury, lead, cadmium, arsenic and other hazardous chemicals as well as emerging contaminants such as PFOS.	Advice from the NSW EPA to the Review.
Mar 2013	ALS Environmental Laboratory Services Pty Ltd (Sydney Laboratory) had its analytical method for PFOS/PFOA analysis (soil and water) NATA (National Association of Testing Authorities, Australia) accredited.	Advice from NATA. See also: http://www.nata.com.au/
28 Apr–10 May 2013	At the sixth meeting of the Conference of the Parties to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, the parties agreed to list PFOS (Perfluorooctane sulfonic acid, perfluorooctane sulfonates, perfluorooctane sulfonamides and perfluorooctane sulfonyls) in Annex III of the Convention. The Review notes that Australia ratified the Rotterdam Convention in 2004.	Available at: http://www.pic.int/TheConvention/ConferenceoftheParties/Meetings/COP6/tabid/2908/language/en-US/Default.aspx
7 June 2013	Seow, J. 2013. *Fire Fighting Foams with Perfluorochemicals—Environmental Review*. Pollution Response Unit, Department of Environment and Conservation, Western Australia. The study concluded that many perfluorochemicals are:	Available at: http://www.hemmingfire.com/news/fullstory.php/aid/1748/ Referred to in Part A of Submission of Defence dated

Date	Event	Source
	• … bioaccumulative in terrestrial and aquatic biota and humans … • have acute and chronic impact upon aquatic and terrestrial biota and humans.	18 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
Nov 2013	Eurofins Environment Testing Australia Pty Ltd (Brisbane Laboratory) had its analytical method for PFOS/ PFOA analysis (soil and water) NATA (National Association of Testing Authorities, Australia) accredited.	Advice from NATA to the Review. See also: http://www.nata.com.au/
2014	Reg 11C(1) of *Industrial Chemicals (Notification and Assessment) Regulations 1990* amended to prohibit the introduction or export of PFOS and PFOA unless written approval obtained from the NICNAS Director.	See *Industrial Chemicals (Notification and Assessment) Regulations 1990*. Also referred to in Submission of NICNAS dated 11 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
Feb 2014	The US EPA's 'Health Effects Document for Perfluorooctane Sulfonate (PFOS)' found there were possible effects from PFOS exposure but the results were inconclusive or inconsistent.	Available at: https://peerreview.versar.com/epa/pfoa/pdf/Health-Effects-Document-for-Perfluorooctane-Sulfonate-(PFOS).pdf
March 2014	The US EPA issued an updated fact sheet on PFOS and PFOA with reference to guideline and health standards. The Review notes that the drinking water and residential soil screening levels quoted in its 2012 fact sheet remained unchanged. The 2014 factsheet notes that the provisional health advisory for PFOS and PFOA is to assess the potential risk from *short-term* exposure via drinking water.	Available at: http://www.epa.gov/sites/production/files/2014-04/documents/factsheet_contaminant_pfos_pfoa_march2014.pdf
23 May 2014	CRC CARE wrote to the 'DL-Policy Advisory Committee' including the NSW EPA about its project on 'Contaminants of Emerging Concern'. CRC CARE sought feedback on screening criteria and risk-based remediation and management proposals for inter alia PFOS/PFOA, in particular the need for ecological screening levels.	Information provided by the NSW EPA to the Review.
10 June 2014	Email from the NSW EPA to CRC CARE in response to CRC CARE's email of 23 May 2014. The NSW EPA expressed the view that the proposal for ecological screening levels for PFOS/PFOA was warranted.	Information provided by the NSW EPA to the Review.
***July 2014**	CRC CARE Technical Report No 32: *Development of Guidance for Contaminants of Emerging Concern.* This report referred to PFOS/PFOA (inter alia) and aimed to progress guidance on contaminants that were of significance to stakeholders. 'Guidance development includes the development of screening criteria and remediation and	Available at: http://www.crccare.com/publications/technical-reports

Date	Event	Source
	management guidance.'	
15 Aug 2014	International Agency for Research on Cancer Monograph 110 in *The Lancet* (Vol 15) classified PFOA as a Class 2B substance ie that it is possibly carcinogenic to humans.[27]	Available at: http://www.sciencedirect.com/science/article/pii/S147020451470316X
Nov–Dec 2014	Grandjean, P. and Clapp, R. 2014. Changing Interpretation of Human Health Risks from Perfluorinated Compounds, *Public Health Reports*, 129(6), 482–485. Grandjean and Clapp (2014) assessed the US EPA 2009 provisional drinking water health advisories of 0.4 micrograms per litre (µg/L) for PFOA and 0.2 µg/L for PFOS and determined that these 'benchmark dose results' were about 1,000-fold higher than those calculated from more recent endocrine and human immunotoxicity studies. They concluded that 'Current exposure limits therefore do not protect against adverse effects.'	Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4187289/
2015	The Danish Environmental Protection Authority completed a review of 'Perfluoroalkylated substances: PFOA, PFOS and PFOSA' including an 'Evaluation of health hazards and proposal for a health based criterion for drinking water, soil and ground water'. It proposed the following health based criteria: • drinking water (including ground water where used for potable sources): PFOA – 0.3 µg/L; PFOS – 0.1 µg/L • soil quality: PFOA – 1.3 mg/kg; PFOS 0.39 mg/kg. The Danish review identified adverse impacts in some animal studies from perfluoroalkylated compounds. However, it noted that the first attempt[28] to use human data on immunotoxicity for the calculation of benchmark reference doses (RfD) for PFOS and PFOA had limitations.	Danish Environmental Protection Authority review available at: http://www2.mst.dk/Udgiv/publications/2015/04/978-87-93283-01-5.pdf
2015	CRC CARE set up a technical working group to develop guidance on PFOS and PFOA. CRC CARE is working with Commonwealth and state regulatory agencies and industry to develop PFOS and PFOA national guidance. It is anticipated the outcomes will be available for stakeholder comment in 2016.	Referred to in Submission of The Department of Regional Infrastructure and Regional Development (undated) to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
***May**	The NSW EPA has advised the Review that Defence emailed it Defence Contamination Directive #8 on Interim Screening	The NSW EPA chronology, provided to the Review on

[27] Note that lead is also classified as Class 2B. See: http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf (accessed 1 February 2016).
[28] Grandjean, P. and Budtz-Jorgensen, E. 2013. Immunotoxicity of perfluorinated alkylates: calculation of benchmark doses based on serum concentrations in children. *Environmental Health*, 12:35, available at: http://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-12-35 (accessed 13 March 2016).

<table>
<tr><th>Date</th><th>Event</th><th>Source</th></tr>
<tr><td>2015</td><td>Criteria dated 19 May 2015.</td><td>4 December 2015.

The Review has not sighted the email from Defence to the NSW EPA.</td></tr>
<tr><td>May 2015</td><td>Defence released Defence Contamination Directive #8 Interim Screening Criteria—Consistency of Toxicology or Ecotoxicology Based Environmental Screening Levels for PFOS, PFOA and 6:2 FTS (fluorinated telomer sulfonates) based on the March 2015 CRC CARE Technical Working Group's recommendations. The Interim Screening Criteria for PFOS/PFOA are set out below.
<table>
<tr><th></th><th>PFOS</th><th>PFOA</th><th>6:2 FTS</th></tr>
<tr><td colspan="4">Soil</td></tr>
<tr><td>Human health – residential (direct contact only)</td><td>6 mg/kg</td><td>16 mg/kg</td><td>60 mg/kg</td></tr>
<tr><td>Human health – industrial (direct contact only)</td><td>90 mg/kg</td><td>240 mg/kg</td><td>900 mg/kg</td></tr>
<tr><td>Ecological (terrestrial)</td><td>0.373 mg/kg - 95% species protection
0.91 mg/kg - Residential: 80% species protection, low reliability
4.71 mg/kg - Commercial/industrial: 60% species protection, low reliability</td><td>3.73 mg/kg</td><td>NA</td></tr>
<tr><td>Clean fill</td><td>0.373 mg/kg</td><td>3.73 mg/kg</td><td>60 mg/kg</td></tr>
<tr><td>Landfill acceptance (contaminated soil and sediment)</td><td>90 mg/kg (soil)
20 µg/L - leachate</td><td>240 mg/kg (soil)
40 µg/L - leachate</td><td>900 mg/kg (soil)
500 µg/L - leachate</td></tr>
<tr><td colspan="4">Groundwater</td></tr>
<tr><td>Human health (drinking water)</td><td>0.2 µg/L</td><td>0.4 µg/L</td><td>5.0 µg/L</td></tr>
<tr><td>Ecological</td><td colspan="3">Compare to surface water screening values</td></tr>
<tr><td colspan="4">Surface water</td></tr>
<tr><td>Ecological (toxicity effects on aquatic organisms)</td><td>6.66 µg/L</td><td>2900 µg/L</td><td>NA</td></tr>
<tr><td>Human health (consumption of fish)</td><td>0.65 ng/L</td><td>300 ng/L</td><td>6.5 ng/L</td></tr>
<tr><td>Recreational use</td><td>2 µg/L</td><td>4 µg/L</td><td>50 µg/L</td></tr>
</table></td><td>Referred to in Part A of Submission of Defence dated 18 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.

The Interim Screening Criteria are available at: http://www.defence.gov.au/estatemanagement/governance/Policy/Environment/Contamination/Docs/Toolbox/ScreeningGuidelinesPFOSMay15.pdf</td></tr>
</table>

Date	Event	Source
1 May 2015	Blum et al. (2015). The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs). *Environmental Health Perspectives*, 123 (5), A107–A111. The 14 authors and 205 signatories of the Madrid statement (comprising scientists and professionals from a variety of disciplines including five from Australia) expressed concern about the production and release into the environment of an increasing number of poly- and perfluoroalkyl substances (PFASs) for seven reasons including: PFASs are man-made and found everywhere. PFASs are highly persistent, as they contain perfluorinated chains that only degrade very slowly, if at all, under environmental conditions. It is documented that some polyfluorinated chemicals break down to form perfluorinated ones … PFASs are found in the indoor and outdoor environments, wildlife, and human tissue and bodily fluids all over the globe. … In animal studies, some long-chain PFASs have been found to cause liver toxicity, disruption of lipid metabolism and the immune and endocrine systems, adverse neurobehavioral effects, neonatal toxicity and death, and tumors in multiple organ systems. … In the growing body of epidemiological evidence, some of these effects are supported by significant or suggestive associations between specific long-chain PFASs and adverse outcomes, including associations with testicular and kidney cancers … liver malfunction … hypothyroidism … high cholesterol … ulcerative colitis … lower birth weight and size … obesity … decreased immune response to vaccines … and reduced hormone levels and delayed puberty …	Available at: http://dx.doi.org/10.1289/ehp.1509934
9 June 2015	Proposal to list PFOA to the Stockholm Convention on Persistent Organic Pollutants. The proposal contained summary information on toxicological effects of PFOA on humans and wildlife. It concluded that the 'Available experimental and epidemiological evidence shows that PFOA, PFOA salts and PFOA-related substances can damage human health and wildlife'.	Available at: http://chm.pops.int/TheConvention/POPsReviewCommittee/Meetings/POPRC11/POPRC11Documents/tabid/4573/ctl/Download/mid/13904/Default.aspx?id=101&ObjID=20843
11 June 2015	The NSW EPA Chair and Chief Executive advised the Commonwealth at a Senior Officials Group (SOG)[29] meeting (for the state and Commonwealth Environment Portfolios, including OEH; the NSW EPA; Commonwealth and other jurisdictions) that NSW supports: • the proposed ratification process for the eleven (11) new chemicals listed under the Stockholm Convention … • further national assessment of the implications of ratification of the chemicals for which there is ongoing use in Australia or potentially significant legacy issues relating to disposal of articles and stockpiles containing the chemicals.	Information provided by the NSW EPA to the Review.

[29] The SOG meeting reports to the Ministers for Environment Meeting on environmental policy issues.

Date	Event	Source
24 June 2015	The Environment, Natural Resources and Regional Development Committee of the Victorian Parliament tabled its Interim Report entitled Inquiry into the CFA [Country Fire Authority] Training College at Fiskville. This detailed, inter alia, contamination of groundwater by PFOS/PFOA from the former use of AFFF.	Available at: http://www.parliament.vic.gov.au/enrrdc/inquiries/article/2526
July 2015	The Meeting of the Environment Ministers approved the implementation of the proposed national standard for environmental risk management of industrial chemicals. The document notes that Stockholm POPs (inter alia), which include PFOS, are considered to be industrial chemicals. These are known to cause adverse effects on the environment, including humans if not managed properly.	Environmental Risk Management of Industrial Chemicals Decision Regulation Impact Statement (June 2015). Available at: https://ris.govspace.gov.au/files/2015/12/Environmental-risk-management-of-industrial-chemicals-Decision-RIS.pdf Information provided by the NSW EPA to the Review.
15 Aug 2015	EPA Victoria published a fact sheet (1611) on perfluorinated chemicals (PFCs). The fact sheet states in part: EPA Victoria is working with other government agencies to identify and resolve issues related to PFC contamination associated with CFA [Country Fire Authority] Regional Training Centres. … There are currently no Australian criteria for PFOS and PFOA. EPA is a member of the working group that is in the process of establishing Australian criteria for these chemicals. The fact sheet notes that when EPA Victoria undertakes an environmental assessment for PFCs it refers to international standards, such as the US soil and water values for PFOS and PFOA (see entries for May 2012 and March 2014). The fact sheet notes that while these levels (i.e. those mirroring the aforementioned US EPA values) are not necessarily unsafe, they would warrant further investigation.	Available at: http://www.epa.vic.gov.au/~/media/Publications/1611.pdf
***18 Aug 2015**	The NSW EPA requested OEH to assess PFC limits proposed in EPA Victoria factsheet 1611 and advise if it is appropriate for use in NSW. OEH prepared a Draft Review of Soil Screening Values for PFOS and PFOA (which were not for circulation).	Email dated 18 August 2015 from the NSW EPA to OEH for a Science Request for advice (High Priority) and subsequent emails in September 2015 refining this request.
19–23 Oct 2015	PFOA nominated for inclusion in Stockholm Convention. The Persistent Organic Pollutants Review Committee determined that 'PFOA, its salts and PFOA-related compounds, meets the Annex D criteria to be considered a POP, namely persistence, bioaccumulation, long-range transport and adverse effects.'	Available at: http://chm.pops.int/TheConvention/POPsReviewCommittee/Meetings/POPRC11/Overview/tabid/4558/mctl/ViewDetails/EventModID/871/EventID/553/xmid/13837/Default.aspx

Date	Event	Source
10 Nov 2015	In response to an email from the Review, 3M Australia Pty Limited provided inter alia the following information about 3M Lightwater Fire Fighting Foam products. **A. Additional Health Hazard Information for Organic Fluorochemicals:** … PFOS has been well studied by 3M and the greater scientific community in experimental animal models, the general population and in exposed workers. Based on the extensive body of data that has been generated, there are no demonstrable adverse human health effects from anticipated exposure to PFOS in the products when the products are used as intended and instructed. … **ii. Environmental and Aquatic Toxicity Summary:** This product contains PFOS and/or substances which may degrade to perfluoroalkyl sulfonate. Numerous studies involving terrestrial, avian, freshwater and marine organisms have been conducted with PFOS. Acute and chronic test results on various aquatic organisms indicate acute EC/LCSO values greater than 1.0 mg/L and chronic no observable effect concentration (NOEC) values greater than 0.1 mg/L. The midge (Chironomus tentans) was found to be the most sensitive organism tested, with reported acute and chronic effect concentrations to be 0.1 and 0.01 mg/L, respectively. Studies indicate that PFOS can accumulate in certain species of fish.	Information provided by 3M Australia Pty Limited to the Review.
30 Nov 2015	An inquiry was established by the Senate (Australian Federal Parliament) in relation to the contamination of Australian Defence Force facilities and of other sites using firefighting foams.	Inquiry terms of reference available at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities
2 Dec 2015	The NSW EPA Board approved a strategic framework for forward action on PFCs.[30]	Information provided by the NSW EPA to the Review.
5 Feb 2016	NICNAS issued a chemical fact sheet on Per- and poly-fluorinated alkyl substances (PFASs) also known as: per- and poly-fluorinated chemicals (PFCs). Per- and poly-fluorinated alkyl substances (PFASs), also commonly known as PFCs (per- and poly-fluorinated chemicals), and their derivatives are part of a group of chemicals that has many specialty applications. They can provide resistance to heat, to other chemicals or to abrasion, and can also be used as dispersion, wetting or surface-treatment agents. PFASs and their derivatives are man-made chemicals and have been used in a wide range of industrial processes and consumer products, including in the manufacture of non-stick cookware (although not added to the finished cookware), specialised garments and textiles, Scotchgard™ and similar products (used to protect fabric, furniture, and carpets from stains), metal plating and in some types of fire-fighting foam. There are two main groups of perfluorinated chemicals used in	Available at: https://www.nicnas.gov.au/communications/publications/information-sheets/existing-chemical-info-sheets/perfluorinated-chemicals-pfcs-factsheet

[30] This framework is detailed in Section 5 of this Interim Report.

<table>
<tr><th>Date</th><th>Event</th><th>Source</th></tr>
<tr><td></td><td>industry:

1. perfluoroalkyl sulfonic acids (PFSA) group, including chemicals such as perfluorooctane sulfonate (PFOS)
2. the perfluorocarboxylic acid (PFCA) group, including chemicals such as perfluorooctanoic acid (PFOA).
…
People and animals can be exposed to PFASs through food, water, and indoor and outdoor dust and air. Some long-chain PFASs bioaccumulate in animals, are toxic to aquatic and terrestrial organisms, and can enter the human food chain.</td><td></td></tr>
<tr><td>19 Feb 2016</td><td>The NSW EPA issued a media release detailing its investigation of legacy PFC use across NSW.</td><td>Available at: https://www.epa.nsw.gov.au/epamedia/EPAMedia16021903.htm</td></tr>
<tr><td>24 Feb 2016</td><td>Department of Environment Regulation (Western Australia) issued guidance on perfluoroalkyl and polyfluoroalkyl substances (PFAS), that include perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA):

• Assessing and managing PFAS contamination
• Assessing risks to human health, the environment and environmental values
• The availability and derivation of generic assessment levels
• The remediation and management of PFAS impacted sites.

Department of Environment Regulation (Western Australia) ‘interim screening levels for soil, sediment, surface water and groundwater’ are set out below.
<table>
<tr><th>Exposure Scenario</th><th>PFOS</th><th>PFOA</th><th>Comments</th></tr>
<tr><td colspan="4">Soil</td></tr>
<tr><td>human health residential*</td><td>4 mg/kg</td><td></td><td></td></tr>
<tr><td>human health industrial/commercial*</td><td>100 mg/kg</td><td></td><td></td></tr>
<tr><td colspan="4">Surface water and groundwater</td></tr>
<tr><td>drinking water*</td><td>0.5 µg/L</td><td></td><td></td></tr>
<tr><td>non-potable and recreational uses*</td><td>5 µg/L</td><td></td><td></td></tr>
<tr><td rowspan="3">ecological – freshwater+</td><td>0.00023 µg/L</td><td>19 µg/L</td><td>High conservation value systems - 99% species protection</td></tr>
<tr><td>0.13 µg/L</td><td>220 µg/L</td><td>Slightly – moderately disturbed systems - 95% species protection</td></tr>
<tr><td>2.0 µg/L</td><td>632 µg/L</td><td>Highly disturbed systems - 90 %</td></tr>
</table></td><td>Available at: https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/Guideline-on-Assessment-and-Management-of-PFAS-.pdf</td></tr>
</table>

Date	Event	Source
	<table><tr><td></td><td></td><td></td><td>species protection</td></tr><tr><td></td><td>31 µg/L</td><td>1,824 µg/L</td><td>Highly disturbed systems - 80 % species protection</td></tr></table> * Values are provisional and will be revised as and when relevant information is published by enHealth. + Draft Australian and New Zealand Water Quality Guidelines applicable to aquatic organisms. The default guideline values may not account for effects which result from the biomagnification of toxicants such as PFOS in air-breathing animals or in animals which prey on aquatic organisms.	
Mar 2016	Defence's environmental investigations into AFFF use at RAAF Base Pearce WA, RAAF Base East Sale in Victoria and HMAS Albatross in NSW, which will take approximately 21 months, are scheduled to commence from March 2016.	Referred to in Part A of Submission of Defence dated 18 December 2015 to the Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
2016–2017	Defence intends to implement a rolling program of investigation at a further 13 bases, commencing at three bases every four months on a priority basis.	Referred to in Part A of Submission of Defence dated 18 December 2015 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other. Commonwealth, state and territory sites.

SECTION 3

Sites regulated by the NSW EPA containing PFOS/PFOA

The Review asked the NSW EPA for a list of sites known to be contaminated with PFOS/PFOA and, where applicable, the dates it acquired knowledge of such contamination. In response the NSW EPA advised the Review as follows:

> Due to the ubiquitous nature of PFOS/PFOA there are potentially 1000s of sites across NSW where these chemicals have been used in household goods (scotchguard), cookware (teflon pots), textiles (rain proof jackets), fast food wrappers as well as fire-fighting foams. Sewage is also likely to contain concentrations of these chemicals and hence contributes to the ubiquitous nature of these chemicals. Hence the level of exposure to these chemicals is what is important. The *Contaminated Land Management Act 1997* (CLM Act) is primarily concerned with sites where a significant exposure pathway exists. The NSW EPA only regulates sites where there is a need to intervene because of a significant risk of harm arising from the contaminated site. The CLM Act relies on a duty to notify trigger as such there are no contaminated sites in NSW notified to the NSW EPA where PFOS/PFOA is the primary contaminant.

The NSW EPA advised the Review of the following NSW sites where PFOS/PFOA is listed as a co-contaminant and the site is regulated under the CLM Act:

- Fuchs Lubricants (Australasia) Pty Ltd, Wickham, Newcastle: notified 7 March 2013;
- Colongra Power Station, Colongra: notified 12 Feb 2015;
- The Shell Company of Australia Limited/Viva Clyde Energy Australia Pty Ltd, Clyde Terminal, Durham Street, Camellia; not notified.

In addition, as identified in the Review's Stage One Interim Chronology (on the PFOS/PFOA contamination at Williamtown RAAF Base), on 29 January 2013 the NSW EPA became aware the groundwater at the sewage treatment plant was contaminated with PFOS/PFOA. This information was contained in the reports prepared by John Holland for Defence entitled Sewage Treatment Plant Lagoon Investigation Report and Sewage Treatment Plant Overflow Area Investigation Report.

The chronologies below reflect information the NSW EPA provided to the Review on 23 December 2015, and 12, 17, 25 and 29 February 2016 in regard to sites it was regulating where it knew there was PFOS/PFOA along with other contaminants.

3.1 Fuchs Lubricants (Australasia) Pty Ltd, 2 Holland Street, Wickham, Newcastle

The Fuchs site is an industrial/commercial facility that stores and blends hydrocarbon products.[31]

Date	Event	Source
4 Mar 2013	The NSW EPA had a meeting with Fuchs Lubricants (Australasia) Pty Ltd (Fuchs) and its consultants to discuss Fuchs' contamination issues.	Information provided by the NSW EPA to the Review.
7 Mar 2013	Fuchs notified the NSW EPA under s 60 of the CLM Act, of petroleum contamination (Light Non Aqueous Phase Liquids, dissolved phase naphthalene, phenol, volatile organic compounds and total petroleum hydrocarbons) on the site. PFOS was also added to the list as a co-contaminant, as was asbestos at a later date.	Information provided by the NSW EPA to the Review.

[31] See http://www.fuchs.com.au (accessed 6 March 2016).

Date	Event	Source
20 Mar 2013	AECOM Australia Pty Ltd (AECOM) provided the NSW EPA an update, on behalf of Fuchs, regarding its investigations to date.	Information provided by the NSW EPA to the Review.
June 2013	Interim Update and Summary report on Phase 2 Environmental Site Assessment (draft) dated June 2013, provided by AECOM to the NSW EPA.	Information provided by the NSW EPA to the Review.
19 Aug 2013	AECOM on behalf of Fuchs provided an update to the NSW EPA regarding its further investigations, interim findings and site auditor commentary.	Information provided by the NSW EPA to the Review.
4 Nov 2013	The NSW EPA replied to the notification (of 7 March 2013) and the information supplied (report dated June 2013). The NSW EPA stated that there was insufficient information to determine whether the contamination was significant to warrant regulation in relation to, inter alia, PFOS contamination in groundwater. The NSW EPA considered that it was appropriate to revisit its determination under the CLM Act when the proposed remediation of the site was completed. It requested Fuchs to provide copies of the validation reports when the remediation work was complete. The Review notes that the NSW EPA's letter did not set or request a timeframe for the completion of the remediation works or the provision of the validation reports.	Information provided by the NSW EPA to the Review.
4 Nov 2013	The NSW EPA wrote to Newcastle City Council advising it of the soil and groundwater contamination at Fuchs (Wickham) and the proposed remediation. The NSW EPA suggested that, in the interim, Newcastle City Council may wish to notate factual information on the land title certificates to provide transparency to prospective purchasers of the site.	Information provided by the NSW EPA to the Review.
16 Oct 2015	The NSW EPA wrote to Fuchs c/o AECOM, referring to its letter dated 4 Nov 2013 and requested an update by 2 Nov 2015 on the expected timeframe for the completion of the remediation and validation of the site. The NSW EPA has advised the Review that an updated Phase 2 Environmental Site Assessment (draft) was provided to it in 2015—no day/month was provided.	Information provided by the NSW EPA to the Review. Information provided by the NSW EPA to the Review.
4 Nov 2015	AECOM on behalf of Fuchs updated the NSW EPA. It stated that the site remediation process was continuing and the expected completion date was December 2017. In particular, AECOM's report noted that PFOS had been recorded in groundwater and was attributed to an historical incident that resulted in the loss of AFFF product from an above-ground fire hydrant. The report stated that soil PFOS concentrations were 'well below the assessment criteria' (the criteria applied were not	Information provided by the NSW EPA to the Review.

Date	Event	Source
	specified), indicating that the source of contamination was no longer present and that it was unlikely to be causing ongoing impact to groundwater beneath the site via soil leaching processes. In the view of AECOM, this aspect of the site contamination did not warrant remediation.	
17 Dec 2015	The NSW EPA emailed AECOM requesting the appendices to the report that was received 4 Nov 2015 along with Phase 1 and 2 investigation reports.	Information provided by the NSW EPA to the Review.
13 Jan 2016	The NSW EPA requested AECOM to follow up on the information requested by the NSW EPA in its email dated 17 Dec 2015.	Information provided by the NSW EPA to the Review.
14 Jan 2016	AECOM emailed the NSW EPA and provided the information the NSW EPA required to complete its review.	Information provided by the NSW EPA to the Review.

3.2 Colongra Power Station, 22 Scenic Drive, Colongra

Colongra Power Station is a gas-fired power station.[32]

Date	Event	Source
17 July 2014	Environmental Resources Management Australia (ERM) prepared a Stage 2 Site Assessment for Colongra Power Station, which stated inter alia that: PFOS and PFOA were detected in groundwater at concentrations in excess of the adopted human health (drinking water) and ecological screening levels within AECs [Areas of Environmental Concern] CI and CF [CI and CF acronyms not defined]. The adopted human health (drinking water) screening levels were obtained from US EPA (2014), with the adopted values being provisional health advisory concentrations, rather than regulatory guidelines. Similarly, the adopted ecological screening levels were obtained from the Netherlands RIVM (2010), with the adopted values only having been proposed as water quality standards in the Netherlands. As such, these values are not called up by section 60 of the CLM (1997) Act as prescribed levels of contamination requiring notification.	Information provided by the NSW EPA to the Review. The RIVM PFOS risk limits are available at: http://rivm.nl/en/Search/Library
3 Feb 2015	Jacobs Group (Australia) Pty Limited wrote to Snowy Hydro Limited (owner of Colongra Power Station) recommending that Snowy Hydro notify the NSW EPA under s 60 of the *Contaminated Land Management Act 1997* (CLM Act). The Jacob's report identified some locations at the power station where there were 'exceedances of criteria for groundwater (metals and PFOS)'. The report noted 'data gaps are associated with groundwater contaminant transport flow and migration'.	Information provided by the NSW EPA to the Review.

[32] See http://www.snowyhydro.com.au/energy/gas/colongra-power-station/ (accessed 6 March 2016).

Date	Event	Source
12 Feb 2015	The NSW EPA received a letter dated 10 Feb 2015 from Snowy Hydro Limited enclosing a notification under s 60 of the CLM Act in relation to Colongra Power Station. The notification form stated inter alia: (1) The contaminants of concern at two locations were 'metals and PFOS in groundwater'. (2) There was insufficient data to suggest persons or the environment were at risk, and that 'the contamination present[ed] a low risk'. The notification attached an extract of ERM's Stage 2 Site Assessment and the letter dated 3 Feb 2015 from Jacobs Group (Australia) Pty Limited to Snowy Hydro Limited.	Information provided by the NSW EPA to the Review.
27 Oct 2015	The NSW EPA wrote to Snowy Hydro Limited acknowledging receipt of the s 60 notification and requested: (1) that Snowy Hydro Limited advise the NSW EPA of the proposed works and the anticipated time frames for reporting to the NSW EPA (2) a copy of the complete Stage 2 Environmental Site Assessment Report (i.e. the Jacobs report referred to in the s 60 notification). The NSW EPA noted that on receipt of the above information it would assess the site under s 12 of the CLM Act to determine whether it required regulation.	Information provided by the NSW EPA to the Review.
18 Nov 2015	Snowy Hydro Limited responded to the NSW EPA's letter of 27 Oct 2015 advising final reporting was expected to be complete by May 2016 and that it was sending the NSW EPA the Stage 2 Environmental Site Assessment Report by courier. The NSW EPA has advised the Review that the information received is under assessment.	Information provided by the NSW EPA to the Review.

3.3 The Shell Company of Australia Limited[33] (former licensee)/Viva Energy Australia Pty Ltd (current licensee), Clyde Terminal Durham Street, Camellia

Clyde Terminal was formerly a hydrocarbon processing refinery, which was converted in 2012 to a storage facility for refined petroleum products.

Date	Event	Source
10 Apr 1995	Shell Refining (Australia) Proprietary Limited wrote to the NSW EPA outlining the findings of a report detailing phase separated hydrocarbon in monitoring wells at the site.	Information provided by the NSW EPA to the Review.
4 May 1995	Internal NSW EPA memorandum stated that in relation to the above report 'the contamination was discovered accidentally and they [Shell Refining (Australia) Proprietary Limited] claim there is no evidence of existing migration off site'.	Information provided by the NSW EPA to the Review.
26 Feb 2001	Shell Refining (Australia) Proprietary Limited wrote to the NSW EPA in relation to groundwater monitoring reports for the Shell refinery site at Clyde.	Information provided by the NSW EPA to the Review.
19 Apr 2001	Meeting between the NSW EPA and Shell Refining (Australia) Proprietary Limited to discuss the groundwater monitoring reports for the Shell refinery site at Clyde. At the meeting the NSW EPA advised Shell Refining (Australia) Proprietary Limited that the contamination in the groundwater posed a significant risk of harm to human health and the environment.	Information provided by the NSW EPA to the Review.
11 July 2001	The NSW EPA wrote to Shell Refining (Australia) Proprietary Limited and advised it that the hydrocarbon contamination in the groundwater at Shell's Clyde refinery posed a significant risk of harm to human health and the environment. Although the assessment was made pursuant to the then s 9 of the CLM Act (Assessment of Risk of Harm), the NSW EPA advised that it intended to regulate the contamination, at least in the short term, by amending the refinery's Environment Protection Licence under the *Protection of the Environment Operations Act 1997* (NSW) (the POEO Act).	Information provided by the NSW EPA to the Review.
2002—June 2010	Various amendments were made to Shell Refining (Australia) Proprietary Limited Environment Protection Licence # 570.	Environment Protection Licence # 570 is available on the POEO Public Register, available at: http://www.epa.nsw.gov.au/licensing/

[33] The information obtained by the Review in relation to the 'Shell' Clyde Terminal site does not use consistent terminology in referring to the name of the former licensee i.e. Shell. Entries in the chronology at Section 3.3 therefore reflect the various names used to describe the Shell company in the information supplied to the Review.

Date	Event	Source
16 Dec 2010	Shell Company of Australia Limited submitted to the NSW EPA a Soil and Groundwater Management Plan, Shell Clyde Refinery and Parramatta Terminal, which was completed by Environmental Resources Management Australia Pty Ltd (ERM). The purpose of the plan was 'to provide a more flexible and effective process of monitoring, managing and improving soil and groundwater conditions at the site'. The plan was subsequently set out in condition 8—U1.1. of Shell's Environment Protection Licence # 570.	Information provided by the NSW EPA to the Review.
27 July 2011	Shell announced it would cease refinery processing by mid-2013 at the Clyde Refinery site and that it proposed to convert the site to a storage facility for refined petroleum products.	Information provided by the NSW EPA to the Review.
12 Oct 2011	The NSW EPA wrote to Shell Refining Australia Pty Ltd outlining its expectations that an investigation and remediation program be developed and implemented for the refinery site such that all contamination legacies be addressed in a timely and comprehensive manner.	Information provided by the NSW EPA to the Review.
23 Feb 2012	The NSW EPA wrote to The Shell Company of Australia Limited attaching a draft Preliminary Investigation Order under s 10 of the CLM Act for comment.	Information provided by the NSW EPA to the Review.
Mar 2012	ERM completed the Annual Progress Report (2011) Clyde Refinery and Parramatta Terminal. The report is dated 30 March 2012. The report stated that: > PFOS was reported to be present at concentrations above the laboratory LOR [limit of reporting] in four of the 10 groundwater monitoring wells submitted for laboratory analysis. The results are not considered to indicate widespread gross contamination for this potential COC [contaminant of concern]. The report also noted that PFOS had not previously been investigated and that it was to be added to the Groundwater Sampling and Analysis Plan for 2012. The NSW EPA advised the Review that in 2012 The Shell Company of Australia Limited provided it with this report.	Information provided by the NSW EPA to the Review.

Date	Event	Source
22 Jun 2012	The NSW EPA issued a Preliminary Investigation Order to Shell Refining (Australia) Pty Ltd under the CLM Act requesting reports on environmental contamination (sediment, soil, water), data gaps and proposed investigation plan by 1 Aug 2012. The Preliminary Investigation Order nominated a number of contaminants potentially affecting the site. PFOS/PFOA were not specifically nominated in the Preliminary Investigation Order, although reference was made to 'legacy waste, including asbestos' and 'Other chemical contaminants associated with the operating history of the site'.	Information provided by the NSW EPA to the Review.
1 Aug 2012	Environmental Conditions Summary Report, Shell Clyde Refinery, prepared by ERM for The Shell Company of Australia Limited in response to the NSW EPA's Preliminary Investigation Order. The report noted: Perfluorooctane Sulfonate (PFOS) is understood to have been present as a surface active agent within fire fighting foam stored and utilised across the site. The report also noted that the results for PFOS were not 'considered to indicate widespread gross contamination for this potential COC' (constituent of concern). The NSW EPA has advised the Review that the Environmental Conditions Summary Report was provided to it in 2012.	Information provided by the NSW EPA to the Review.
25 Sept 2012	The NSW EPA wrote to The Shell Company of Australia Limited and identified some concerns in relation to the proposed activities to comply with the action in the Preliminary Investigation Order. The NSW EPA requested Shell to provide further information and reports within two months of the date of the letter.	Information provided by the NSW EPA to the Review.
30 Sept 2012	Shut down of refining and processing units at Shell Clyde was scheduled to commence.	See: http://www.shell.com.au/content/dam/shell-new/local/country/aus/downloads/clyde/shell-clyde-eis-210812.pdf
28 Nov 2012	Shell Refining (Australia) Pty Ltd wrote to the NSW EPA providing the information and reports requested on 25 Sept 2012. Attached to this was a letter dated 28 Nov 2012 from ERM to The Shell Company of Australia Limited containing the requested supplementary information.	Information provided by the NSW EPA to the Review.

Date	Event	Source
31 Oct 2013	Ownership of the refinery site was transferred from Shell Refining (Australia) Pty Ltd to Shell Company of Australia Limited. The site's Environment Protection Licence # 570 was also transferred to the Shell Company of Australia Limited.	Information provided by the NSW EPA to the Review.
2014	Viva Energy Australia Ltd became the owner and licensee of the site.	Information provided by the NSW EPA to the Review.
14 Oct 2015	The NSW EPA completed a s 12 Assessment Report under the CLM Act and determined that the site contamination was significant enough to warrant regulation. One of the reasons for this determination was that 'PFOS was identified at concentrations above LOR [limit of reporting] in localised groundwater monitoring wells at the site. The s 12 assessment was completed **without** a notification pursuant to s 60 of the CLM Act. The NSW EPA has advised the Review that a s 60 notification is not required for declaring the site.	Information provided by the NSW EPA to the Review.

SECTION 4

Commonwealth sites known to be contaminated by PFOS/PFOA

The contamination at the Williamtown RAAF Base, which is a Commonwealth site, illustrates that PFOS/PFOA can migrate into state territory and adversely impact water, soil and biota. Importantly, there are demonstrable human exposure pathways in impacted communities, including those at Williamtown and its surrounds.[34] It is therefore relevant to also consider Commonwealth sites known to be contaminated by PFOS/PFOA.

The Review asked the NSW EPA to provide information about Commonwealth sites it knew to be contaminated with PFOS/PFOA. The Review notes that the NSW EPA does not have jurisdiction over Commonwealth sites. The NSW EPA provided information on Airservices Australia sites and a Moorebank Intermodal Company site.

4.1 Airservices Australia sites

Airservices Australia is a Commonwealth corporate entity, which provides services to the aviation industry.[35] Its sites are regulated under the *Airports (Environmental Protection) Regulation 1997* (Cth). The NSW EPA has advised the Review that Airservices has advised it of issues related to the former use of aqueous film forming foams (AFFF) at Sydney Airport (Mascot), Tamworth Airport and Bankstown Airport.

In addition, the Review notes that:

- Airservices Australia has identified 36 sites (current and historical) that have, or are suspected of having, PFC (perfluorinated chemical) residues from AFFF use.[36] The relevant AFFF-impacted NSW airports are those noted above.
- The Department of Infrastructure and Regional Development has also identified Camden airport (NSW) as a site that has been potentially contaminated by PFCs.[37]

The following chronologies reflect information the NSW EPA provided to the Review on 23 December 2015; 25, 29 February 2016; and 2, 8 March 2016; as well as the Review's research.

[34] See the Review's Stage One Interim Report on Williamtown RAAF Base contamination—https://www.epa.nsw.gov.au/MediaInformation/taylor-report-williamtown.htm (accessed 19 February 2016); The Senate—Inquiry into firefighting foam contamination Part A Report—RAAF Base Williamtown, http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities/Report_part_A (accessed 5 February 2016).
[35] See www.airservicesaustralia.com.
[36] Submission of Airservices Australia dated February 2016 to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites—http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities/Submissions (accessed 22 February 2016).
[37] Submission of Department of Infrastructure and Regional Development (undated) to Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites—http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Foreign_Affairs_Defence_and_Trade/ADF_facilities/Submissions (accessed 22 February 2016).

Chronology of knowledge and communications regarding PFOS/PFOA contamination at Airservices Australia sites

Date	Event	Source
16 July 2010	Airservices Australia wrote to the Department of Environment, Climate Change and Water (NSW) advising that it had become of aware of potential contamination issues from the use of AFFF (including PFOS/PFOA) products for emergency response and training purposes. It foreshadowed arranging a meeting with the Department to discuss these issues.	Information provided by the NSW EPA to the Review.
20 Aug 2010	Meeting between Airservices Australia, the NSW EPA and AECOM (consultants). Airservices Australia airport sites of potential concern were raised in regard to PFOS contamination from AFFF use. The NSW EPA foreshadowed it would list the issue as an agenda item for the Strategic Liaison Group (comprising staff from the Department of Environment, Climate Change and Water; NSW EPA; NSW Health).	Information provided by the NSW EPA to the Review.
27 Aug 2010	Strategic Liaison Group meeting. While the action list for this meeting records that 'emerging issues' were discussed there is no specific mention in the action list of PFOS or PFOA or its legacy effects. The meeting referred to the WHO (World Health Organization) top ten chemicals of public health concern.[38]	Information provided by the NSW EPA to the Review.
19 Aug 2011	Airservices Australia wrote to the Office of Environment and Heritage (NSW) and advised of the preliminary results of a contamination and risk assessment investigation at current and former fire training ground sites at Sydney Airport. Contamination from historical use of AFFFs was identified in on-site soils and groundwater. PFOS and PFOA were also found in water and sediments in waterways adjacent to current and former fire training ground sites. PFOS was also found in aquatic fauna.	Information provided by the NSW EPA to the Review.
Nov 2011	Airservices Australia consulted with the NSW EPA regarding the potential for off-site PFOS/PFOA contamination of NSW land from sites where there has been storage or use of AFFF for firefighting training.	Information provided by the NSW EPA to the Review.
3 May 2012	The NSW EPA wrote to Airservices Australia noting the meeting scheduled for 16 April 2012 to provide an update on its AFFF investigations had been cancelled. The NSW EPA requested a detailed site investigation report and advice on whether remedial activities were anticipated.	Information provided by the NSW EPA to the Review.

[38] See http://www.who.int/ipcs/assessment/public_health/chemicals_phc/en/ (accessed 4 March 2016). The Review notes that the WHO list of 'Ten chemicals of major public health concern' does not include PFOS/PFOA.

Date	Event	Source
26 July 2012	Internal NSW EPA issues brief referred to contamination of Sydney Airport by firefighting foams, and that Airservices Australia had briefed the NSW EPA on further investigations (having previously flagged the issue in November 2011). The issues brief also noted that PFOS was a widespread contaminant and 'This issue maybe relevant to other assets where these foams have been used (Defence sites, NSWFB [NSW Fire Brigade] fire training grounds).'	Information provided by the NSW EPA to the Review.
8 Nov 2012	Airservices Australia presented AECOM's 'Contamination Investigation Report' and 'Human Health and Ecological Risk Assessment' reports for Sydney Airport (dated 24 August 2012) to the NSW EPA. The Human Health and Ecological Risk Assessment report noted the presence of PFOS in aquatic biota, which may have the potential to result in adverse effects on higher order predators such as seabirds (both migratory and non-migratory).	Information provided by the NSW EPA to the Review.
5 Feb 2014	Airservices Australia had a teleconference with inter alia the NSW EPA regarding a project by Airservices Australia to develop trigger levels for PFOS/PFOA. At this meeting, Airservices Australia advised the following: • It had identified 39 sites suspected of being contaminated with PFOS/PFOA.[39] • High risk locations had been assessed using the Minnesota guidelines for drinking water. • There was a need to develop trigger levels relevant to Australian conditions and appropriate for industrial sites. • It proposed to engage a consultant to develop trigger levels using the NEPM (National Environment Protection Measures) method for the Assessment of Site Contamination.	Information provided by the NSW EPA to the Review.
26 Mar 2014	The Department of Infrastructure and Regional Development (Cth) emailed inter alia the NSW EPA a summary of the Airservices Australia PFOs/PFOA investigation proposal and a guideline document outlining the use of firefighting foam for training exercises at Leased Federal Airports (airports) without an aviation rescue and firefighting service. The guideline stated that it applied to the following airports: Archerfield (Queensland), Bankstown (NSW), Camden (NSW), Essendon (Victoria), Moorabbin (Victoria), Parafield (South Australia) and Jandakot Airport (Western Australia).	Information provided by the NSW EPA to the Review.
26 Mar 2014	The Contaminated Sites section of the NSW EPA forwarded the above email from the Department of Infrastructure and Regional Development (Cth) dated 26 March 2014 to the Chemicals section of the NSW EPA.	Information provided by the NSW EPA to the Review.

[39] The Review notes that, as stated in Section 4.1, as at February 2016 Airservices Australia had identified 36 sites suspected of being contaminated with PFC residues from AFFF use.

Date	Event	Source
14 Apr 2014	The Department of the Environment (Cth) circulated to state and territory officers and regulators a copy of Airservices' project proposal to develop trigger levels for PFOS and PFOA in surface water, soil and sediment at Airservices sites as well as a record of the teleconference of 5 February 2014. The proposal attached to the email stated in part that: Airservices is seeking the involvement of both State and Commonwealth regulators in the project to ensure that the process used and the final HIL [health investigation level] and EIL [ecological investigation level] derivations meet the critical needs of regulators so that the derived investigations levels can then be used to assess Airservices sites with minimal debate over the relevancy of the levels themselves. … Airservices intends to use these trigger levels only as investigation levels when undertaking site assessments. Although there is potential scope for developing these as formal investigation levels for inclusion within the ASC NEPM, Airservices aim is in developing trigger levels for use at Airservices sites rather than for more general use. However, Airservices has no objection to the inclusion of these trigger levels into the ASC NEPM as investigation levels should that prove possible.	Information provided by the NSW EPA to the Review.
15 Apr 2014	NSW Office of Environment and Heritage forwarded to the NSW EPA the Airservices Australia email dated 14 April 2014, together with the Project Plan for the Development of Trigger Levels for PFOS and PFOA.	Information provided by the NSW EPA to the Review.

4.2 Moorebank Intermodal Company—former Defence site at Moorebank, NSW

Moorebank Intermodal Company Limited (MIC) is an Australian Government Business Enterprise, which is incorporated under the *Corporations Act 2001* (Cth), and operates under the *Commonwealth Authorities and Companies Act 1997* (Cth).

On 13 December 2012, MIC was established to develop a freight terminal at Moorebank in Sydney's south-west. MIC has applied for planning approval under s 104 of the *Environmental Protection and Biodiversity Act 1999* (Cth) and is seeking concept approval for a terminal on its site under the *Environmental Planning and Assessment Act 1979* (NSW).[40]

The NSW EPA has advised the Review that an accredited site auditor is dealing with contamination issues on the MIC site and that it is 'currently managing the EIS [Environmental Impact Statement] review process and the incorporation of necessary monitoring and control.'

Chronology of knowledge and communications regarding PFOS/PFOA contamination at the former Defence site at Moorebank, NSW

Date	Event	Source
9 Oct 2015	Moorebank Intermodal Company (MIC) wrote to the NSW EPA and identified as part of its Environmental Impact Statement process that aqueous film forming foams (AFFF) had been found at three locations at the development site. In particular, low concentrations of AFFF were measured in water from the Georges River and were ascribed to former firefighting training activities undertaken by the Department of Defence. MIC's environmental consultant determined, in the absence of NSW EPA or national criteria, to adopt the values currently being used by the Department of Defence for AFFF. MIC noted that further investigation of the presence of AFFF in soil and groundwater and in receiving environments was planned for early 2016.	Information provided by the NSW EPA to the Review.
13 Oct 2015	The NSW EPA replied to MIC's above communication and requested that: • areas that act as source sites for AFFF are contained as a matter of priority to limit any further mobilisation of AFFF to receiving environments • water monitoring be expedited to determine potential impacts on groundwater and implications for human health and the environment.	Information provided by the NSW EPA to the Review.
15 Dec 2015	MIC submitted its final Environmental Impact Statement to the Department of the Environment (Cth). This Environmental Impact Statement relates to the planning approval application under s 104 of the *Environmental Protection and Biodiversity Act 1999* (Cth).	See: http://www.micl.com.au

[40] Moorebank Intermodal Company Limited website: see http://www.micl.com.au (accessed 6 March 2016).

SECTION 5

The NSW EPA's ongoing and future management of sites potentially or actually contaminated by PFOS/PFOA

The information in this section addresses the NSW EPA's ongoing and scheduled future strategies with respect to PFOS/PFOA contamination at sites known and unknown. The Review was tasked specifically to examine the NSW EPA's *past* and *future* management of PFOS/PFOA contaminated sites. However, it considered this also entailed capturing the NSW EPA's ongoing activities,[41] including its processes for acquiring knowledge and undertaking risk assessments.

5.1 Sites suspected to be contaminated with PFOS/PFOA

The Review was asked to evaluate the NSW EPA's management of sites 'unknown' to be contaminated by PFOS/PFOA. Therefore the Review requested, inter alia, the NSW EPA to provide information about sites it suspected to be contaminated with PFOS/PFOA. The NSW EPA provided the following information in relation to fire service and Defence operations in NSW.

Fire services

On 25 November 2015, the NSW EPA wrote to Fire & Rescue NSW and NSW Rural Fire Service to obtain 'information … regarding details such as historical usage, storage and disposal, and current stock levels and management practices for these materials [PFOS and related chemicals]' and 'environmental assessments and proposed remedial actions at sites within NSW that are potentially impacted by these materials.'[42]

On 9 December 2015, NSW Rural Fire Service informed the NSW EPA that it was in the process of gathering the information requested.[43] On 11 December 2015, Fire & Rescue NSW informed the NSW EPA it had:

- withdrawn AFFF from service in 2007;
- no remaining stocks of AFFF;
- disposed of its stock of AFFF in a high temperature incinerator;
- possibly used AFFF in small quantities at the following Fire & Rescue NSW training centres—Alexandria, Armidale, Albion Park, Deniliquin, and Wellington;
- used the Workcover Authority/TestSafe site at Londonderry Road (Londonderry, NSW) for training with various foam types during the 1990s and early 2000s.[44]

Defence

The NSW EPA advised the Review on 23 December 2015 that it has asked Defence to provide information on other sites in NSW that it suspects or knows are contaminated with AFFF or PFOS/PFOA. Senior officers of Defence have advised the EPA that they 'are not aware of any other site with PFOS issues'.[45]

Draft minutes dated 16 October 2015 of a joint agency meeting involving the NSW EPA and Defence recorded the following action item:

[41] As demonstrated below, ongoing activities of the NSW EPA include its engagement with fire services and the Department of Defence in relation to identifying sites contaminated by PFOS/PFOA.
[42] Information provided by the NSW EPA to the Review.
[43] Ibid.
[44] Ibid.
[45] Ibid.

> Defence to advise the EPA of any other Defence sites in NSW where PFOS/PFOA contamination is identified.
> At present no other sites have been identified by Defence in NSW. They are currently compiling a list of potential sites and prioritising them for investigation.[46]

The NSW EPA has advised the Review that it will continue to liaise with the Defence regarding its portfolio of sites as part of its future program on PFCs.[47]

5.2 Regulation of Defence sites

The Review notes that Defence stated in December 2015 that it would undertake an investigation of AFFF use, inter alia, at HMAS Albatross in NSW, commencing in March 2016.[48] In addition, Defence has committed to a rolling program of investigation of AFFF use at a number of other bases across Australia.[49]

The Review's research has identified that the RAAF Base Richmond site is also contaminated with AFFF.[50] This information conflicts with earlier statements attributed to Defence in regard to its knowledge of AFFF on its sites. In the draft minutes of the joint agency meetings of October 2015, Defence stated that at that time it was unaware of other sites in NSW contaminated by PFOS/PFOA.

The Review notes that the regulation of Defence in relation to contamination caused by it on NSW land continues to be problematic. The Williamtown issue highlights a key gap in the regulation of Commonwealth agencies such as Defence for contamination caused by them on NSW land. This gap needs addressing particularly as there are more sites in NSW that may present Williamtown-like risks.

The NSW EPA Board made it clear that it is not an unreasonable expectation that Commonwealth agencies should be subject to the same environmental standards and laws as other entities in NSW. There are a variety of arrangements that could be explored to achieve regulation more satisfactorily. Potentially, these include establishing a regulator for Defence. The following precedent models are noted:

- The Australian Radiation Protection and Nuclear Safety Agency—regulates Commonwealth entities using radiation with the objective of protecting people and the environment from the harmful effect of radiation.[51]
- National Offshore Petroleum Safety and Environmental Management Authority—[which regulates] health and safety, well integrity and environmental management for all offshore petroleum facilities and activities in Commonwealth waters and in coastal waters where state and territory functions have been conferred. [52]

From the Review's enquiries, it is clear the arrangements for regulating Defence activities that impinge upon NSW territory are not operating satisfactorily.[53] Defence provided the following

[46] Information provided by the NSW EPA to the Review.
[47] The NSW EPA's future program on PFCs is discussed in Section 5.4 below.
[48] Part A of Submission of the Department of Defence dated 18 December 2015 to the Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
[49] Ibid.
[50] Department of Defence, RAAF Base Richmond, NSW, http://www.defence.gov.au/id/_Master/docs/NCRP/NSW/0902RAAFBaseRichmondNSW.pdf (accessed 18 January 2016).
[51] The Australian Radiation Protection and Nuclear Safety Agency, available at: http://www.arpansa.gov.au/index.htm (accessed 12 March 2016).
[52] National Offshore Petroleum Safety and Environmental Management Authority, available at: http://www.nopsema.gov.au (accessed 12 March 2016).
[53] Stage One Interim Report on Williamtown RAAF Base contamination dated 14 December 2015. Available: http://www.epa.nsw.gov.au/MediaInformation/taylor-report-williamtown.htm (accessed 9 March 2016).

comment to the Review in relation to the question of how it is regulated in relation to contamination it has caused:

> The *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) regulates the actions of Commonwealth agencies, including Defence, which have, or are likely to have, a significant impact on the environment, including actions taken on Commonwealth land.[54]

The Review considers that action needs to be taken to address the regulatory gap with respect to contamination caused by Commonwealth agencies, including Defence, on state or territory land. In this regard, the NSW EPA Chair and CEO, together with leaders of other Australian state and territory environment protection authorities, should explore options for consideration by the Meeting of Environment Ministers for regulating Commonwealth agencies that may cause contamination on non-Commonwealth land. The Review understands that the NSW EPA Board supports such an approach.[55]

In addition, the NSW EPA should develop a protocol for the staged escalation of issues where the polluter falls outside the jurisdiction of the NSW EPA or other state agencies but potential exposure pathways exist that could impact the environment or human health. The experience of the NSW EPA in dealing with contamination emanating from Commonwealth-owned land at Williamtown RAAF Base demonstrates a pressing need to establish procedures to ensure early intervention by its senior officers when a polluter falls outside its jurisdiction. The Review understands that the NSW EPA Board supports such an approach.[56]

5.3 NSW EPA's resourcing and costs to address PFOS/PFOA contamination

The Review asked the NSW EPA to detail its costs for managing PFOS/PFOA related contamination issues. The Review wanted to understand the actual costs associated with the recent response to the Williamtown RAAF Base contamination issue and the subsequent investigation into the broader impacts and potential risk of harm arising from PFOS/PFOA in the environment.

The NSW EPA informed the Review that funds have been provided for the items detailed below.[57]

Williamtown related costs

- Approximately seven full-time equivalent staff have been required to service The Williamtown Incident Coordination Centre, the Expert Panel and its three Working Groups—estimated cost of $0.85 million.

Additional expenses for management of the Williamtown PFOS/PFOA related site issues for the 2015–16 and 2016–17 financial years were identified as follows:

- $0.41 million—specialist consulting fees for the Expert Panel and its Working Groups
- $0.6 million—Office of Environment and Heritage specialist expertise services
- $0.1 million—supplementary sampling and analysis (including emergency sampling already undertaken and an estimate for further sampling and analysis in 2015–16)
- $0.4 million—The Independent Review of the NSW EPA's Management of Contaminated Sites (i.e. this Review), including the NSW EPA's staff costs to support Review inquiries.

[54] Advice from the Department of Defence.
[55] Consultation with the NSW EPA Board.
[56] Ibid.
[57] Advice from the NSW EPA.

The total estimated costs for executing the above PFOS/PFOA program amount to $2.36 million over approximately two years. These funds are in addition to the current annual allocation of $1.8 million for the NSW EPA's regulation and management of contaminated sites.

5.4 The NSW EPA's future program on perfluorinated chemicals (PFCs)

In December 2015 the NSW Treasury approved a $0.4 million **resourcing package** for a NSW EPA future program on PFCs to be delivered over an 18-month period in 2016 and 2017. This provides sufficient funding for:

- four full-time equivalent positions to execute the new PFC program
- environmental sampling costs
- external expert advice and investigation.[58]

The broad objectives of the program are to:

- reduce risks posed by PFOS, PFOA and other hazardous PFCs at scheduled premises and at other sites that may be adversely affected by these chemicals; and
- obtain commitment and coordinate an agreed approach with other Branches to assist improved management of potential risks associated with PFCs.[59]

The program's strategic approach consists of the following components:

- A legacy program investigating sites known or suspected to be contaminated with PFCs and a proactive initiative to systematically identify any other sites that may be of concern.
- A current stocks, usage and regulation program that improves our understanding of current stocks and usage of PFCs, promotes their sound management and where appropriate directs substitution of lower risk alternatives.
- An information, communications and guidance program that communicates the EPA's activities, conducts scientific and technical research and develops guidance on managing PFCs that supports credible regulation.
- A resourcing package to ensure delivery of the above, including dedicated staffing, an appropriate operating budget, and a capability to secure external contractors for specialised tasks.[60]

The **legacy program** includes:

- reviewing existing notifications for sites known to be contaminated with PFCs
- assessing sites known to the NSW EPA where fire training exercises have been conducted
- reviewing significant historical incidents involving hydrocarbon fires
- engaging at high-level with Defence regarding other sites potentially affected by PFCs in NSW[61]
- investigating potential legacy contamination at NSW EPA licenced sites including ports, hazardous waste facilities, Major Hazard Facilities,[62] bulk fuel storage locations, coal mines, wastewater plants and landfill waste biomaterial
- tailoring appropriate regulatory responses to individual sites
- identifying potential exposure pathways at high risk sites from potable water supplies, recreational water and fisheries[63]
- implementing the 'polluter pays' principle at PFC-affected sites for investigation and sample

[58] Information provided by the NSW EPA to the Review.
[59] Ibid.
[60] Ibid.
[61] The Review notes that the Department of Defence has identified 16 sites that it will be investigating for AFFF from 2016—see Part A of Defence's Submission dated 18 December 2015 to the Senate Inquiry on Contamination of Australia's Defence Force Facilities and other Commonwealth, state and territory sites.
[62] Major Hazard Facility is defined in *Work Health and Safety Regulation 2011* (NSW) reg 5.
[63] Consultations with DPI Fisheries and DPI Water emphasised the need for hydrology and groundwater assessment of PFC transport as part of any future site assessment.

programs
- public reporting.[64]

The **current stocks, usage and regulation program** includes a review of:
- selected EPA-licensed premises
- waste regulatory criteria for PFCs.[65]

Subject to resourcing, future work is projected to include:

- expanding the scope of EPA-licensed premises to be reviewed
- profiling the amount of PFCs of concern held and used in NSW—involving consultation and engagement with the Commonwealth Department of the Environment and relevant industry
- developing and implementing national/international standard waste disposal measures for remaining PFC stocks
- promoting the use of lower risk alternatives to PFCs.[66]

In addition to the information the NSW EPA has developed for the Williamtown RAAF Base investigation,[67] the **information, communications and guidance program** could include:

- developing new information resources for example, a fact sheet on PFOS
- establishing a consultation framework
- investigating treatment technologies for PFC contaminants
- considering developing PFC assessment criteria for land and groundwater pending the development of national criteria
- maintaining a watching brief on related Australian issues and developments.[68]

The NSW EPA has also identified the following items for consideration in its program:

- establishing an informal interagency consultation panel
- tendering for experts to undertake investigations
- appointing technical expertise in the management of PFCs
- examining the viability of dedicated resources for fast tracking the investigation of PFC-contaminated sites where the polluter may not be known or lacks sufficient financial resources.

The NSW EPA issued a media release on 19 February 2016, informing the public about its new strategy on PFCs. Relevantly, the media release stated:

> … the investigation will focus on sites where, in the past, the chemicals may have been used in large quantities, including airports, firefighting training facilities and some industrial sites, and where it is determined there are exposure pathways that may increase people's contact with the chemicals, such as bore water usage, surface water usage or fishing sites.
> The EPA will work with occupiers and owners of these sites to collect samples of soils and/or waters for indicative analysis for PFCs, and to look for exposure pathways.

[64] Information provided by the NSW EPA to the Review.
[65] The Review notes that there are no NSW guidelines for the classification of waste containing perfluorinated chemicals (PFCs) (see: NSW EPA Waste Classification Guidelines Part 1: Classifying waste, available at: http://www.epa.nsw.gov.au/resources/wasteregulation/140796-classify-waste.pdf (accessed 12 March 2016). This is a critical gap particularly in light of the phase-out of products containing PFCs and the need for their safe disposal. Moreover, the NSW Chief Scientist & Engineer noted in consultation with the Review that more attention should be given to remediation and containment—and that the NSW Expert Panel on Williamtown will be paying particular attention to these issues in 2016.
[66] Information provided by the NSW EPA to the Review.
[67] For information and resources relating to Williamtown RAAF Base contamination from legacy firefighting chemicals see: https://www.epa.nsw.gov.au/MediaInformation/williamtown.htm (accessed 19 February 2016).
[68] Information provided by the NSW EPA to the Review.

> The EPA has received preliminary results from some Fire & Rescue NSW training sites and [is] conducting further investigations in conjunction with NSW fire agencies.[69]

In addition to the NSW EPA's future program on PFCs, the NSW EPA has offered financial support for a Queensland University National Centre for Environmental Toxicology (Entox) Australian Research Council Linkage Project to study 'Fate of fluorinated surfactants and hydrocarbons at coastal airports'.[70] The funding outcome is not yet known.

Review's observations on the NSW EPA's PFCs future program

The NSW EPA's future PFC program is a structured and appropriate response to addressing the identification and potential risk of harm from PFCs. All aspects of this program merit resourcing. Their implementation will help achieve efficiencies and maximise lessons about best practice for assessing, managing and regulating PFC-contaminated sites.

The Review notes that one key aspect of the future PFC program is 'consideration of developing NSW-specific guidance on assessment and/or remediation of PFC contaminated land and groundwater pending development of criteria at the national level.' However, the Review considers that the *actual* development and promulgation of guidelines are crucial.

As noted in the Review's Stage One Interim Report on Williamtown RAAF Base contamination dated 14 December 2015, there is an urgent need to establish environment guidelines for PFOS/PFOA. The Review notes that numerous organisations (industry and government) have identified that PFOS/PFOA are chemicals of concern. This has been accompanied with requests for criteria to be developed,[71] adoption of criteria from other jurisdictions[72] or development of criteria by individual organisations.[73]

In addition, at least two components of the NSW EPA's future program would assist it in harnessing lessons from the numerous current and proposed investigations into PFOS-contaminated sites across NSW and Australia. These items are the establishment of an informal interagency panel and the maintenance of a watching brief on related Australian issues and developments.

Recommended additions to the NSW EPA's future program on PFCs

The Review considers that as part of its future management of PFCs the NSW EPA should consider requiring, at least in the short-term (e.g. 12 months), relevant environment protection licence holders to undertake environmental sampling and analysis for PFCs on- and off-site as part of their licence conditions.

Following receipt and evaluation of data collected pursuant to a PFC sampling and analysis condition, the NSW EPA could assess the need to retain such a condition on a site-by-site basis. This will assist the NSW EPA to understand better the presence of PFCs in the environment and is in line with its adherence to the principle of the 'polluter pays'.

[69] Media release available at: https://www.epa.nsw.gov.au/epamedia/EPAMedia16021903.htm (accessed 19 February 2016).
[70] Information provided by the NSW EPA to the Review.
[71] For example, the CEO and Chair of the NSW EPA advised the Commonwealth at a Senior Officials Group at its meeting of 11 June 2015 that 'PFOS is an emerging groundwater and land contamination issue in parts of NSW and there is a need for clear national guidance on remediation and treatment standards including investigation trigger levels.'
[72] For example, the use of provisional US EPA criteria by industry (see Colongra in Section 3.2 of this Report, entry for 17 July 2014) and by EPA Victoria (see Section 2.2 of this Report, entry for 15 August 2015).
[73] For example, Department of Defence (see Section 2.2 of this Report, entry for May 2015) and Airservices Australia (see Section 4.1 of this Report, entry for 5 February 2014).

Furthermore, the NSW EPA should consider capturing data collected related to NSW PFC environmental sampling and analysis in a single data portal. The NSW Environmental Data Portal, which is currently under development, would be a suitable location for storing and sharing such data.[74]

5.5 Emerging contaminants other than PFOS/PFOA

Given that PFOS/PFOA are only part of a suite of emerging contaminants listed under the Stockholm Convention,[75] the Review wanted to understand what the NSW EPA's plans were for dealing with other new chemicals. The Review recommended previously that the 'NSW Government should resource the EPA with a team to undertake assessments and sampling of emerging contaminants, such as PFOS/PFOA. Such a team could provide the EPA with the level of responsiveness and knowledge-gathering commensurate with its objectives under the *Protection of the Environment Administration Act 1991* (NSW) to protect the environment and reduce the risks to human health.'[76]

The Review is cognisant of the costs and impact that have arisen from the Williamtown RAAF Base contamination issue. It is interested in ascertaining the NSW EPA's preparedness for dealing with other emerging contaminants. This is particularly important given that the NSW EPA's response to Williamtown was largely reactive.[77]

The NSW EPA has advised that further to the Review's Interim Recommendation 5 in its Stage One Report, it has developed a new Emerging Chemical Contaminants Program. The program will:

- assess national and international developments in emerging chemical contaminants
- undertake investigations to determine the use, risk and exposure pathways for emerging chemical contaminants in the NSW environment
- assess the adequacy of existing controls to manage the risk from emerging chemical contaminants
- assess existing treatment and disposal options for emerging chemical contaminants
- develop, implement and coordinate response programs to address current and future contamination risks posed by emerging chemical contaminants.[78]

Review's observations on the NSW EPA's Emerging Chemical Contaminants Program

All aspects of the NSW EPA's Emerging Chemical Contaminants Program merit resourcing. This will assist the NSW EPA in being better prepared to manage any issues arising from these contaminants.

In addition, the Review considers that the NSW Government should engage with the Commonwealth Government, to consult with other relevant government agencies and scientific experts, to initiate the process of developing national guidance on emerging contaminants, other than PFCs, such as those listed on the Stockholm Convention.

[74] NSW Environmental Data Portal, available at: http://www.resourcesandenergy.nsw.gov.au/miners-and-explorers/programs-and-initiatives/nsw-environmental-data-portal (accessed 15 March 2016).
[75] Stockholm Convention website is available at: http://chm.pops.int (accessed 9 March 2016).
[76] Stage One Interim Report on Williamtown RAAF Base contamination dated 14 December 2015, Interim Recommendation 5. Available: http://www.epa.nsw.gov.au/MediaInformation/taylor-report-williamtown.htm (accessed 9 March 2016).
[77] Stage One Interim Report on Williamtown RAAF Base contamination dated 14 December 2015. Available: http://www.epa.nsw.gov.au/MediaInformation/taylor-report-williamtown.htm (accessed 9 March 2016).
[78] Information provided by the NSW EPA to the Review.

The absence of guidelines for emerging contaminants presents a risk that the NSW EPA could miss an opportunity to intervene, at an early stage, in a contamination incident of the type and magnitude at Williamtown. As stated by the NSW EPA in 2014:

> Proactive work is important and, when strategically undertaken can pre-empt some of the reactive work by preventing incidents and non-compliance. This work can offer some of the biggest environmental gains, especially through cumulative impacts of smaller actions.[79]

The NSW EPA should also consider adding sampling and analysis for emerging contaminants other than PFCs to existing environment protection licence conditions.

The above strategies will enable the NSW EPA to address knowledge gaps that may hinder its effective future regulatory action in regard to emerging contaminants. Emerging contaminant data should also be stored in a single data portal.[80] This is consistent with the Review's opinion about PFC data storage.

5.6 Knowledge strategies

The Review wanted to understand how the NSW EPA kept itself informed of the changing regulatory landscape with respect to chemicals, environmental risk, guidelines and policy.

The NSW EPA's engagement with the National Industrial Chemicals Notification and Assessment Scheme

As part of the consultation process, the Review met with NICNAS (National Industrial Chemicals Notification and Assessment Scheme), which is a statutory scheme administered by the Australian Government Department of Health. Amongst its functions, NICNAS provides 'information on the human health and environmental impacts of industrial chemicals and [makes] recommendations on their safe use.' NICNAS provides its information to Commonwealth, state and territory authorities with responsibilities for the regulation of chemicals. It also publishes information on its web portal.[81,82] Relevant to this Review, NICNAS has provided advice and undertaken assessments of the human health and environmental risks of PFOS and PFOA and advised on their safe use and disposal.[83]

In particular, NICNAS informed the Review that its 2004 document 'Options for Disposal of PFOS Waste'[84]

> was prepared in close consultation with all state and territory environmental protection authorities. Each state provided information on its handling of the PFOS wastes and had opportunity to comment on the document prior to its publication.[85]

This information makes it clear the NSW EPA was aware from at least 2004 about PFOS and its potential risk of harm to the environment. As stated in Interim Finding 1 of this Report, since at least 2000, there has been growing acceptance by government, industry and science that

[79] NSW EPA Submission: Inquiry into the performance of the NSW Environment Protection Authority General Purpose Standing Committee No. 5, 2014, page 28, available at: http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/8BB621B4F96A7FCCCA257D4D00114702 (accessed 1 December 2015).
[80] For example, the NSW Environmental Data Portal, available at: http://www.resourcesandenergy.nsw.gov.au/miners-and-explorers/programs-and-initiatives/nsw-environmental-data-portal (accessed 15 March 2016).
[81] Information provided by NICNAS to the Review.
[82] NICNAS website available at: https://www.nicnas.gov.au (accessed 19 February 2016).
[83] Information provided by NICNAS to the Review. See also entries in chronology in Section 2 of this Report relating to the various NICNAS alerts on PFOS and PFOA.
[84] See chronology at Section 2.2, entry for 2004.
[85] Information provided by NICNAS to the Review.

PFOS/PFOA are persistent, bioaccumulative and toxic to both wildlife and humans. However, the 'safe' level of exposure and its specific causal relations to human health outcomes remain under debate.

In response to the Review's questions about the NSW EPA's communications and linkages with NICNAS, the NSW EPA noted it does not have a protocol or MOU (memorandum of understanding) with NICNAS because it is within the Commonwealth Health portfolio and its focus is largely on Work Health and Safety (WHS). The NSW EPA stays abreast of WHS issues via the 'EPA/SafeWork NSW/NSW Health Strategic Liaison Group.'[86] The NSW EPA also noted the following:

> Most of the EPA's interaction at a national level on industrial chemical issues is through the Commonwealth Department of Environment.
>
> The mechanisms for national environmental issues are through the Meeting of Environment Ministers (MEM), The Senior Officials Committee (SOC) Heads of EPA (HEPA) and, for chemical issues at officer level, through the NChEM Working Group …
>
> [It] receives publicly available NICNAS newsletters (e.g. through stakeholder mailing lists) … [and] is aware of the 6 alerts of PFOS/PFOA referred to by the Review.[87]

However, during consultations with Regional NSW EPA staff it became clear that although the NSW EPA receives and is aware of the NICNAS alerts, including those on PFOS/PFOA, this information may not be being disseminated as effectively as it could throughout the NSW EPA. Some regional staff members were not aware of the NICNAS alerts at the time of their issue.[88] In the Stage One Interim Report, the Review noted that following the discovery of the Williamtown RAAF Base contamination issue a Regional NSW EPA officer undertook a Wikipedia search on PFOS/PFOA.[89] In respect to the internal dissemination of information including NICNAS alerts, the NSW EPA advised the Review 'Feeding every factsheet or potential issue to generalist regional staff who cover a very broad range of environmental issues would create more distraction from our core business than gained.'[90]

The Review questions the wisdom of this approach particularly in light of the NSW EPA's stated stakeholder engagement objective to:

> Be widely known as a trusted source of scientific and technical expertise and a credible regulator.[91]

Other sources of knowledge accessed by the NSW EPA

The NSW EPA informed the Review that it is currently involved with a range of other relevant activities that inform its understanding, approach and assessment of risk. These include inter alia:

- Contributions to the National PFC (Perfluorinated Chemicals) Summit coordinated by the Environmental Health Standing Committee (enHealth) of the Australian Health Protection

[86] Information provided by the NSW EPA to the Review.
[87] Ibid.
[88] Consultation NSW EPA North; information provided by the NSW EPA to the Review.
[89] See Interim Chronology in Review's Stage One Interim Report on Williamtown RAAF Base contamination dated 14 December 2015.
[90] Advice received from the NSW EPA.
[91] NSW EPA Submission: Inquiry into the performance of the NSW Environment Protection Authority General Purpose Standing Committee No. 5, 2014, page 28, available at: http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/743BDB8875807D85CA257CFC002142D1 (accessed 1 December 2015).

Principal Committee. It is anticipated that national guidance on blood tests, breast feeding, pregnancy and tolerable daily intake criteria will be established by the middle of 2016.[92]

- Contributions to the development of a National Standard for environmental risk management of industrial chemicals[93] via the National Framework for Chemicals Environmental Management (NChEM)[94] framework.
- The CRC Care Technical Working Group (TWG), convened in March 2015, which the NSW EPA has joined. The NSW EPA will attend the next TWG meeting in March 2016. The TWG guidance will address the national review processes for water (ANZECC[95] fresh and marine water quality guideline review process) and soil National framework (NEPM).[96] The NSW EPA and the Office of Environment and Heritage intend to implement the output of this national review, which is expected in 2016.[97]

Other NSW EPA knowledge strategies include attendance and engagement with the International Committee on Contaminated Land.[98] The Review notes that the NSW EPA was part of the September 2015 Melbourne meeting session covering Emerging Contaminants.[99]

Supplementing the work of the NSW EPA and its various information sources is its Service Agreement with the Office of Environment and Heritage for the provision of scientific services. In brief, these services include:

- chemical analysis
- ecotoxicology
- environmental forensics
- contaminants/chemicals and wastes
- National Risk Assessment and management of chemicals
- emerging chemical issues
- water
- air quality.[100]

In contrast to the NSW EPA's numerous interactions with state, national and international regulators its engagement with Australia's leading research institutions is limited. For example the NSW EPA's contribution to the recent ARC Linkage Project examining fluorinated surfactants and hydrocarbons at coastal airports amounted to a cash contribution of $5,000 with no in-kind contributions [101] (e.g. dedicated NSW EPA staff time to contribute to project field and laboratory work). While the Review understands budgets are typically pre-set and limited, the opportunity to provide in kind contributions is broader. Moreover, such contributions can yield significant benefits for organisations in terms of knowledge, skills acquisition and relationship building.

In addition, there should be opportunity for NSW EPA staff to have desktop access to peer-reviewed research directly via the internet. Peer-reviewed research is typically considered the 'gold standard' for scientific output. However, the Review understands that:

[92] Information provided by the NSW EPA to the Review.
[93] Ibid. See also National Standard for Environmental Risk Management of Industrial Chemicals: http://www.environment.gov.au/protection/chemicals-management/national-standard (accessed 4 March 2016).
[94] NChEM: http://www.scew.gov.au/coag-strategic-priorities/national-waste-policy-and-chemicals/nchem (accessed 4 March 2016).
[95] Australian and New Zealand Environment and Conservation Council.
[96] Information provided by the NSW EPA to the Review.
[97] Ibid.
[98] International Committee on Contaminated Land website available at: http://www.iccl.ch/ (19 February 2016).
[99] International Committee on Contaminated Land 12th meeting in Melbourne, Australia, 10–11 September 2015 http://www.iccl.ch/meeting_melbourne.html#sessionc (accessed 19 February 2016).
[100] The Review notes that it has not yet had the opportunity to examine the operationalisation of these services with respect to the NSW EPA management of contaminated sites.
[101] Information provided by the NSW EPA to the Review.

- Library services available to EPA staff are somewhat limited compared to those available to someone with a university [library] log in.
- Many journals are not easily accessible and have to be accessed from other libraries with costs associated.
- The library budget is very limited and hence services are managed as such.[102]

Thus, access to relevant, peer-reviewed material for NSW EPA staff appears to be cumbersome. By comparison, science researchers can access the global library of peer-reviewed research instantly via university on-line library connections.[103]

5.7 Human health and environmental risk assessments for PFOS/PFOA

Two key instruments driving the NSW EPA's assessment of contaminated sites are the NEPM and the CLM Act. First, there are no national (NEPM/ANZECC) or NSW standards or guidelines for PFOS and PFOA covering groundwater, surface water, sediment and soil. Second, the CLM Act:

> is primarily concerned with sites where a significant exposure pathway exists. The EPA only regulates sites where there is a need to intervene because of a significant risk of harm arising from the contaminated site. **The CLM Act relies on a duty to notify trigger** as such there are no contaminated sites in NSW notified to the EPA where PFOS/PFOA is the primary contaminant. (Emphasis added).[104]

The Review enquired about the procedures and risk-management decision-making tools for dealing with site contamination for dealing with AFFF and, specifically, PFOS/PFOA site contamination to which the NSW EPA adheres. In response, the NSW EPA stated:

> Our evidence based approach with regards to assessment of contaminated sites regarding the relative risks to human health and the environment is through the application of the NEPM (Assessment of Site Contamination—1999 amended 2013) process. Schedule B1—Investigation levels for Soil and Groundwater, Schedule B4—Site-Specific Human Health Risk Assessment.[105]

The NEPM relies on investigation or health screening levels, which are defined as 'the concentration of a contaminant above which further appropriate investigation and evaluation will be required'.[106] Schedule B7 of the NEPM does not list PFOS or PFOA as a contaminant.

At the time of finalising this Interim Report, enHealth issued guidance statements on PFCs 'for state and territory public health units for use in assessing any public health risks where these chemicals have been released into the environment'.[107] While no reference or guideline values were provided, an expert group is to be convened:

> to provide advice to the Australian Health Protection Principal Committee on the development of an Australian interim health reference value for PFOS and PFOA for consistent use in the undertaking of human health risk assessments.[108]

[102] Ibid.
[103] For example, Science Direct hosts more than 14 million research articles on its web portal, available at: http://www.sciencedirect.com/ (accessed 12 March 2016).
[104] Information provided by the NSW EPA to the Review.
[105] Ibid.
[106] *National Environment Protection (Assessment of Site Contamination) Measure 1999* (Cth). Available at: https://www.legislation.gov.au/Details/F2013C00288 (accessed 29 January 2015).
[107] The enHealth guidance document is available at: http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-publicat-environ.htm (accessed 16 March 2016).
[108] Ibid.

Application of environment risk assessment to PFOS/PFOA at Williamtown RAAF Base

The land and waters surrounding Williamtown RAAF Base represent the only known site where PFOS/PFOA are the primary contaminants and there is a demonstrable exposure pathway.[109] Therefore, it is pertinent to examine the decision-making processes that the NSW EPA undertook in relation to Williamtown to ascertain whether those processes are adequate to deal with PFOS/PFOA contamination within the NSW EPA's jurisdiction.

As mentioned above, the NSW EPA has advised that it applies the NEPM and the CLM Act to deal with site contamination. The following is a post hoc analysis of applying its stated approach to dealing with site contamination at Williamtown RAAF Base. The objective of this exercise is to highlight likely procedural hurdles that the NSW EPA could face in its ongoing and future regulation of PFOS/PFOA contamination.

First, even if the NSW EPA had applied the NEPM[110] at Williamtown it would have ultimately reached the 'No further action' point of the assessment because the prior threshold question of 'Are investigation levels or screening levels for intended land use exceeded?' would have no application. This is because there are no screening values for PFOS/PFOA in the NEPM.[111]

Second, the Guidelines on the NSW EPA's Duty to Report Contamination under the *Contaminated Land Management Act 1997*,[112] which specifically rely on the NEPM, would not be triggered:

Such a person is required to notify the EPA of contamination in the following circumstances:

> the level of the contaminant in, or on, soil is equal to or above a level of contamination set out in Schedule B1 of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC 2013) or other approved guideline value[113] with respect to a current or approved use of the land, and people have been, or foreseeably will be, exposed to the contaminant
>
> OR
>
> the contamination meets a criterion prescribed by the regulations[114]
>
> OR
>
> the contaminant or a by-product has entered, or will foreseeably enter, neighbouring land, the atmosphere, groundwater or surface water, and is above, or will foreseeably be above, a level of contamination set out in *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC 2013) or other approved guidelines and will foreseeably continue to remain equal to or above that level.[115]

Third, because the CLM Act relies on a duty to notify[116] and irrespective of the reasons for a lack

[109] See Stage 1 Report Transfield Services: RAAF Williamtown Stage 1–Conceptual Site Model for AFFF Contamination, prepared by GHD, pp. 36, 39, 40, 68, 69. Report available at: http://www.defence.gov.au/id/williamtown/Documents.asp (accessed 11 March 2016).
[110] *National Environment Protection (Assessment of Site Contamination) Measure 1999* (Cth). Available at: https://www.legislation.gov.au/details/f2013c00288 (accessed 29 January 2015).
[111] Ibid, Schedule A—Recommended general process for assessment of site contamination.
[112] Guidelines on the Duty to Report Contamination under the *Contaminated Land Management Act 1997.* Available at: http://www.epa.nsw.gov.au/resources/clm/150164-report-land-contamination-guidelines.pdf (accessed 10 March 2016).
[113] Guidelines are made or approved under s 105 of the CLM Act.
[114] At the time of publication of these guidelines, the *Contaminated Land Management Regulation 2013* did not prescribe any such criterion.
[115] Section 60(3) of the CLM Act.
[116] However, as noted above in Section 3.3 and below, the NSW EPA advised the Review that a formal s 60 notification was not required for declaring the site at Shell/Clyde, Camellia.

of notification[117] the NSW EPA did not undertake an assessment under s 12 of the CLM Act. Such an assessment would have determined if the contamination was significant enough to warrant regulation. The NSW EPA has advised the Review that:

> A site assessment form was not undertaken [for Williamtown] as it was not notified under section 60 of the *Contaminated Land Management Act 1997* (CLM Act),[118,119] and was awaiting the requested information from Defence. Additionally the Williamtown issue was being led by the EPA Hunter Region with assistance from EPA Contaminated Sites.[120]

For the above reasons the NSW EPA urgently needs to remedy the absence of guidelines for PFCs and other significant known, but not yet NEPM-listed emerging contaminants. Such contaminants could include those listed on the Stockholm Convention.

[117] In the case of Williamtown notification may not have occurred because the Department of Defence is not subject to NSW legislation.
[118] In relation to contamination at The Shell Company of Australia Limited/Viva Energy Australia Pty Ltd Clyde Terminal, Camellia, the NSW EPA informed the Review that 'A formal s 60 notification is not required for declaring the site': Information provided by the NSW EPA to the Review.
[119] *Contaminated Land Management Act 1997* (NSW) s 60 (8) provides that: 'The EPA may identify land as significantly contaminated land or make an order under Part 3 in respect of any person, whether or not the person has notified the EPA in accordance with this section.'
[120] Information provided by the NSW EPA to the Review.

SECTION 6

Interim Findings with supporting facts

General findings on PFOS/PFOA

1. Since at least 2000, there has been growing acceptance by government, industry and science that PFOS/PFOA are persistent, bioaccumulative and toxic to both wildlife and humans. The 'safe' level of exposure and its specific causal link to human health outcomes remain under debate.

Illustrative supporting facts extracted from the chronology at Section 2 of this Stage Two Interim Report include:

21 Jan 1999 – *3M study on Perfluorooctane Sulfonate: Current Summary of Human Sera, Health and Toxicology Data*.

> Subchronic studies have been done in rats and primates. PFOS causes liver enzyme elevations and hepatic vacuolization in rats, and hepatocellular hypertrophy at higher doses. Higher doses also cause other GI toxicity, haematological abnormalities, weight loss, convulsions, tremors and death. Monkeys show anorexia, emesis, diarrhea, hypoactivity and at higher doses prostration, convulsions and death.

16 May 2000 – 3M announced its voluntary phase out of PFOS and its commitment to finding substitutes. 3M's media release stated:

> 3M data supplied to [the US] EPA indicated that these chemicals are very persistent in the environment, have a strong tendency to accumulate in human and animal tissues and could potentially pose a risk to human health and the environment over the long term.

21 Nov 2002 – Chemicals Organisation for Economic Cooperation and Development (OECD) Report Co-operation on Existing Chemicals—Hazard Assessment of Perfluorooctane Sulfonate (PFOS) and its Salts stated:

> PFOS is persistent, bioaccumulative and toxic to mammalian species.

May 2003 – Environmental Issues Associated with Defence Use of AFFF, completed by Environmental Stewardship Directorate, Defence.

> Both PFOS and PFOA have been implicated with a variety of cancers and toxic health effects in humans that have had long term exposure to products containing PFOS/PFOA.

2005–2006 – CRC CARE research into AFFF use at RAAF Base Williamtown and RAAF Base Edinburgh found that the:

> data suggested significant accumulation of PFOS in soil with toxic effects on algal growth, earthworm survival and soil enzymes.

12 Dec 2006 – In Directive 2006/122/EC of the European Parliament and the Council, the Scientific Committee on Health and Environmental Risks concluded that PFOS fulfils the criteria for classification as very persistent, very bioaccumulative and toxic.

2007 – CRC CARE study: Mallavarapu, M. and Naidu, R. 2007. Environmental impacts of AFFF at long-term contaminated sites. 24–28 June, 2007 Contamination CleanUp 07 & Industrial Summit, Adelaide, Australia. In relation to the long term impact of AFFF at three legacy sites located at RAAF Base Williamtown (NSW) and RAAF Edinburgh (South Australia):

> Toxicological tests revealed bioaccumulation of PFOS in earthworms incubated with contaminated soils from the above sites and inhibition of soil enzyme activities that are important for maintaining soil health.

2009 – Australian Government, Regulation Impact Statement for the Consideration of the Addition of Nine Chemicals to the Stockholm Convention on Persistent Organic Pollutants (POPS) stated:

> PFOS is easily absorbed and bio-accumulative. It is toxic to humans and wildlife, especially aquatic organisms, due to its persistency and long range transport in the environment.

26 Aug 2009 – PFOS added to Annex B of Stockholm Convention on Persistent Organic Pollutants.

7 June 2013 – Pollution Response Unit, Department of Environment and Conservation, Western Australia published a study of firefighting foams containing perfluorochemicals and concluded they are bioaccumulative in, and have acute and chronic impact upon, aquatic and terrestrial biota and humans.

Feb 2014 – The US EPA's 'Health Effects Document for Perfluorooctane Sulfonate (PFOS)' found there were possible effects from PFOS exposure but the results were inconclusive or inconsistent.

15 Aug 2014 – International Agency for Research on Cancer Monograph classified PFOA as possibly carcinogenic to humans (i.e. a Class 2B substance).

Nov–Dec 2014 – Grandjean and Clapp (2014) assessed the US EPA 2009 provisional drinking water health advisories of 0.4 micrograms per litre (µg/L) for PFOA and 0.2 µg/L for PFOS and determined that these 'benchmark dose results' were about 1,000-fold higher than those calculated from more recent endocrine and human immunotoxicity studies. They concluded that 'Current exposure limits therefore do not protect against adverse effects.'

2015 – The Danish Environmental Protection Authority completed an evaluation of PFOS and PFOA and identified adverse impacts in some animal studies. However, it noted that the first attempt (by Grandjean and Clapp 2014) to calculate safe limits for human exposure to PFOS and PFOA had limitations.

1 May 2015 – Blum et al. (2015). The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs). *Environmental Health Perspectives*, 123 (5), A107–A111. The 14 authors and 205 signatories of the Madrid Statement expressed concern about the production and release into the environment of an increasing number of poly- and perfluoroalkyl substances (PFASs) because inter alia:

> In animal studies, some long-chain PFASs have been found to cause liver toxicity, disruption of lipid metabolism and the immune and endocrine systems, adverse neurobehavioral effects, neonatal toxicity and death, and tumors in multiple organ systems.
> …

> In the growing body of epidemiological evidence, some of these effects are supported by significant or suggestive associations between specific long-chain PFASs and adverse outcomes, including associations with testicular and kidney cancers … liver malfunction … hypothyroidism … high cholesterol … ulcerative colitis … lower birth weight and size … obesity … decreased immune response to vaccines … and reduced hormone levels and delayed puberty …

9 June 2015 – Proposal to list PFOA to the Stockholm Convention on Persistent Organic Pollutants concluded that the 'Available experimental and epidemiological evidence shows that PFOA, PFOA salts and PFOA-related substances can damage human health and wildlife'.

19–23 Oct 2015 – PFOA was nominated for inclusion in the Stockholm Convention because it meets the criteria to be considered a persistent organic pollutant—it is persistent, bioaccumulative, has adverse effects, and is subject to long-range environmental transport.

2. **The status of PFOS and PFOA as emerging contaminants has not deterred international environmental regulators from setting relevant guidelines for soil and water for these contaminants.**

   Illustrative supporting facts extracted from the chronology at Section 2 of this Stage Two Interim Report include:

   8 Jan 2009 – The US EPA developed Provisional Health Advisory values for PFOS and PFOA to assess potential risk from exposure to these chemicals through drinking water. These were PFOS (0.2 µg/L) and PFOA (0.4 µg/L).

   20 Nov 2009 – The US EPA Region 4 set soil screening levels for PFOS (6 mg/kg) and PFOA (16 mg/kg).

   May 2012 – The US EPA published a fact sheet that advised inter alia that in 2009:
   - The US EPA established 'a provisional health advisory (PHA) of 0.2 micrograms per litre (µg/L) for PFOS and 0.4 µg/L for PFOA to protect against the potential risk from exposure of these chemical through drinking water'.
   - The US EPA Region 4 'recommended a residential soil screening level of 6 milligrams per kilogram (mg/kg) for PFOS and 16 mg/kg for PFOA'.

3. **The absence of Australian PFOS/PFOA guidelines has not deterred Victorian and Western Australian environmental regulators from setting interim guidelines for soil and water for these contaminants.**

   Illustrative supporting facts extracted from the chronology at Section 2 of this Stage Two Interim Report include:

   15 Aug 2015 – EPA Victoria fact sheet on perfluorinated chemicals (PFC) states in part:
   - There are currently no Australian criteria for PFOS and PFOA.
   - EPA Victoria refers to international standards, such as the US EPA soil and water values for PFOS and PFOA, concentrations above which warrant further investigation.

   24 Feb 2016 – Department of Environment Regulation (Western Australia) set interim PFOS and PFOA screening levels for soil, sediment, surface water and groundwater.

   The Review notes that the Western Australia PFOS and PFOA screening levels differ in concentration and scope from those promulgated by EPA Victoria.

The NSW EPA's past management of PFOS/PFOA contaminated sites, both known and unknown

4. **In the absence of an express regulatory requirement under the *Contaminated Land Management Act 1997* (NSW) or the *Protection of the Environment Operations Act 1997* (NSW), industry in NSW has voluntarily added PFOS/PFOA to the suite of contaminants to be tested during site assessment.**

   At each of the sites regulated by the NSW EPA that contain PFOS/PFOA,[121] the environmental consultants completing site investigations voluntarily screened for PFOS/PFOA in soil and water. For example, as detailed in Section 3 of this Interim Report:

   March 2012 – Environmental Resource Management's Annual Progress Report (2011) on contamination at the Clyde Refinery and Parramatta Terminal noted that PFOS had not previously been investigated and that it was to be added to the Groundwater Sampling and Analysis Plan for 2012.

5. **The absence of Australian guidelines has led government bodies and industry to utilise a range of PFOS/PFOA criteria for contaminated site investigations including those conducted in NSW.**

   Illustrative supporting facts extracted from the chronologies at Sections 2, 3 and 4 of this Stage Two Interim Report include:

   2008 – Airservices Australia started site assessment work of firefighting training grounds examining PFCs (including PFOS and PFOA) in soil and groundwater.

   In the absence of regulatory screening or investigation levels in Australia for PFCs, Airservices Australia adopted the Minnesota Department of Health guidelines because:

   - The screening levels covered both water and soil.
   - Due to the presence of 3M manufacturing sites within Minnesota, the guidelines were developed by a Department that had a reasonable amount of experience in dealing with PFOS and PFOA related issues.
   - The US EPA had not produced any guidance at that time.

   5 Feb 2014 – Airservices Australia advised the NSW EPA that at high-risk locations it had applied the Minnesota (2008) guidelines for drinking water.

   17 July 2014 – In relation to PFOS and PFOA contamination, Environmental Resources Management's Stage 2 Site Assessment for Colongra Power Station adopted the following screening levels for:

   - human health (drinking water) — US EPA (2014).
   - ecological screening (water quality) — Netherlands RIVM (2010).

   May 2015 – Defence released Defence Contamination Directive #8 Interim Screening Criteria—Consistency of Toxicology or Ecotoxicology Based Environmental Screening Levels for PFOS, PFOA and 6:2 FTS (fluorinated telomer sulfonates) based on the March 2015 CRC CARE Technical Working Group's recommendations.

[121] Fuchs Lubricants, Wickham; Colongra Power Station, Colongra; Shell/Viva Clyde terminal, Camellia; as detailed in Section 3 of this Interim Report.

9 Oct 2015 – Golder Associates, the environmental consultants to Moorebank Intermodal Company, determined in the absence of NSW EPA or national criteria to adopt the values currently being used by the Department of Defence for AFFF.

4 Nov 2015 – AECOM's report in relation to the Fuch's site at Wickham stated that soil PFOS soil concentrations 'were well below the assessment criteria' but the actual criteria values were not specified.

6. **The absence of Australian guidelines has prompted government bodies and industry to initiate projects to develop PFOS/PFOA screening criteria for contaminated site investigations including those conducted in NSW.**

   Illustrative supporting facts extracted from the chronologies at Sections 2 and 4 of this Stage Two Interim Report include:

   5 Feb 2014 – Airservices Australia indicated to the NSW EPA its intention to develop trigger levels for PFOS/PFOA and advised there was a need to develop trigger levels relevant to Australian conditions and appropriate for industrial sites.

   July 2014 – CRC CARE Technical Report No 32: Development of Guidance for Contaminants of Emerging Concern (including PFOS/PFOA). This report included the development of screening criteria and remediation and management guidance.

   2015 – CRC CARE set up a technical working group to develop guidance on PFOS and PFOA. CRC CARE is working with Commonwealth and state regulatory agencies and industry to develop PFOS and PFOA national guidance. It is anticipated the outcomes will be available for stakeholder comment in 2016.

7. **A lack of guidelines may have meant that sites potentially contaminated with PFOS/PFOA have not been notified because there are no national trigger values upon which the NSW EPA can rely.**

8. **The NSW EPA could have acted earlier in developing or adopting interim guidelines for the assessment of PFOS/PFOA in the environment to promote a consistent approach in NSW.**

   The Review makes Interim Finding 8 in light of Interim Findings 2–7 above and the supporting facts for those findings.

   On **18 August 2015** the NSW EPA requested advice on PFC limits from the Office of Environment and Heritage (see Section 2).

9. **Capability for PFOS analysis was available in Australia since at least 2005. Therefore this was not a limiting factor to developing environmental or ecological effects-based guidelines.**

   As detailed in Section 2 of this Stage Two Interim Report:

   In **2005** CRC CARE developed laboratory methods for the assessment of AFFF including PFOS.

In **2013** two Australian laboratories obtained NATA (National Association of Testing Authorities, Australia) accreditation for PFOS/PFOA analysis. These were ALS Environmental Laboratory Services Pty Ltd (Sydney Laboratory) and Eurofins Environment Testing Australia Pty Ltd (Brisbane Laboratory).

10. The sites known to be contaminated by PFOS/PFOA represent a very small fraction of the total number of contaminated sites notified to the NSW EPA.

As at 7 December 2015 there were 1589 contaminated sites notified to the NSW EPA.[122] The three sites regulated under the *Contaminated Land Management Act 1997* that are known to be contaminated inter alia with PFOS/PFOA are: Fuchs, Wickham; Colongra Power Station, Colongra; and Shell/Viva Clyde Terminal, Camellia (see Section 3).

In addition, there are several Commonwealth sites known to be contaminated with PFOS/PFOA (see Sections 4 and 5).

Therefore, the findings below regarding the NSW EPA's past management of known sites contaminated by PFOS/PFOA must necessarily be viewed in the context of the Review having a limited sample of relevant examples upon which to draw findings.

The number of sites per se that are contaminated by PFOS/PFOA does not necessarily reflect the regulatory resources required to respond. As demonstrated by the Williamtown contamination, is it the scale and complexity of an incident that can drive the resourcing of a regulatory response.

11. In relation to the three known sites regulated by the NSW EPA that are contaminated, inter alia, by PFOS/PFOA, there is evidence of the NSW EPA:

(a) setting clear timeframes for the provision of relevant site information, and taking positive steps in addressing contamination; and
(b) responding comparatively slowly to notification of contamination and omitting to set clear timeframes for the provision of relevant site information.

Illustrative supporting facts in relation to **Interim Finding 11(a)**, extracted from the chronologies at Section 3 of this Stage Two Interim Report, include:

- On **25 September 2012**, the NSW EPA wrote to The Shell Company of Australia requesting information within two months of the date of the letter.
- On **4 November 2013**, the NSW EPA wrote to Newcastle City Council to suggest that the factual information relating to site contamination at the Fuchs site could be placed on the land title certificates to provide transparency to prospective purchasers of the site.
- On **14 October 2015**, the NSW EPA completed an assessment of the Shell/Viva Clyde Terminal at Camellia pursuant to s 12 of the *Contaminated Land Management Act 1997*. It determined the site had significant contamination to warrant regulation without a notification pursuant to s 60 of the *Contaminated Land Management Act 1997*.

Illustrative supporting facts in relation to **Interim Finding 11(b)**, extracted from the chronologies at Section 3 of this Stage Two Interim Report, include:

[122] List of notified sites available at: http://www.epa.nsw.gov.au/clm/publiclist.htm (accessed 14 March 2016).

- The NSW EPA took eight months to reply to notification of contamination at the Fuchs, Wickham site. The notification was dated 7 March 2013 and the NSW EPA's response was dated 4 November 2013.
- The NSW EPA's letter of 4 November 2013 to Fuchs c/o AECOM, which requested copies of validated reports when remediation work was completed, did not set a time for provision of this information. It was nearly two years later, on 16 October 2015, that the NSW EPA requested an update from Fuchs on the expected timeframe for the remediation and validation of the site.
- The NSW EPA took eight months to reply to notification of contamination at the Colongra power station site. The notification was dated 10 February 2015 and the NSW EPA's response was dated 27 October 2015.

In relation to the Fuchs Wickham site, the Review invited the NSW EPA to explain why, following its letter dated 4 November 2013, it took nearly two years for it to request an update from Fuchs. The NSW EPA responded:

> During this period the EPA understood that some further investigation and remediation was recommended and that an EPA accredited auditor would oversee this process. The EPA was satisfied with this approach and requested that post further investigation/remediation that reports once reviewed by the Site Auditor be presented to the EPA. These further investigations and remediation have taken two years, which is not uncommon, and is ongoing.[123]

The Review notes that the NSW Auditor-General in 2014 recommended inter alia by June 2015 that the NSW EPA should 'develop and implement key performance indicators to measure its success, including target timeframes for acknowledging notified sites'.[124] The NSW EPA has advised the Review that for new sites notified to it, a new KPI has been established whereby it will provide an initial response within two weeks of receipt of notification.[125] The Review will assess the NSW EPA's implementation of the Auditor-General's recommendation in its final report. Accordingly, at this time, the Review intentionally refrains from making any recommendations addressing the NSW EPA's timeliness in managing contaminated sites.

12. In some instances the NSW EPA engaged proactively at a comparatively early stage with the issue of emerging contaminants, including PFOS/PFOA.

Illustrative supporting facts extracted from the chronologies at Sections 2 and 4 of this Stage Two Interim Report, include:

20 Aug 2010 – The NSW EPA attended a meeting with Airservices Australia and AECOM to discuss PFOS contamination from AFFF use at Airservices Australia airports. The NSW EPA foreshadowed it would list the issue as an agenda item for the Strategic Liaison Group.[126]

27 Aug 2010 – At the Strategic Liaison Group meeting 'emerging issues' were discussed but there is no specific mention of PFOS or PFOA in the action list for the meeting. The meeting

[123] Advice received from the NSW EPA.
[124] New South Wales Auditor-General's Report Performance Audit Managing contaminated sites, 2014 (recommendation 3 directed to the NSW EPA), available at: http://www.audit.nsw.gov.au/ArticleDocuments/336/01_Managing_Contaminated_Sites_Full_Report.pdf.aspx?Embed=Y (accessed 18 September 2015).
[125] Advice received from the NSW EPA.
[126] The Strategic Liaison Group comprised staff from the Department of Environment, Climate Change and Water; NSW EPA; NSW Health.

referred to the WHO list of ten chemicals of major public health concern, which did not include PFOS/PFOA.

25 July 2011 – Internal OEH 'Action Sheet – Executive Services' stated that 'We will be meeting shortly with NSW Fire and Rescue to discuss the extent of PFOS use in NSW and implications of its listing on the Stockholm Convention Annexes'.

23 Jan 2012 – The NSW EPA met with OEH science and discussed emerging contaminants. File note indicates that PFOS and airports were discussed.

31 Jan 2012 – The NSW EPA was involved in a teleconference meeting including CRC CARE, environmental regulators and industry to discuss the risk and compliance models for contaminants of emerging concern, including PFOS.

13. Despite the NSW EPA's early engagement with NSW fire services as early as July 2011 to ascertain the extent of PFOS use in NSW at their sites, it appears that the issue was not followed up until late 2015.

Illustrative supporting facts extracted from Sections 2 and 5 of this Stage Two Interim Report, include:

Evidence of early engagement
25 July 2011 – Internal OEH 'Action Sheet – Executive Services' stated that 'We will be meeting shortly with NSW Fire and Rescue to discuss the extent of PFOS use in NSW and implications of its listing on the Stockholm Convention Annexes'.

Evidence of recent engagement
25 Nov 2015 – The NSW EPA wrote to Fire & Rescue NSW and NSW Rural Fire Service to obtain information about PFOS and related chemicals and any relevant environmental assessments and proposed remedial actions at impacted sites.

2 Dec 2015 – As part of the NSW EPA's future program on PFCs, it is assessing sites known to the NSW EPA where fire-training exercises have been conducted.

Engagement with Commonwealth sites known to be contaminated by PFOS/PFOA

14. In relation to the Commonwealth sites known to be contaminated by PFOS/PFOA, there is some evidence of the NSW EPA responding in a positive and timely manner to the notification of contamination.

Illustrative supporting facts in relation to Interim Finding 14(a), extracted from the chronologies at Section 4 of this Stage Two Interim Report, include:

Airservices Australia
3 May 2012 – The NSW EPA wrote to Airservices Australia noting the 16 April 2012 meeting had been cancelled and expressing concern that 'information relating to chemical contamination that may impact upon NSW lands has yet to be provided.' It requested a detailed site investigation report and advice as to whether remedial activities were anticipated.

Moorebank Intermodal Company

9 Oct 2015 – The Moorebank Intermodal Company wrote to the NSW EPA and informed it that AFFF had been found at its development site.

13 Oct 2015 – The NSW EPA replied to Moorebank Intermodal Company and requested that:

- source sites for AFFF be contained as a matter of priority;
- water monitoring be expedited.

In addition, the Review relies on the supporting facts for Interim Finding 12 above in relation to the actions taken by the NSW EPA on 20 and 27 August 2010.

However, as set out in Interim Finding 8 above, the NSW EPA could have acted earlier in developing or adopting interim guidelines for the assessment of PFOS/PFOA. One of the reasons for this is that Airservices Australia advised it on 5 February 2014 there was a need to develop trigger levels relevant to Australian conditions and appropriate for industrial sites.

The NSW EPA's ongoing and future management of sites potentially or actually contaminated by PFOS/PFOA

15. In June 2015, the NSW EPA Chair and CEO demonstrated leadership on the issue of PFOS and emerging contaminants at the Senior Officials Group meeting for state and Commonwealth environmental portfolios.

The supporting facts for this Interim Finding extracted from the Section 2 chronology and Section 5.4 are set out below.

At the above-mentioned meeting the NSW EPA Chair and CEO articulated the need for clear guidance for remediation and treatment standards including trigger levels. In addition, he advised the Commonwealth of NSW's support for:

- the proposed ratification process for the eleven new chemicals listed under the Stockholm Convention;
- further national assessment of the implications of ratification of the chemicals for which there is ongoing use or potentially significant legacy issues.

16. The NSW EPA's future PFC program is a structured and appropriate response to addressing the identification and potential risk of harm from PFCs.

The basis for this Interim Finding is discussed at Section 5.4.[127]

17. The absence of NSW or Australian PFOS/PFOA trigger/criteria levels may limit the regulatory traction of the NSW EPA's future PFC program.

The supporting facts for this Interim Finding are set out in Sections 5.4 and 5.7.

18. The absence of guidelines for emerging contaminants other than PFOS/PFOA is a potential constraint for effective future regulatory intervention at contaminated sites.

[127] The future PFC program is addressed in the Interim Recommendations.

As identified in Section 5 of this Stage Two Interim Report and in the Stage One Interim Report, the absence of PFOS/PFOA guidelines contributed to uncertainty in addressing the Williamtown RAAF Base contamination.

There are other emerging contaminants such as those listed on the Stockholm Convention that may pose a significant risk to the environment and human health.

The absence of guidelines for emerging contaminants presents a risk that the NSW EPA could miss an opportunity to intervene, at an early stage, in a contamination incident of the type and magnitude at Williamtown.

Knowledge strategies

19. It appears that information on PFOS/PFOA provided by NICNAS (National Industrial Chemical Notification and Assessment Scheme) to the NSW EPA since 2002 did not stimulate any significant early regulatory response.

This Interim Finding is based on the information in Sections 2, 5.4 and 5.6 of this Interim Report.

For example, although in 2004 NICNAS prepared a document 'Options for Disposal of PFOS Waste', which was prepared in consultation with the NSW EPA, there are still no guidelines for PFOS or related chemicals in the NSW EPA Waste Classification Guidelines.

20. The NSW EPA received the six NICNAS alerts relating to PFOS/PFOA issued between 2002 and 2008. However, some regional NSW EPA officers who were dealing with PFOS/PFOA contamination were not aware of these alerts.

The facts supporting this Interim Finding are set out in Section 5.6 of this Interim Report.

The Review notes the primary role of NICNAS is to provide Commonwealth, state and territory authorities responsible for regulating industrial chemicals with:

- information about the risks of industrial chemicals; and
- recommendations to mitigate these risks.

Since 2002, NICNAS has provided advice and published information on the human health and environmental risks of PFOS and PFOA, including on the introduction, safe use and disposal of these chemicals.

In this respect, the NSW EPA advised the Review that 'Feeding every factsheet or potential issue to generalist regional staff who cover a very broad range of environmental issues would create more distraction from our core business than gained.'[128]

The Review questions the wisdom of this approach particularly in light of the NSW EPA's stated stakeholder engagement objective to:

> Be widely known as a trusted source of scientific and technical expertise and a credible regulator.[129]

[128] Advice received from the NSW EPA.
[129] NSW EPA Submission: Inquiry into the performance of the NSW Environment Protection Authority General Purpose Standing Committee No. 5, 2014, page 28, available at:

SECTION 7

Interim Recommendations with reasons

The Review made Interim Recommendations 1 and 2 below in its Stage One Interim Report. However, the Stage Two Interim Findings and supporting facts have reinforced the need for the Review to repeat these Interim Recommendations. Additional reasons for reiterating these recommendations appear in Section 5.7 of this Interim Report.

The Review recommends:

1. **The NSW EPA, in consultation with relevant government authorities and scientific experts, should set interim guidelines for PFOS/PFOA for a range of environmental samples including soil, sediment and groundwater, as a matter of priority, pending finalisation of national guidelines.**

2. **The NSW Government should engage with the Commonwealth Government, to consult with other relevant government agencies and scientific experts, to develop and set national guidelines for PFOS/PFOA for a range of environmental samples, including soil, sediment groundwater and surface water.**

   The Review notes that surface waters fall under the Australian and New Zealand guidelines for fresh and marine water quality, for which the Commonwealth Department of Agriculture and Water Resources is responsible.

3. **Further to Interim Recommendation 3 in the Review's Stage One Interim Report, the NSW EPA Chair and CEO, together with leaders of other Australian state and territory environment protection authorities, should develop an options paper for consideration by the Meeting of Environment Ministers for regulating Commonwealth agencies that may cause contamination on non-Commonwealth land.**

   This recommendation is critical to ensure that the NSW EPA along with other state and territory environment authorities can address the unfolding issue of PFOS/PFOA contamination at multiple military and airport sites across NSW and Australia.

4. **The NSW EPA should develop a protocol for the staged escalation of issues where the polluter falls outside the jurisdiction of the NSW EPA or other state agencies and potential exposure pathways exist that could impact the environment or human health.**

   The experience of the NSW EPA in dealing with contamination at Williamtown RAAF Base demonstrates a pressing need to establish procedures to ensure intervention by its senior officers at the earliest opportunity when a polluter falls outside its jurisdiction.

http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/743BDB8875807D85CA257CFC002142D1 (accessed 1 December 2015).

5. The NSW EPA should be resourced to execute all aspects of its future PFC and emerging contaminants programs.

The NSW EPA's future program on PFCs merits resourcing because its implementation will help achieve efficiencies and maximise lessons about best practice for assessing, managing and regulating PFC-contaminated sites.

There are numerous current and proposed investigations into PFOS-contaminated sites across NSW and Australia. The knowledge and lessons gained from these investigations need to be harnessed.

At least two components of the NSW EPA's future program would assist it in harnessing these lessons. These items are:

- establishment of an informal interagency panel; and
- maintenance of a watching brief on related Australian issues and developments.

In addition, one key aspect of the future PFC program is 'consideration of developing NSW-specific guidance on assessment and/or remediation of PFC contaminated land and groundwater pending development of criteria at the national level.'

As reflected in Interim Recommendation 1 above, the Review considers this action to be a priority item.

Further, resourcing the NSW EPA to execute its emerging contaminants program will assist it in being better prepared to manage any issues arising from these contaminants.

6. The NSW EPA should consider requiring, at least in the short-term (e.g. 12 months), relevant environment protection licence holders to undertake environmental sampling and analysis for PFCs on- and off-site as part of their licence conditions.

The Review notes that the NSW EPA's future program on PFCs includes investigating potential legacy contamination and identifying potential exposure pathways at high-risk sites. However, it is not clear whether its future program on PFCs specifically envisages the imposition of a PFC sampling and analysis condition on licence holders.

Following receipt and evaluation of data collected pursuant to a PFC sampling and analysis condition, the NSW EPA could assess the need to retain such a condition on a site-by-site basis.

This recommendation will assist the NSW EPA to understand better the presence of PFCs in the environment and is in line with its adherence to the principle of the 'polluter pays'. Moreover, as stated in Interim Finding 4, industry in NSW has voluntarily added PFOS/PFOA to the suite of contaminants to be tested during site assessment.

7. The NSW EPA should consider, as part of its future program on PFCs, capturing data relating to NSW PFC environmental sample results in a single data portal.

A single data portal will assist in better understanding the impact of PFCs on the broader environment. The NSW Environmental Data Portal, which is being developed, would be a suitable location to house collected data on PFCs.

8. **The NSW Government should engage with the Commonwealth Government, to consult with other relevant government agencies and scientific experts, to initiate the process of developing national guidance on emerging contaminants, other than PFCs, such as those listed on the Stockholm Convention.**

9. **The NSW EPA should consider requiring relevant environment protection licence holders to undertake environmental sampling and analysis for emerging contaminants, other than PFCs, as part of their licence conditions.**

The purpose of Interim Recommendations 8 and 9 is to address knowledge gaps that may hinder effective future regulatory action by the NSW EPA in regard to emerging contaminants, other than PFCs.

As stated in Interim Finding 18, the absence of guidelines for emerging contaminants presents a risk that the NSW EPA could miss an opportunity to intervene, at an early stage, in a contamination incident of the type and magnitude at Williamtown.

Moreover, as stated by the NSW EPA in 2014:

> Proactive work is important and, when strategically undertaken can pre-empt some of the reactive work by preventing incidents and non-compliance. This work can offer some of the biggest environmental gains, especially through cumulative impacts of smaller actions.[130]

10. **The NSW EPA should revisit its knowledge strategy and its internal dissemination of relevant regulatory and scientific information about, inter alia, emerging contaminants.**

In particular, the Review considers that relevant NSW EPA officers, including those from its regional offices, should be provided with key regulatory updates such as alerts on emerging chemicals as issued by NICNAS.

In addition, it would be advantageous if the NSW EPA were able to facilitate direct (online) access by its officers to peer reviewed research. This would assist it in its objective of being perceived 'as a trusted source of scientific and technical expertise'.[131]

[130] NSW EPA Submission: Inquiry into the performance of the NSW Environment Protection Authority General Purpose Standing Committee No. 5, 2014, page 28, available at: http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/0/8BB621B4F96A7FCCCA257D4D00114702 (accessed 1 December 2015).
[131] Ibid.

Appendix A

List of consultations

Date	Institution/persons consulted	Location
1 October 2015	NSW EPA: Mr Barry Buffier (Chair and CEO), Mr Craig Lamberton, (Director Hazardous Incidents and Environmental Health).	NSW EPA Offices, Goulburn Street, Sydney.
8 October 2015	Williamtown Expert Panel.	Newcastle Williamtown Airport.
4 November 2015*	NSW EPA: Mr Craig Lamberton (Director Hazardous Incidents and Environmental Health), Ms Lynne Neville (Principal Policy Officer), Mr Matthew James (Major Projects Coordinator, Contaminated Sites Section).	NSW EPA Offices, Goulburn Street, Sydney.
9 November 2015	NSW Chief Scientist & Engineer, Professor Mary O'Kane.	Macquarie University, North Ryde, Sydney.
19 November 2015	Williamtown community drop-in session.	Salt Ash Primary School, Salt Ash, Hunter, NSW.
23 December 2015*	NSW EPA: Mr Barry Buffier (Chair and CEO), Mr Craig Lamberton (Director Hazardous Incidents and Environmental Health).	NSW EPA Offices, Goulburn Street, Sydney.
19 January 2016*	NSW EPA: Mr Mark Gifford (Chief Environmental Regulator), Ms Lynne Neville (Principal Policy Officer), Mr Matthew James (Major Projects Coordinator, Contaminated Sites Section).	NSW EPA Offices, Goulburn Street, Sydney.
21 January 2016*	EPA North: Mr Gary Davey (Director North Branch), Mr Adam Gilligan (Manager Hunter Region). Also present Ms Lynne Neville (Principal Policy Officer, NSW EPA).	Ground Floor 117 Bull Street Newcastle West.
27 January 2016*	DPI Fisheries: Mr Doug Ferrell (Director, Fisheries Analysis).	Building 24, Chowder Bay Road, Mosman, Sydney.
28 January 2016*	DPI Water: Mr Bruce Cooper (Deputy Commissioner), Mr Mitchell Isaacs (Director Planning Policy & Assessment Advice).	Level 48 MLC Centre, Martin Place, Sydney.

Date	Institution/persons consulted	Location
8 February 2016*	NICNAS (National Industrial Chemicals Notification and Assessment Scheme): Dr Kerry Nugent (Principal Scientist, Existing Chemicals), Angela McKinnon (Head of Program, Existing Chemicals Program)	Level 7 260 Elizabeth Street Surry Hills, Sydney.
8 February 2016*	NSW Chief Scientist & Engineer Professor Mary O'Kane, Dr Chris Armstrong (Director), Dr Jaclyn Aldenhoven (Senior Manager).	Level 48 MLC Centre, Martin Place, Sydney.
11 February 2016*	NSW EPA: Mr Craig Lamberton, (Director Hazardous Incidents and Environmental Health), Mr Andrew Mitchell (Manager, Hazardous Incidents) Mr Matthew James (Major Projects Coordinator, Contaminated Sites Section).	NSW EPA Offices, Goulburn Street, Sydney.
11 February 2016*	NSW EPA Board: Mr Barry Buffier (Chair and CEO), Mr Alec Brennan, Ms Julie Savet Ward, Ms Christine Covington, Mr Chris Knoblanche.	NSW EPA Offices, Goulburn Street, Sydney.

The Review also sought a meeting with the Department of Health (NSW) to discuss relevant aspects of Stages 1 and 2 of the Review.

*Indicates meeting attended by both Professor Mark P Taylor (Independent Reviewer of the NSW EPA's Management of Contaminated Sites) and Ms Isabella Cosenza (Consultant to Review of the NSW EPA's Management of Contaminated Sites). In other instances, only Professor Mark P Taylor from the Review was in attendance.

Appendix B

List of abbreviations

Term	Abbreviation
AECOM Australia Pty Ltd	AECOM
aqueous film forming foam	AFFF
Australian Inventory of Chemical Substances	AICS
Contaminated Land Management Act 1997 (NSW)	CLM Act
Cooperative Research Centre for Contamination Assessment and Remediation of the Environment	CRC CARE Pty Ltd
Department of Defence	Defence
ecological investigation level	EIL
Environmental Health Standing Committee	enHealth
Environmental Protection and Biodiversity Conservation Act 1999 (Cth)	EPBC Act
Environmental Resources Management Australia	ERM
Fuchs Lubricants (Australasia) Pty Ltd	Fuchs
Heads of Environment Protection Authorities	HEPA
health investigation level	HIL
limits of reporting	LOR
Material Safety Data Sheet	MSDS
Meeting of Environment Ministers	MEM
Memorandum of Understanding	MOU
Moorebank Intermodal Company Limited	MIC
National Association of Testing Authorities, Australia	NATA
National Environment Protection Measures (Australia)	NEPM
National Framework for Chemicals Environmental Management	NChEM
National Industrial Chemicals Notification and Assessment Scheme	NICNAS
New South Wales Environment Protection Authority	NSW EPA
Occupational Health and Safety	OHS
Office of Environment and Heritage (NSW)	OEH

Term	Abbreviation
Organisation for Economic Co-operation and Development	OECD
perfluorinated alkylated substances	PFAS
perfluorinated chemicals	PFCs
perfluorooctane sulfonate	PFOS
perfluorooctanoic acid (also referred to as perfluorooctane acid)	PFOA
persistent organic pollutants	POPs
Protection of the Environment Operations Act 1997 (NSW)	POEO Act
Senior Officials Group (for the state and Commonwealth Environment portfolios)	SOG
United States Environmental Protection Authority	US EPA
World Health Organization	WHO

MACQUARIE University

Macquarie University is a vibrant hub of intellectual thinkers, all working towards a brighter future for our communities and our planet.

A PLACE OF INSPIRATION

Macquarie is uniquely located in the heart of Australia's largest high-tech precinct, a thriving locale which is predicted to double in size in the next 20 years to become the fourth largest CBD in Australia.

Our campus spans 126 hectares, with open green space that gives our community the freedom to think and grow. We are home to fantastic facilities with excellent transport links to the city and suburbs, supported by an on-campus train station.

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We are ranked among the top two per cent of universities in the world, and with a 5-star QS rating, we are renowned for producing graduates that are among the most sought after professionals in the world.

A PROUD TRADITION OF DISCOVERY

Our enviable research efforts are brought to life by renowned researchers whose audacious solutions to issues of global significance are benefiting the world we live in.

BUILDING SUCCESSFUL GRADUATES

Our pioneering approach to teaching and learning is built around a connected learning community: our students are considered partners and co-creators in their learning experience.

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Macquarie University NSW 2109 Australia
T: +61 (2) 9850 7111
mq.edu.au

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