

The Senate

Environment and Communications
References Committee

Protection of Aboriginal rock art of the
Burrup Peninsula

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Abbreviations

AER	Annual Environmental Report
AN	Ammonium Nitrate
BRAMMC	Burrup Rock Art Monitoring Management Committee
BRASTRG	Burrup Rock Art Stakeholder Reference Group
BRATWG	Burrup Rock Art Technical Working Group
CO	Carbon Monoxide
DAA	Data Analysis Australia
DBCA	Department of Biodiversity, Conservation and Attractions (WA)
DER	Department of Environmental Regulation (WA)
DoEE	Department of the Environment and Energy
DPM	Department of Minerals and Petroleum (WA)
EP Act	<i>Environmental Protection Act 1986 (WA)</i>
EPA WA	Environmental Protection Authority of Western Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FARA	Friends of Australian Rock Art
LCA	Law Council of Australia
MAC	Murujuga Aboriginal Corporation
MLSU	Murujuga Land and Sea Unit
MPC	Murujuga Park Council
NEPM	National Environmental Protection Measure
NO	Nitrogen Oxides
PER	Public Environmental Review
SCE	Safety Critical Elements
SIA	Strategic Industrial Area
TAN	Technical Ammonium Nitrate
TANPF	Technical Ammonium Nitrate Production Facility
TAPM	The Air Pollution Model
WHO	World Health Organization
YPF	Yara Pilbara Fertilisers
YPH	Yara Pilbara Holdings
YPN	Yara Pilbara Nitrates

Chapter 1

Introduction

Referral and terms of reference

1.1 On 30 November 2016, the Senate referred the following matter for inquiry and report by 21 March 2017:

The Commonwealth's responsibility under the *Environment Protection and Biodiversity Conservation Act 1999* to protect the globally significant and National Heritage listed Aboriginal rock art of the Burrup Peninsula in Western Australia, with particular reference to:

- (a) the total industrial pollution load from existing industrial activities and port zone on the Burrup Peninsula in Western Australia, and its existing impacts on Aboriginal rock art;
- (b) the projected additional pollution load from the Yara Pilbara Fertilisers Pty Ltd ammonium nitrate plant, including the likely impacts on the Aboriginal rock art, human health and the environment;
- (c) the accuracy and adequacy of reports used by the Western Australian and Commonwealth governments when setting the relevant technical, environmental and cultural conditions regulating the construction and operation of the Yara Pilbara Fertilisers Pty Ltd ammonium nitrate plant in an area of highly significant Aboriginal rock art;
- (d) the rigour and adequacy of the monitoring, analysis, compliance and enforcement performed by the Western Australian and Commonwealth government agencies in carrying out their legislated responsibilities in overseeing industries on the Burrup Peninsula;
- (e) the projected level of fugitive gas and nitric acid leaks from the Yara Pilbara fertiliser and ammonium nitrate plants, their effects on human health, likely effects on rock art and the general environment, and the adequacy of the company responses;
- (f) the failure by Yara Pilbara Fertilisers Pty Ltd, the Western Australian Government or the Federal Government to include risk analysis of establishing an ammonium nitrate plant in close proximity to the rock art, a gas hub and major port and in a cyclone surge zone;
- (g) the adequacy of the Yara Pilbara plans to protect the communities of Dampier and Karratha and the rock art sites from the consequences of any explosion caused by 'sympathetic detonation' or other factors, including the ability to douse the nitrate stores with sufficient water to prevent a spontaneous explosion; and

(h) any related matters.¹

1.2 The Senate granted a number of extensions of time to report.² On 14 February 2018, the Senate granted a final extension of time to report by 21 March 2018.³

Conduct of the inquiry

1.3 In accordance with its usual practice, the committee advertised the inquiry on its website and wrote to relevant individuals and organisations inviting submissions. The date for receipt of submissions was 23 January 2016. The committee received 17 submissions, which are listed at Appendix 1.

1.4 The committee held three public hearings in:

- Canberra on 17 February 2017;
- Perth on 20 April 2017; and
- Canberra on 17 November 2017.

1.5 The list of witnesses who participated in public hearings is at Appendix 2.

1.6 The public submissions, additional information received and *Hansard* transcript are available on the committee's website at: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/BurruPeninsla.

Acknowledgment

1.7 The committee would like to thank the organisations and individuals who provided evidence to the inquiry.

1 *Journals of the Senate*, No. 22, 30 November 2016, pp. 709–710.

2 *Journals of the Senate*, No. 31, 20 March 2017, p. 1054; *Journals of the Senate*, No. 40, 10 May 2017, p. 1326; *Journals of the Senate*, No. 45, 19 June 2017, p. 1472; *Journals of the Senate*, No. 65, 17 October 2017, p. 2084; *Journals of the Senate*, No. 72, 27 November 2017, p. 2283; *Journals of the Senate*, No. 78, 6 December 2017, p. 2483; *Journals of the Senate*, No. 81, 6 February 2018, p. 2586.

3 *Journals of the Senate*, No. 86, 14 February 2018, p. 2717.

Structure of the report

1.8 This report comprises seven chapters, as follows:

- Chapter 1 — contains an introduction to the Aboriginal rock art of the Burrup Peninsula, and Yara Pilbara and its operations on the Burrup Peninsula;
- Chapter 2 — provides an overview of the environmental and heritage protection legislation which applies to industrial development on the Burrup Peninsula;
- Chapter 3 — canvasses concerns raised by submitters in relation to the impact of existing and future industrial development on the Aboriginal rock art, human health and the environment;
- Chapter 4 — explores concerns raised in relation to monitoring programs and subsequent reports utilised by industry and regulators;
- Chapter 5 — canvasses issues raised in relation to the compliance, monitoring and management of Yara Pilbara's facilities on the Burrup Peninsula;
- Chapter 6 — explores the evidence that beyond industrial development, the rock art of the Burrup Peninsula faces threats from vandalism and unrestricted access to the area. This chapter also examines the additional protections which could be afforded to the rock art through education programs, enforcement activity, and World Heritage listing; and
- Chapter 7 — provides a committee view.

The Burrup Peninsula

1.9 The Dampier Archipelago (including the Burrup Peninsula) located on the Indian Ocean coast of the west Pilbara region in north Western Australia is comprised of 42 islands, islets and rocks that range from less than 2ha to 3,290ha in size. It covers an area of approximately 4,000 km².⁴

1.10 The Burrup Peninsula (which measures 27km long by 5km wide) was formerly Dampier Island—the largest in this island chain. Prior to industrial development and the building of road and rail infrastructure between Karratha and Dampier, it was separated from the mainland by tidal mudflats.⁵

4 Australian Heritage Database listing for Burrup Peninsula, Islands of the Dampier Archipelago and Dampier Coast, Final Assessment Report, 2006, p. 13, <http://www.environment.gov.au/system/files/pages/5b14f51b-b7e1-432f-8049-1e653713607d/files/dampier-archipelago.pdf> (accessed 9 January 2017).

5 Australian Heritage Database listing for Burrup Peninsula, Islands of the Dampier Archipelago and Dampier Coast, Final Assessment Report, 2006, p. 13, <http://www.environment.gov.au/system/files/pages/5b14f51b-b7e1-432f-8049-1e653713607d/files/dampier-archipelago.pdf> (accessed 9 January 2017).

1.11 On 3 July 2007, the then Minister for the Environment and Water Resources, the Hon Malcolm Turnbull, listed the Dampier Archipelago (including the Burrup Peninsula) as a National Heritage Place under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).⁶

1.12 The majority of the Dampier Archipelago (including the Burrup Peninsula) National Heritage Place is within Murujuga National Park and the Dampier Archipelago island reserves, managed by the Western Australian Government's Department of Biodiversity, Conservation and Attractions.⁷

Rock art of the Burrup Peninsula

1.13 The Burrup Peninsula is known for its cultural and archaeological significance, as it is the densest known concentration of rock engravings anywhere in the world. It contains Australia's largest collection of Aboriginal rock art (also known as petroglyphs) with more than one million images in an area of 36,857 hectares.⁸ The Dampier Archipelago also contains a number of dreaming sites, ceremonial sites, and other archaeological sites including shell middens, quarries, standing stones, and burials.⁹

1.14 The Dampier Archipelago, called Murujuga by the five Indigenous custodian groups: the Ngarluma, the Mardudhunera, the Yaburara, the Yindjibarndi and the Wong-Goo-Tt-Oo, is described as 'the most culturally significant place on earth and, with more than one million petroglyphs and over 40,000 years of occupation, it is of the critical importance to local Aboriginal people'. Further:

Murujuga is a place of worship and understanding. It is where our stories began. It is our bible, but it is also our law book. Our law is written through the petroglyphs and the munda—or the stone.¹⁰

1.15 In 2011, the Australian Heritage Council reported to the Minister for Sustainability, Environment, Water, Population and Communities on its assessment of the Outstanding Universal Values of the Dampier Archipelago site and any threats to that site. In its statement of potential Outstanding Universal Values, the Australian

6 Department of the Environment and Energy, *Submission 8*, p. 1.

7 Department of the Environment and Energy, *Submission 8*, p. 1.

8 Australian Heritage Council, [*The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to that Site*](#), 2011, (accessed 17 January 2017).

9 Australian Heritage Database listing for Burrup Peninsula, Islands of the Dampier Archipelago and Dampier Coast, Final Assessment Report, 2006, p. 16, <http://www.environment.gov.au/system/files/pages/5b14f51b-b7e1-432f-8049-1e653713607d/files/dampier-archipelago.pdf> (accessed 9 January 2017).

10 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 1.

Heritage Council stated that the 'Dampier Archipelago bears a unique or at least exceptional testimony to a cultural tradition or to a civilisation which is living'.¹¹

1.16 The Australian Heritage Council also stated that the Dampier Archipelago represents a masterpiece of human creative genius:

The density and diversity of the rock engravings on the Dampier Archipelago represents a masterpiece of human creative genius. The place is home to one of the most exciting and significant collections of rock engravings in the world.¹²

1.17 Dr Ken Mulvaney, heritage expert, stated that the Dampier Archipelago rock art collection 'represents the longest continual production of rock art in the world; as such it comprises one of the densest and stylistically diverse collection of petroglyphs'.¹³ Dr Mulvaney also informed the committee that the collection contains:

...some of the earliest depictions of the human face in rock art that exists anywhere in the world, but we also have changes in the way humans are reflecting their presence in a landscape and their cultural richness. All that was produced up until Europeans arrived in the area in 1860s. There is nowhere else in the world that has a continual sequence of rock art. That is why this place is of world significance.¹⁴

1.18 In addition to the earliest known image of a human face, the rock art collection also contains images of extinct mega-fauna, Tasmanian tigers, hunting traditions, and mathematical representations and geometrical forms.¹⁵

1.19 The images are believed to reflect the change in the environmental conditions of the area over 45,000 years. Dr Mulvaney explained that prior to the sea level rise, the islands of the Dampier Archipelago were hills in a vast coastal plain, and the rock art from that era reflects terrestrial fauna. However, 'following the sea level rise, into the period known as the Holocene, you start getting marine fauna in the art, in particular animals like turtles and fish'.¹⁶

11 Australian Heritage Council, [*The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to that Site*](#), 2011, p. 5 (accessed 17 January 2017).

12 Australian Heritage Council, *The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to that Site*, 2011 p. 4 (access 17 January 2017).

13 Dr Ken Mulvaney, *Submission 10*, p. 1.

14 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 5.

15 Professor John Black, *Submission 13*, p. 1.

16 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 5.

Industrial development on the Burrup Peninsula

1.20 Development on the Burrup Peninsula first centred around whaling and pearling activities. This was followed by pastoral development. Over the last 40 years, industrial development has occurred with industries including Yara Pilbara's liquid ammonia plant and technical ammonia.

1.21 In January 2000, the Western Australian Government gave notification of its intention to acquire land for the construction of heavy industrial estates on the Burrup Peninsula and adjacent Maitland area.

1.22 In 2003, the Western Australian Government entered into the Burrup and Maitland Industrial Estates Agreement Implementation Deed (the Burrup Agreement) with the three native title claimant groups on the Burrup Peninsula: the Wong-Goo-Tt-Oo, Ngarluma Yindjibarndi and the Yaburara Mardudhunera peoples. This agreement allowed the Western Australian Government to compulsorily acquire native title rights and interests in the area of the Burrup Peninsula, and some areas of land near Karratha. The agreement allowed for industrial development across the southern area of the Burrup Peninsula, created a conservation estate (which later became the Murujuga National Park) and ensured the protection of Aboriginal heritage.¹⁷

Yara Pilbara

1.23 The following section provides an overview of the companies engaged in managing the liquid ammonia plant, and the technical ammonium nitrate (TAN) plant on the Burrup Peninsula. The Yara group of companies is headed by Yara International ASA. It is the world's largest producer of ammonia, nitrates and NPKs (Nitrogen, Phosphorous, Potassium).¹⁸

1.24 The liquid ammonia plant on the Burrup Peninsula is owned, operated and managed by Yara Pilbara Fertilisers (YPF), a wholly owned subsidiary of Yara Pilbara Holdings Pty Ltd (YPH). YPH is in turn, a wholly owned subsidiary of Yara Australia Pty Ltd.¹⁹

1.25 Yara is a 55 per cent joint venture partner with Orica Limited (Orica) in Yara Pilbara Nitrates (YPN), which is currently engaged in commissioning a TAN production facility (TANPF) located adjacent to the liquid ammonia plant. The TANPF is due to become operational in 2017 with Yara maintaining operational

17 Department of Water and Environmental Regulation, *Draft Burrup Rock Art Strategy*, 2017, p. 4.

18 Yara Pilbara, *Submission 9*, p. 3.

19 Yara Pilbara, *Submission 9*, p. 4.

control of the plant. Orica is responsible for marketing the TAN produced by the facility, through a separate incorporated joint venture.²⁰

1.26 For the purposes of this report, both the TANPF and the liquid ammonia plant will be referred to as being operated by Yara Pilbara.

Liquid ammonia plant

1.27 In 2001, Burrup Fertilisers proposed the construction of an export orientated liquid ammonia plant in the Dampier region.²¹ The plant commenced production in April 2006.

1.28 The liquid ammonia plant is located within a 72 hectare leased area of the Burrup Strategic Industrial Area. Natural gas, the feedstock required for producing ammonia, is piped through a pipeline and metering station from the Dampier Bunbury Natural Gas Pipeline. The plant's minimum production guarantee is 2,200 tonnes of anhydrous ammonia per day, however production between 2,500 and 2,600 tonnes per day can be achieved.²²

TANPF

1.29 The TANPF is located 13 kilometres north-west of Karratha and is adjacent to the Yara Pilbara liquid ammonia plant on a site of approximately 35 hectares. The plant is in the commissioning phase and is not yet operational.²³ When operational the plant will have a production capacity of 350,000 tonnes per annum or 915 tonnes per day of technical ammonium nitrate.²⁴

1.30 The TANPF is comprised of three major processing units:

- nitric acid plant—converts ammonia into nitric acid with the ammonia piped from the liquid ammonia plant;
- ammonium nitrate solution plant—converts ammonia and nitric acid into an ammonium nitrate solution; and

20 Yara Pilbara, *Submission 9*, p. 4.

21 Burrup Fertilisers Pty Ltd was acquired by Yara Pilbara Holdings in 2012. For more information, Yara International, '2012: Strengthening position in Asia and Oceania', (accessed 16 January 2017).

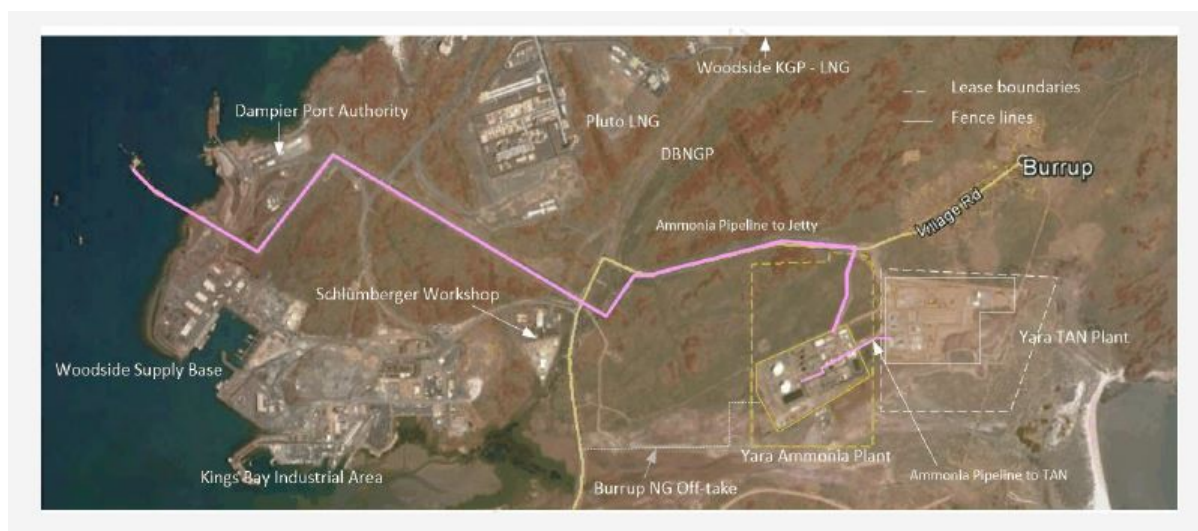
22 Yara Pilbara, *Submission 9*, pp. 4–5.

23 The plant cannot commence operations until the Department of the Environment and Energy has approved Yara Pilbara Nitrates' Operation Environment Management Plan. See Department of the Environment and Energy, *Submission 8*, p. 3.

24 Yara Pilbara, *Submission 9*, p. 5.

- technical ammonium nitrate plant—converts the ammonium nitrate solution into the final product of technical ammonium prills. The plant also has storage, loading and transport facilities.²⁵

Figure 1: Location of the ammonia plant and technical ammonium nitrate plant instruction within the Burrup industrial area



Source: Yara Pilbara, Submission, p. 6.

Other industrial development

1.31 The port of Dampier is located on the Burrup Peninsula. It was developed in the early 1960s as the deep water port to serve the Pilbara region's expanding resource industry. It is now one of the busiest ports in the world: 5,170 ships entered the port in 2014–15. The Dampier Port Authority controls the port through which gas, iron ore, salt and fertiliser are shipped.

1.32 Resources industries and associated infrastructure have expanded in the region including Woodside's LNG processing plant; Rio Tinto's iron ore leases and railhead; and the Holcrim Quarry. Dampier Salt has been exporting salt since 1972.²⁶

25 Yara Pilbara Nitrates, *TAN Plant MS870 Compliance Assessment Report 2016*, p. 5.

26 Australian Heritage Council, *The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to that Site*, 2011, p. 13, <https://www.environment.gov.au/system/files/pages/5b14f51b-b7e1-432f-8049-1e653713607d/files/outstanding-universal-values-may2012.pdf>, (accessed 17 January 2017).

Chapter 2

Regulatory framework

2.1 This chapter provides an overview of the environmental and heritage protection legislation which applies to industrial development on the Burrup Peninsula.

2.2 The Burrup Peninsula as a place of both cultural and historical significance is also the site of a number significant industrial complexes including a major iron ore port, liquefied natural gas production, salt production, and the Yara Pilbara nitrate facilities. As such, industrial facilities on the Burrup Peninsula operate under both Western Australian and Commonwealth legislation. This includes the *Aboriginal Heritage Act 1972* (WA), the *Environmental Protection Act 1986* (WA), the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), and the *National Environment Protection Council Act 1994* (Cth).¹

State regulation and monitoring

2.3 A number of pieces of state legislation are utilised to manage and preserve the cultural, archaeological and natural values of the Burrup Peninsula.

2.4 The *Aboriginal Heritage Act 1972* (WA) provides for the protection and preservation of Aboriginal heritage and culture throughout Western Australia. Under the *Aboriginal Heritage Act 1972* (WA) a number of locations on the Burrup Peninsula have been declared Protected Places and consent is required from the Western Australian Minister for Aboriginal Affairs for any activity which may have negative consequences for Aboriginal heritage sites.²

2.5 The *Environmental Protection Act 1986* (WA) (EP Act) requires ministerial approval of any industrial development that is likely to have a significant effect on the environment. The Western Australian Department of Water and Environmental Regulation (previously known as the Department of Environmental Regulation) is responsible for the control of pollution and for enforcement under the EP Act. This includes responsibility for licensing, compliance and enforcement of emissions and discharges.³ The Environmental Protection Authority of Western Australia (EPA WA) is responsible for the development of environmental protection policies; assessment of

1 The Chamber of Minerals and Energy of Western Australia, *Submission 2*, p. 2.

2 Department of Water and Environmental Regulation, *Draft Burrup Rock Art Strategy*, 2017, p. 4. See also The Chamber of Minerals and Energy of Western Australia, *Submission 3*, p. 2.

3 The Chamber of Minerals and Energy of Western Australia, *Submission 3*, p. 2.

environmental impact of proposals and schemes; and overseeing the implementation of proposals.⁴

2.6 In 2003, the Western Australian Government entered into the Burrup and Maitland Industrial Estates Agreement with three Aboriginal groups: the Narluma-Yindjibarndi, the Yaburara-Mardudhunera, and the Wong-Goo-Tt-Oo. This agreement allowed the WA Government to compulsorily acquire native title rights and interests in the area of the Burrup Peninsula, and some areas of land near Karratha. The agreement allowed for industrial development across the southern area of the Burrup Peninsula, created a conservation estate (which later became the Murujuga National Park) and ensured the protection of Aboriginal heritage.⁵

2.7 In 2003, the Burrup Maitland Industrial Estates Agreement Additional Deed committed the WA Government to organising and funding a minimum four-year study into the effects of industrial emissions on rock art within and near the industrial estate established on the Burrup Peninsula. This included:

- the monitoring of ambient concentrations of air pollutants and microclimate and deposition undertaken by CSIRO Atmospheric Research; and
- the artificial fumigation of rock surfaces and fieldwork on rock surface colour undertaken by CSIRO Manufacturing and Infrastructure Technology.⁶

2.8 In 2009, following the completion of these studies, the Burrup Rock Art Monitoring Management Committee (BRAMMC) recommended that the study of ambient air quality and rock microbiology monitoring be suspended and only recommenced if warranted by a major increase in emissions, or if new evidence makes further monitoring warranted.⁷

2.9 In 2013, the Western Australian Government established the Murujuga National Park which covers the Northern Burrup Peninsula. The focus of the Murujuga National Park Management Plan (2013) is to ensure protection and awareness of the cultural and natural values of area. Increased protection of the rock art is also achieved through the application of provisions of the *Conservation and Land Management Act 1984* (WA) (CALM Act).⁸

4 Western Australian Environmental Protection Authority, <http://www.epa.wa.gov.au/legislation>, (accessed 17 January 2017).

5 Department of Water and Environmental Regulation, *Draft Burrup Rock Art Strategy*, 2017, p. 4.

6 Department of Water and Environmental Regulation, *Draft Burrup Rock Art Strategy*, 2017, p. 5.

7 Department of Water and Environmental Regulation, *Draft Burrup Rock Art Strategy*, 2017, p. 4.

8 Department of Water and Environmental Regulation, *Draft Burrup Rock Art Strategy*, 2017, p. 4.

2.10 The management of the Murujuga National Park is administered by the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) in accordance with policy directions provided by the Murujuga Park Council (MPC). The MPC is comprised of representatives from the Murujuga Aboriginal Corporation (MAC), the DBCA, and a representative appointed by the Minister for Aboriginal Affairs. The Rangers of the Murujuga Land and Sea Unit (MLSU) conduct the practical management of park alongside DBCA staff.⁹

Burrup rock art monitoring program

2.11 As noted above, monitoring of the rock art was commissioned and reviewed by BRAMMC. The Western Australian Government established the BRAMMC in 2002 in response to concerns about possible adverse impacts on the rock art from industrial air emissions.

2.12 The BRAMMC commissioned a number of investigations to identify whether industrial emissions were having or could have adverse effects on the rock art of the Burrup Peninsula. A number of studies were initiated including:

- annual independent monitoring of colour change and spectral mineralogy of rock art, conducted by CSIRO;
- air quality monitoring conducted in 2004–2005 and 2007–2008 by CSIRO to assess the likelihood that air pollution from industrial activities in the area would damage rock art;
- air dispersion modelling atmospheric pollutants occurred in 2009 to provide a better understanding of the potential for emissions from local industry to have an impact on rock art;
- a study conducted between 2004–2008 by Murdoch University into the possibility that microbial activity stimulated by air pollutants could accelerate surface corrosion;
- accelerated erosion tests conducted between 2004–2007 by CSIRO utilising fumigation chambers to investigate the impact of pollutant scenarios and the role of dust in rock surface modification.¹⁰

2.13 The BRAMMC provided the results of CSIRO's and other studies to the Western Australian Minister for Environment in 2009. It concluded that 'there was no

9 Department of Water and Environmental Regulation, *Draft Burrup Rock Art Strategy*, 2017, p. 4.

10 Yara Pilbara, *Submission 9*, pp. 10–11.

scientific evidence that indicates measurable impacts to rock art from industrial emissions on the Burrup Peninsula'.¹¹

2.14 Based on the recommendations of the BRAMMC, the Western Australian Minister for Environment established the Burrup Rock Art Technical Working Group (BRATWG) in September 2010. The BRATWG was established as an independent technical body tasked with managing and coordinating the continued monitoring of the rock art of the Burrup Peninsula. It was funded by existing industries on the Burrup Peninsula with Yara Pilbara being a major financial contributor since Yara assumed control of the Ammonia Plant in 2012.¹²

2.15 In 2016, the BRATWG completed its five year term of engagement, and provided a draft report to the Western Australian Minister for Environment. According to Yara Pilbara, the draft report:

... concluded, consistent with the earlier findings of BRAMMC, that there is no scientific evidence that indicates any measurable impact of industrial emissions on the rock art on the Burrup over the period 2004 to 2014. The report also contains a recommendation that the monitoring of rock art continue on an annual basis to provide an early warning of any possible impacts to rock art from industrial emissions and recommended that the function of BRATWG continue for another five year term.¹³

2.16 Yara Pilbara submitted that it supports the recommendations contained in the draft report and the 'ongoing operation of BRATWG as an effective independent group to facilitate the monitoring and analysis efforts'.¹⁴

2.17 The Chamber of Minerals and Energy of Western Australia similarly stated that it supports 'the continuation of BRATWG in its role of overseeing the Burrup rock art monitoring program to assist in the protection and preservation of petroglyphs on the Burrup Peninsula'.¹⁵

11 Yara Pilbara, *Submission 9*, p. 11. See also Burrup Rock Art Monitoring Committee, *Report and Recommendations to the Minister for State Development*, April 2009, [http://pandora.nla.gov.au/pan/103684/20090805-1626/www.dsd.wa.gov.au/documents/090115_Burrup_Rock_Report_\(1\).pdf](http://pandora.nla.gov.au/pan/103684/20090805-1626/www.dsd.wa.gov.au/documents/090115_Burrup_Rock_Report_(1).pdf), (accessed 1 June 2017).

12 Yara Pilbara, *Submission 9*, p. 11.

13 Yara Pilbara, *Submission 9*, p. 12. See also The Chamber of Minerals and Energy of Western Australia, *Submission 2*, p. 5.

14 Yara Pilbara, *Submission 9*, p. 12.

15 The Chamber of Minerals and Energy of Western Australia, *Submission 2*, p. 4.

Commonwealth regulation

2.18 The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework for the management and protection of nationally important, flora, fauna, ecological communities and heritage places which are defined in the Act as matters of national environmental significance. Matters of national environmental significance relating to cultural heritage include National Heritage Places.¹⁶

2.19 The principles of ecologically sustainable development, as established in section 3A of the EPBC Act, are required to be followed in relation to areas listed as National Heritage Places. These principles are as follows:

- (a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;
- (b) if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- (c) the principle of intergenerational equity—that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;
- (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; and
- (e) improved valuation, pricing and incentive mechanisms should be promoted.¹⁷

2.20 Under the EPBC Act, the Department of the Environment and Energy has responsibility for listing new National Heritage Places, and regulating the impact of development actions that are likely to have a significant impact on National Heritage Places.¹⁸ The Minister for the Environment and Energy, on behalf of the Commonwealth, under section 45 of the EPBC Act, has a bilateral agreement with the State of Western Australia in relation to accreditation of the state's Environmental Impact Assessment processes.¹⁹

2.21 In 2007, the Dampier Archipelago, including the Burrup Peninsula, was added to the Heritage List. The Australian Heritage Council found that the Dampier

16 Department of the Environment and Energy, *Submission 8*, p. 1.

17 *Environment Protection and Biodiversity Conservation Act 1999*, s 3A. See also, Law Council of Australia, *Submission 3*, pp. 1–2.

18 Department of the Environment and Energy, *Submission 8*, p. 1.

19 Law Council of Australia, *Submission 3*, p. 2.

Archipelago met five of the eight criteria for National Heritage Listing under the EPBC Act. These criteria are:

- the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history;
- the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history;
- the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history;
- the place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:
 - a class of Australia's natural or cultural places; or
 - a class of Australia's natural or cultural environments; and
- the place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period.²⁰

2.22 The listing of the Dampier Archipelago 'recognised the extraordinary extent, diversity and significance of petroglyphs, standing stones and circular stone arrangements of the place'.²¹

2.23 At the time of listing, EPBC Act Conservation Agreements were signed by the then Minister for the Environment and Water Resources, the Hon Malcolm Turnbull, with Woodside Energy Ltd, Hamersley Iron Pty Ltd, and Dampier Salt Ltd (Rio Tinto). Under the Conservation Agreements, these companies provide funding for research, management and monitoring of the National Heritage values of the place. The Murujuga Rangers are supported by the Conservation Agreements to manage the National Heritage values in cooperation with the Australian and Western Australian governments.²²

2.24 As a consequence of its listing as a National Heritage Place, the provisions of the EPBC Act and the *National Environment Protection Council Act 1994* apply to developments on the Burrup Peninsula. However, the application of the EPBC Act is limited to actions commenced after 16 July 2000 (the commencement date of the EPBC Act). Action which commenced prior to that date and was either legally authorised, or is a lawful continuation of a use of land, the sea or the sea bed that

20 Commonwealth of Australia, *Commonwealth of Australia Gazette*, No. S127, 3 July 2007, <http://www.environment.gov.au/system/files/pages/d53ee213-2f1e-481e-b0f6-85d861a52de2/files/10572701.pdf>, (accessed 3 April 2017).

21 Department of the Environment and Energy, *Submission 8*, p. 1.

22 Department of the Environment and Energy, *Submission 8*, p. 1.

commenced prior to July 2000 is exempt from the assessment and approval provisions of the EPBC Act. The Department of the Environment and Energy (the department) stated that much of the industrial development on the Burrup Peninsula is subject to the exemption provisions of the EPBC.²³

EPBC Act assessment of the liquid ammonia plant

2.25 In 2001, the proposed liquid ammonia plant was referred to the Commonwealth for a decision under the EPBC Act as to whether it required approval. The Commonwealth Minister decided that the proposal was not a controlled action (i.e. it was not likely to have a significant impact on matters of national environmental significance).²⁴

2.26 At the time of this decision, national heritage had not been added to the EPBC Act as a matter of national environmental significance. The provisions of the EPBC Act which relate to national heritage were added in 2003, and commenced operation in 2004. Similarly, the listing of the Dampier Archipelago (including Burrup Peninsula) as a National Heritage Place did not occur until 2007. As neither the EPBC Act nor the heritage listing operate retrospectively, existing activities such as the liquid ammonia plant are permitted to continue unless there is a significant alteration to the nature of those activities.²⁵

EPBC assessment and approval of the TANPF

2.27 In 2008, the environmental approvals process commenced for the construction and operation of the TANPF. The Commonwealth Minister determined that the proposal for the construction of the TANPF was a controlled action under the EPBC Act for likely impacts to National Heritage places, listed threatened species and listed migratory species. Pursuant to the bilateral agreement between the Commonwealth and the State of Western Australia, the proposal was referred for assessment by the EPA WA. This assessment process included an eight week public review period.²⁶

23 Department of the Environment and Energy, *Submission 8*, pp. 1–2.

24 Law Council of Australia, *Submission 3*, p. 2.

25 Law Council of Australia, *Submission 3*, p. 2.

26 Department of the Environment and Energy, *Submission 8*, p. 2. See also Law Council of Australia, *Submission 3*, p. 3.

2.28 The EPA WA provided a report and recommendations to the Commonwealth Minister. This report stated that it was considered that it:

...is unlikely that the relatively small quantities of NO₂ [nitrogen dioxide] and NH₃ [ammonia] that would be emitted from the TANPF would have a significant impact on rock art in the surrounding areas.²⁷

2.29 The EPA WA based its decision on the 'results obtained from the Pluto LNG Development Cumulative Air Quality Study, the CSIRO study on the impact of industrial air emissions on rock art located on the Burrup Peninsula, and the Burrup Peninsula Air Pollution Study: Report for 2004/2005 and 2007/2008'.²⁸

2.30 The EPA WA also expressed the view that

...the proposal could be managed to meet the EPA's environmental objectives and recommended conditions including what it described as "the adoption and implementation of best practice pollution control technology to minimise ammonia emissions and particulate emissions from the drilling plant common stack".²⁹

2.31 The WA Government approved the construction of the TANPF on 11 July 2011.

2.32 Twenty seven environmental conditions were set by the Western Australian Government under relevant state legislation. These include the requirement to prepare and implement an ambient air monitoring programme, and the requirement to submit an annual Compliance Assessment Report.³⁰

Commonwealth environmental conditions

2.33 The Commonwealth Minister for the Environment approved the proposed action, with 15 conditions, on 14 September 2011. Conditions 7, 8, 9 and 10 relate to the protection of the Dampier Archipelago (including the Burrup Peninsula) National Heritage place.³¹

27 Western Australian Environmental Protection Authority, *Technical Ammonium Nitrate Production Facility, Burrup Peninsula Report and Recommendations*, January 2011, p. iii.

28 Western Australian Environmental Protection Authority, *Technical Ammonium Nitrate Production Facility, Burrup Peninsula Report and Recommendations*, January 2011, p. iii.

29 Law Council of Australia, *Submission 3*, p. 3.

30 Ministerial Statement No. 870, Technical Ammonium Nitrate Production Facility, Burrup Peninsula, Shire of Roebourne, 11 July 2011.

31 Department of the Environment and Energy, *Submission 8*, p. 2. See *Submission 8*, Attachment 1 for a complete list of conditions.

2.34 Condition 7 required the submission and implementation of the following plans:

- Construction Environment Management Plan—approved by a delegate of the Minister for the Environment in November 2012;
- Operational Environment Management Plan—currently being considered by the department and relates to air quality and dust, water quality, erosion control and storm water, waste and traffic. The plant cannot commence operation until the plan is approved;
- Aboriginal Heritage Management Plan—approved by the department in October 2012;
- Hazardous Materials Management Plan—approved by the department in November 2012; and
- Emergency Response Management Plan—approved by the department in November 2012.³²

2.35 Condition 8 required avoidance measures relating to the rock art sites, including fencing, signage and personnel access to the National Heritage place. The department conducted a site inspection in September 2016 and 'verified that the management measures required under condition 8 were being implemented'.³³

2.36 Condition 9 required air quality monitoring at three sites used in the Burrup Rock Art Monitoring Program. Emissions of ammonia, nitrogen oxides, sulphur oxides and total suspended particles would have to be monitored, and form the baseline of air quality data. The baseline air quality monitoring was to be reported to the department by 21 February 2017 with annual air quality monitoring at the rock art sites occurring for at least five years after operations commence.³⁴

2.37 Condition 10 required spectral mineralogy monitoring of rock art sites adjacent to the site, consistent with the Burrup Rock Art Monitoring Program. Monitoring must continue for at least five years after commencement of operations and until the approval holder has demonstrated that operation of the facility is not having an unacceptable impacts on the rock art sites. The approval holder is also required to provide results to the department and to publish them on the internet.³⁵

2.38 Condition 10 also required the engagement of a heritage monitor or other suitably qualified person to survey rock art sites within a two kilometre radius of the

32 Department of the Environment and Energy, *Submission 8*, pp 2–3; p. 4.

33 Department of the Environment and Energy, *Submission 8*, p. 3.

34 Department of the Environment and Energy, *Submission 8*, p. 3.

35 Department of the Environment and Energy, *Submission 8*, p. 3.

project. This heritage monitor is required to provide advice on any changes to the appearance, or cultural value of rock art sites within the examined area.³⁶

Issue of licence to operate

2.39 Following the decision by the Commonwealth Minister, Yara Pilbara obtained a licence to operate under the EP Act (WA). An application to amend the licence was advertised on 11 July 2016.³⁷

Variation of Commonwealth conditions

2.40 Following application by Yara Pilbara, the Commonwealth's environmental approval conditions were varied on 18 December 2013, which deleted condition 8(d) and amended conditions 10 and 11.³⁸

2.41 Condition 8(d), which was deleted, referred to the annual survey of rock art sites within a 2 kilometre radius of the project site by a heritage monitor or other suitably qualified person and the reporting requirements of that survey.³⁹

2.42 New condition 10(c) included the monitoring requirements for additional monitoring of rock art sites in a manner that is consistent with the Burrup Rock Art Monitoring Program. Six requirements were set for this condition including that the monitoring be undertaken at least annually and that the Murujuga Aboriginal Corporation be engaged in the planning and reporting associated with the annual survey of rock art sites required under condition 10(c).⁴⁰

2.43 Condition 11 was amended to require the proponent to notify the department within 72 hours of any results of the state government managed monitoring program

36 Department of the Environment and Energy, *Submission 8*, Attachment 1, p. 4.

37 Law Council of Australia, *Submission 3*, p. 3.

38 Department of the Sustainability, Environment, Water, Population and Communities, EPBC Act public notices, Proposed technical ammonium nitrate production facility (EPBC 2008/4546), 18 December 2013, http://epbcnotices.environment.gov.au/_entity/annotation/1a62b8f0-3168-e511-9099-005056ba00a8/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1486528464989 (accessed 16 January 2017).

39 Department of the Environment and Energy, *Submission 8*, Attachment 1, p. 3.

40 Department of the Sustainability, Environment, Water, Population and Communities, EPBC Act public notices, Proposed technical ammonium nitrate production facility (EPBC 2008/4546), 18 December 2013, http://epbcnotices.environment.gov.au/_entity/annotation/1a62b8f0-3168-e511-9099-005056ba00a8/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1486528464989 (accessed 16 January 2017).

or additional monitoring, as required under condition 10(c) that show there is evidence of changes in the surface of rock art motif or surrounding rock surface.⁴¹

2.44 A further variation to the Commonwealth's approval conditions was approved on 10 February 2014. Condition 10(c) (iv) was amended, which changed the timing of the first rock art monitoring event from within 12 months of the commencement of construction to 16 months.⁴²

2.45 The Yara Pilbara compliance report of 2016 stated that Yara Pilbara would seek a further variation regarding assessment of rock art.⁴³

Directed variation to approval

2.46 On 12 September 2017, the Department of the Environment and Energy (the department) issued a directed variation to the approval for the TANPF. A directed variation to approval conditions to require stricter regulatory controls of an action may be put in place for 'repetitive non compliances, where a non-compliance has led to environmental harm or where an approval holder does not engage with the Department in relation to a breach of approval conditions'.⁴⁴

2.47 The directed variation replaced 11 conditions, added 7 further conditions and replaced a number of definitions. The directed variation includes measures that (amongst others):

- impose new reporting requirements (Condition 3, Condition 3A and Condition 14);
- impose new air quality monitoring and reporting requirements (Condition 9A and Condition 9B); and
- require that the approval holder ensure that there is no measurable impact from air pollution to any rock art sites within two kilometres, for the life of the approval (Condition 11). And further, if the Minister is not satisfied that this is being met, then a Rock Art Impact Mitigation Review (RAIMR) must be submitted for approval by the Minister (Condition 11A). If an RAIMR is not submitted to the satisfaction of the Minister, or Condition 11 is not met,

41 Department of the Sustainability, Environment, Water, Population and Communities, EPBC Act public notices, Proposed technical ammonium nitrate production facility (EPBC 2008/4546), 18 December 2013, <http://epbcnotices.environment.gov.au/entity/annotation/1a62b8f0-3168-e511-9099-005056ba00a8/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1486528464989> (accessed 16 January 2017).

42 Department of the Environment and Energy, EPBC Act public notices, Proposed technical ammonium nitrate production facility (EPBC 2008/4546), 10 February 2014, <http://epbcnotices.environment.gov.au/publicnoticesreferrals/>.

43 Law Council of Australia, *Submission 3*, p. 5.

44 Department of the Environment, *Compliance Monitoring Program 2015–16*, p. 9.

then the Minister may order a reduction in air emissions for a specified period of time (Condition 11B).⁴⁵

2.48 Ms Monica Collins, Chief Compliance Officer, Department of the Environment and Energy, told the committee that the variation was issued because the department had:

...found noncompliance with the full set of conditions in relation to the air quality monitoring in that they [Yara Pilbara] didn't have the full set of monitoring data for the total suspended particulates.⁴⁶

2.49 Ms Collins explained that the intent of the directed variation was 'to make very clear the need for ongoing monitoring and, specifically, what parameters they were required to monitor'. Ms Collins also told the committee that the department was 'making it very clear that the purpose of the license is to ensure the protection of the rock art in the national heritage place'.⁴⁷

45 Department of the Environment and Energy, 'Variation to Conditions Attached to Approval', 12 September 2017, <http://epbcnotices.environment.gov.au/entity/annotation/cd15cb17-289c-e711-994c-005056ba00a8/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1506573061985>.

46 Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 3.

47 Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 3.

Chapter 3

Key issues with emissions from, and the location of, industrial activities

3.1 This chapter examines the evidence received in relation to the measurement and impact of existing industrial activities on the rock art of the Burrup Peninsula.

3.2 It also examines the evidence received in relation to the projected additional pollution load from Yara Pilbara's technical ammonium nitrate production facility (TANPF), and the expected impact on rock art, human health, and the environment.

Existing industrial activities and the impact on Aboriginal rock art

3.3 As noted previously, a range of industries are located on the Burrup Peninsula. Submitters raised concern that emissions from these industrial activities and the port zone may have had, and may continue to have, an impact on the Aboriginal rock art of the Burrup Peninsula.

3.4 Submitters were also concerned that the total emission load has either not been measured, or if it has been measured, the results are not publicly available.¹

Shipping

3.5 The Port of Dampier is one of the busiest bulk ports in the world: 5,170 ships entered the port in 2014–15. Shipping lanes and anchorages are situated within a few kilometres of a number of Aboriginal rock art sites.

3.6 The committee received evidence concerning the possible impact of emissions from ships on rock art. It was noted that bulk cargo vessels utilise high-sulphur content fuel and it is estimated that a single bulk cargo ship will release an estimated 5,200 tonnes of sulphur dioxide into the atmosphere in a year. These sulphur dioxide emissions are highest during start-up and shut-down which occur at anchorage.²

1 Bob Brown Foundation, *Submission 11*, p. 3.

2 Professor John Black, *Submission 13*, pp. 14–15.

3.7 The Friends of Australian Rock Art (FARA) noted the lack of monitoring or emissions from ships and stated that:

...there has also been no specific measurement or monitoring of the toxic fumes emitted by ships burning cheap bunker oil in Dampier port; the low-quality oil results in a higher percentage of damaging sulphur emissions and particulates than refined oil.³

3.8 Sulphur dioxide, when combined with moisture in the air, forms sulphuric acid and precipitates as acid rain or fog which is globally known to have severe effects on stone buildings, rocks and rock art. Professor Black noted that areas in Australia such as Sydney Harbour require cruise ship operators to use fuel with a maximum sulphur content of 0.10 per cent. This is similar to the maximum sulphur content requirements in designated Emissions Control Areas established under Annex VI to IMO MARPOL 73/78 Convention. Professor Black submitted that this limit should also be applied to shipping occurring at the Port of Dampier.⁴ However, the committee notes that the measures in Sydney Harbour only apply to passenger cruise ships. Caution should be exercised in comparing the operations of passenger cruise ships and commercial freight vessels.

Existing industries

3.9 As noted in Chapter 1, there are a range of existing industries on the Burrup Peninsula. Some submitters voiced concern that the impact of existing industries on the rock art of the Burrup Peninsula has never been quantified. Further, that the total emission load of these industries has never been measured.

3.10 The Bob Brown Foundation, for example, submitted that given the Commonwealth's responsibility to protect the environment and Aboriginal rock art from adverse impacts from emissions, then the current total emission load should be measured. The Foundation stated that such 'an accumulative load figure is critical to determine the environmental and public health impacts of existing industrial load pollution before additional loads are permitted'.⁵

3.11 Dr Ken Mulvaney noted that the Western Australian Government sponsored air quality monitoring undertaken by CSIRO in 2004–2005 and 2007–2008, however this monitoring ended before the Woodside Pluto LNG plant went into production. Further, the Burrup liquid ammonia plant was not in full production during these periods either. As such, 'it is unlikely that there is an accurate capture of the total pollution load from existing industrial activities'.⁶

3 Friends of Australian Rock Art, *Submission 14*, p. 2.

4 Professor John Black, *Submission 13*, p. 15.

5 Bob Brown Foundation, *Submission 11*, p. 3.

6 Dr Ken Mulvaney, *Submission 10*, p. 1.

3.12 Submitters provided evidence which they argued indicated that emissions from Woodside's industrial site are already degrading the environment. For example, FARA stated that the impact of industrial emissions can be seen on the surface of concrete pavers at the Woodside Visitor Centre.⁷

3.13 Similarly, Professor Black provided his observations on the impact of emissions on buildings:

Although, no scientific analysis of the bricks have been made to my knowledge...where there is a gap between the two roofs, the bricks on the paving have been eroded and the black marking to the side suggest an increase in microbial growth. If the current emissions are already having such a marked effect on bricks, what effect are they having on the acid-sensitive desert varnish, which is so crucial for preservation of the rock art?⁸

3.14 In addition to these observations, Professor Black submitted that a high level of air pollution is also demonstrated through the Bureau of Meteorology's radar vision for the area indicating that it is raining every day, despite an average of rainfall of only 20 days per year.⁹

3.15 FARA further expressed concern that 'Woodside's monitoring is kept internal and not posted on its website, and...the company has been experiencing difficulties in controlling the size of its main flare, which is visible up to 30 km away'.¹⁰

Impact on rock art

3.16 Professor Black stated that 'there is strong evidence that the acidity of rock surfaces on [the] Burrup Peninsula has already increased dramatically since pre-industrial times'. Professor Black described studies undertaken by Dr Ian MacLeod, former Director of the Western Australian Maritime Museum, which found that acidity on rock surfaces in 2004, was found to be as low as pH 4.2 compared to a near neutral pH7 on rock sample specimens collected before industrialisation. Professor Black stated that 'most importantly, Dr MacLeod observed logarithmic increases in the solubility of manganese and iron compounds with increasing acidity of the more recently measured rocks'.¹¹

3.17 Dr MacLeod found that on the rocks of the Burrup Peninsula where:

...acidity increased—that is, as the pH went down—there was a logarithmic increase in the number of microbes that inhabited the rock art or the rocks

7 Friends of Australian Rock Art, *Submission 13*, p. 2.

8 Professor John Black, *Submission 13*, p. 12.

9 Professor John Black, *Submission 13*, p. 12.

10 Friends of Australian Rock Art, *Submission 14*, p. 2.

11 Professor John Black, *Submission 13*, pp. 10–11.

where the rock art is. He showed there that one of the reasons for the logarithmic increase in the way that the manganese and iron compounds were dissolved was because of this increase in acidity so that the acidity and the dissolving of the outer patina go together and they are both logarithmic so that, as acidity increases, this increases tenfold.¹²

3.18 Other evidence provided to the committee included the findings of studies conducted by Robert G. Bednarik over a number of decades. Professor Black explained that in 2007 Bednarik collected the 'through fall' rain under trees at sites on the Burrup Peninsula and found that it was highly acidic with a pH as low as 3.2. This was due to tree canopies retaining large amounts of dry airborne pollutants in their layers of foliage. As water falls through the foliage, the acid forming chemicals such as NO_x and SO_x are concentrated in the rainfall. Bednarik found the complete removal of rock patina below trees adjacent to the Woodside site on the Burrup Peninsula.¹³

3.19 Bednarik also photographed rock sites on the Burrup Peninsula from the 1960s and utilised the International Federation of Rock Art Organisation's standard colour assessment system to identify marked changes in colour from pre-industrial times to 2002. Based on these observations, Bednarik predicted in 2002 that the Burrup Peninsula's petroglyphs would disappear during the second half of the 21st century at the then current rates of acid emissions, and by 2030 if such emissions trebled. Professor Black noted that in 2014, Woodside released 22,400 tonnes of acid load into the environment and Yara Pilbara's liquid ammonia plant released 13,600 tonnes into the environment—extremely large amounts of acid forming emissions. Professor Black concluded that:

There is irrefutable empirical and theoretical evidence that any increasing acid accumulation on the surface of rocks on Burrup Peninsula is now destroying and will completely dissolve the desert varnish patina. These processes will result in the destruction of the petroglyphs within the next 20-30 years at the current rate of acid emissions.¹⁴

Response from industry

3.20 In response to concerns raised in relation to the impact of existing industrial activities on the rock art of the Burrup Peninsula, Yara Pilbara noted that:

...the total industrial emission load on the Burrup Peninsula is a matter that has been addressed in detail in the various proposals and approval documents submitted by Yara Pilbara Fertilisers. Accordingly, it is a matter that has been presented for consideration during the course of the relevant approval processes.¹⁵

12 Professor John Black, *Submission 13*, p. 12.

13 Professor John Black, *Answers to Questions on Notice*, p. 2.

14 Professor John Black, *Answers to Questions on Notice*, pp. 2–3.

15 Yara Pilbara, *Submission 9*, p. 10.

3.21 Yara Pilbara reiterated that it 'shares the broad community expectation that the unique Aboriginal heritage values of the Burrup Peninsula remain unaffected by industrial activities.' As such, it:

...is committed to ongoing monitoring and investigations of rock art nearby to its operations to ensure that its environmental and heritage protection measures remain effective and to adapt these measures as may be required in response to scientific data.¹⁶

Projected emissions from Yara Pilbara's TANPF

3.22 The following sections explore evidence presented to the committee on the possible impact of the projected emissions from the TANPF on the rock art of the Burrup Peninsula. It also canvasses concerns raised in relation to the possible impact on human health and the environment.

3.23 The TANPF is expected to emit ammonium nitrate particles, nitrogen oxides, nitrous oxide, carbon monoxide, methane, ammonia, and carbon dioxide (see Table 3.1) into the atmosphere when it begins production.

Table 3.1 – TANPF expected emission load

Emission	Amount released
Nitrogen Oxides (NO _x)	Up to 135 t/yr
Nitrous Oxide (N ₂ O)	Up to 163.7 t/yr
Carbon Monoxide (CO)	Up to 41 t/yr
Methane (CH ₄)	Up to 17.8 t/yr
Ammonia (NH ₃)	Condition 5 from Report 1379, 11 July 2011: Best practice pollution control technology; 19.6 t/yr under initial application (calculated from EPA Report 1379, January 2011)
PM ₁₀ ammonium nitrate dust particles	Condition 5 from Report 1379, 11 July 2011: Best practice pollution control technology; 25.2 t/yr under initial application (EPA Report 1379, January 2011)
Sulphur Dioxide	Trace
Carbon Dioxide (CO ₂)	Up to 532.6 t/yr
Total greenhouse gas emission	Approx. 84,451 t/yr

Source: Environment Protection Authority Western Australia, 'Technical Ammonium Nitrate Production Facility, Burrup Peninsula Report and Recommendations', January 2011, cited in Professor John Black, *Submission 13*, p. 8.

3.24 Submitters noted that these predicted emissions are 'minimum estimates, as they omit emissions from conveying, storage and transport of nitrate prills'.¹⁷

¹⁶ Yara Pilbara, *Submission 9*, p. 10.

¹⁷ Ms Lyndy Scott, *Submission 12*, p.1. See also Professor John Black, *Submission 13*, p. 8.

Likely impact of emissions on rock art

3.25 A number of submitters expressed concern that the expected increase in emissions on the Burrup Peninsula resulting from the TANPF would destroy the rock art on the Burrup Peninsula 'over a relatively short period of time'.¹⁸ For example, Professor Black stated that the proposed acid load into the atmosphere of 200meq/m²/year from the TANPF are 'at the highest category of the international scale for environments susceptible to acids'. Professor Black submitted:

Acid emissions of the magnitude proposed are known to degrade whole ecosystems, destroy life in lakes and waterways and to deface stone statues and stone buildings around the world.¹⁹

3.26 Ms Lyndy Scott stated that 'an acid load of this magnitude damages granite and feldspar rocks (like Burrup types) around the world'.²⁰ The Bob Brown Foundation submitted:

As rocks on Burrup Peninsula contain a substantial proportion of feldspar they are likely to be degraded by weak acids formed from the industrial emissions. The degradation is most likely to be greatest along the petroglyph engravings.²¹

3.27 Professor Black explained that the effects of pollutants on rocks are cumulative and increase over time. Weathering and exfoliation of the surface are the only ways that pollutants can be removed from rocks; however this process is also irreversible and would erase any rock art present. Professor Black noted that these processes only occur to a very limited extent to rocks on the Burrup Peninsula, and 'therefore the impact of increasing acid on Burrup rock surfaces over time is a critical factor when considering survival of the art'.²²

3.28 Professor Black submitted that the Burrup Peninsula consists of a series of hills of stone blocks, with very little soil except on the lower regions. These rocks are 'extremely hard and do not exfoliate readily into soil, but split into large blocks with flat sides'. Professor Black further stated that though the petroglyphs found in the area largely occur on 'the flat surfaces of slow weather, hard gabbro and granophyre igneous rocks, they are extremely sensitive to increased surface acidity like calciferous limestone and marble'.²³

3.29 The petroglyphs of the Burrup Peninsula are carved into the weathering rind of parent igneous rocks. This weathering rind can differ in thickness, depending on the

18 Professor John Black, *Submission 13*, p. 9.

19 Professor John Black, *Submission 13*, p. 8.

20 Ms Lyndy Scott, *Submission 12*, p. 1.

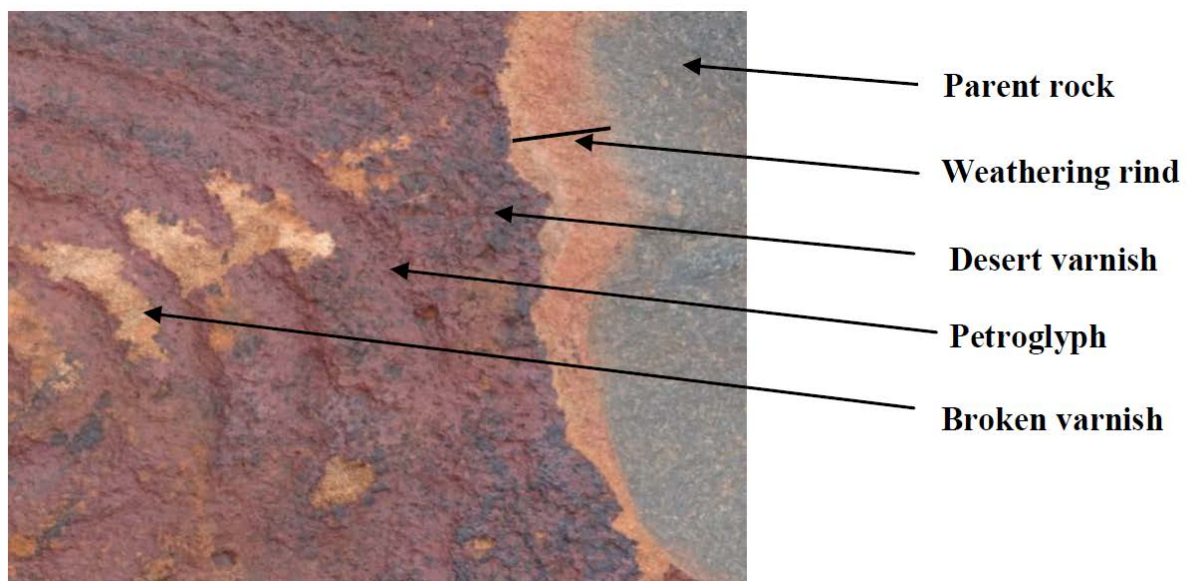
21 Bob Brown Foundation, *Submission 11*, p. 4.

22 Professor John Black, *Submission 13*, p. 9.

23 Professor John Black, *Submission 13*, p. 9.

time from fracture of the rock surface, from a few microns to around 10 millimetres after 30,000 years. The rind has a hard, dark-coloured outer patina called rock or desert varnish up to 200 microns thick, depending on its age. Petroglyphs are formed when the patina is broken, exposing the softer and lighter coloured, weathered rock beneath. This rock consists largely of partially formed clays. This process creates a colour and contour contrast between the petroglyph and background rock as demonstrated in Figure 3.1.²⁴

Figure 3.1 – Burrup rock with petroglyph showing parent rock, weathering rind and desert varnish



Source: Professor John Black, Submission 13, p. 10.

3.30 Professor Black explained that desert varnish forms in low rainfall arid conditions where rock surfaces are alkaline. It has a growth rate of up to 10 microns per thousand years, and is formed by micro-organisms extracting minerals and clay from manganese and iron compounds.²⁵ These micro-organisms deposit extracted iron and manganese into an outer sheath which protects them from the harsh environment of the Burrup Peninsula, where temperatures can exceed 70 degrees centigrade.²⁶ These micro-organisms are thought to live for hundreds of years, lie dormant for much of the time, and only grow during favourable conditions. It is believed that the death of five of these micro-organisms per 1000 years is sufficient to form desert varnish

24 Professor John Black, *Submission 13*, pp. 9–10.

25 Professor John Black, *Committee Hansard*, 17 February 2017, p. 16.

26 Professor John Black, *Submission 13*, p. 10. See also Professor John Black, *Committee Hansard*, 17 February 2017, p. 16.

when incorporated with clay. Under normal alkaline desert environments, desert varnish continues to increase in thickness over time, albeit slowly.²⁷

3.31 Desert varnish is susceptible to damage from an increase in the presence of acids in the environment, as acid dissolves manganese and iron compounds. This makes desert varnish thinner, weaker and lighter in colour. Professor Black submitted that:

Removal of darker manganese and iron compounds from the outer, desert varnish layer, and the relative increase in ferrous oxide and clays in the desert varnish will result in the rock surface layers becoming thinner, lighter, redder and more white/yellow in colour over time. The impact on engraved surfaces will be greater because the desert varnish is thinner than on the non-engraved surface rock. Pollution from industry with an increase in acidity of the rock surfaces on Burrup Peninsula is likely to destroy the rock art over time.²⁸

3.32 In addition to the impact of an increase in acidity on petroglyphs, concern was also expressed in relation to the effect of an increase in nitrogen on rock surfaces. As previously noted, the TANPF is expected to emit 25.2 tonnes per year of ammonium nitrate particles. Ammonium nitrate stimulates the growth of plants and other organisms through the provision of nitrogen and Professor Black stated that the 'increase in nitrogen on the surface of Burrup Peninsula rocks will stimulate greatly the growth of adventitious organisms that are traditionally at very low concentrations on rock surfaces'.²⁹ FARA described the effect of this emission as being:

...equivalent to sprinkling fertiliser over the rock art landscape, which in turn, thanks to the perfect conditions of heat, dew/rain and humidity, will encourage unprecedented growth of the microbes on the rock surfaces. These burrowing microbes break down the rock surface and progressively degrade the petroglyphs. It has been suggested that the rock art could thus be destroyed within a generation.³⁰

3.33 Professor Black highlighted research undertaken by Dr Ian MacLeod, former Director of the Western Australian Maritime Museum, which found that the growth of adventitious bacteria, algae, fungi and lichens increased as the nitrogen content of rock surfaces increases. Of particular note is the finding that these organisms will overrun and out-compete varnish forming micro-organisms, and produce organic acids which increase the acidity of rock surfaces. Further, Dr MacLeod found that the hyphae of growing fungi penetrate the soft weathering rind below the desert varnish

27 Professor John Black, *Submission 13*, p. 10. See also Professor John Black, *Committee Hansard*, 17 February 2017, p. 16.

28 Professor John Black, *Submission 13*, pp. 10–11. See also Professor John Black, *Committee Hansard*, 17 February 2017, p. 16.

29 Professor John Black, *Submission 13*, p. 12.

30 Friends of Australian Rock Art, *Submission 14*, p. 2.

layer, and break away the edges of petroglyph engravings.³¹ Lichen and fungi also produce organic acids such as oxalic and acetic acid which substantially weather desert varnish.³²

3.34 Professor Black concluded that:

The combination of an increased acid load dissolving the desert varnish and growth of adventitious organisms stimulated by increased ammonium nitrate and other nitrogen rich compounds in the air will destroy the petroglyphs over time.³³

3.35 The committee also received evidence that rocks in California have been found to have lost desert varnish as a result of acid fog, and that based on this example, the petroglyphs of the Burrup Peninsula could disappear in 100 years. However, it should be noted that without undertaking proper measurements of the rocks of the Burrup Peninsula, the exact speed at which the rock art is being affected cannot be accurately predicted.³⁴

Impact on the environment

3.36 As previously noted, increased nitrogen in the environment stimulates plant growth. Some submitters expressed concern that an increase in emissions from the TANPF would create significant changes to the unique vegetation growth on the Burrup Peninsula. Professor Black stated:

The slow rate of degradation of the rocks on Burrup Peninsula results in a very low buffering capacity of the small amount of soil formed. Low buffering capacities in landscapes make ecosystems extremely susceptible to ecological changes from increasing acid loads. The vegetation on Burrup Peninsula is unique with many plant species common only to this area (Long *et al.* 2016). Thus, high acid emissions of 200 meq/m²/yr are likely to make significant changes to this unique vegetation over time.³⁵

3.37 Concern was expressed that an increase in vegetation would make the area susceptible to an increase in fire intensity resulting from lightning strikes. An increase in the intensity of bush fires would increase the degradation of the rock art, and would also contribute to the hastening of changes in flora populations in the area.³⁶

31 Professor John Black, *Submission 13*, p. 12.

32 Professor John Black, *Committee Hansard*, 17 February 2017, p. 16.

33 Professor John Black, *Submission 13*, p. 12.

34 Professor John Black, *Committee Hansard*, 17 February 2017, p. 17.

35 Professor John Black, *Submission 13*, p. 18. See also Professor John Black, *Committee Hansard*, 17 February 2017, p. 18.

36 Professor John Black, *Submission 13*, p. 18.

3.38 FARA submitted that the threat of fire:

...will increase in magnitude and ferocity when the spread of fertiliser from Yara's TAN plant encourages unprecedented growth of the vegetation– thus potentially destroying much of the 45,000 year old rock art and seriously endangering plant infrastructure and the lives and health of the workers and residents of Dampier, Karratha and Roebourne.³⁷

3.39 In addition, concern was raised that there has already been an increase in algal growth in the region's waterways as a result of an increase in nitrogen levels on the Burrup Peninsula.³⁸

3.40 FARA provided evidence that at meetings with the Circle of Elders of the Murujuga Aboriginal Corporation, concerns were raised that water in the area has become undrinkable as a result of an increase in algal bloom in rock pools.³⁹

Impact on human health from emissions

3.41 Evidence was received that emissions from the TANPF may have detrimental effects on the health of those who live, visit and work in the area. In particular, concern was expressed that 'evidence shows that airborne ammonium nitrate particles, inhaled or digested, are toxic to humans at levels *below* Yara's proposed output'.⁴⁰ Ammonium nitrate can cause orthostatic hypotension due to rapid dilation of blood vessels which results in faintness, dizziness, fatigue and reflex tachycardia (increased heart rate). If it is ingested, it can cause nephritis (kidney inflammation), and where converted to nitrite, cause nitrite poisoning.

3.42 Professor Black stated that:

A 70 kg person undergoing light activity, with a lung-minute volume of 10 litres/min, breathing air with 50 mg/m³ ammonium nitrate particles (as may exist during upset conditions close to the Common stack) would reach the limit of exposure of 5 mg/kg/d (350 mg) in 11.6 hours. This analysis suggests airborne ammonium nitrate particles are a severe threat to the health of workers and the public and should not be released into the environment.⁴¹

3.43 The World Health Organization (WHO) recommends a maximum concentration in the air of 20 micrograms per cubic metre over a year, and 50 micrograms over 24 hours for all PM₁₀ and smaller sized particles.⁴² The TANPF

37 Friends of Australian Rock Art, *Submission 14*, p. 2.

38 Professor John Black, *Submission 13*, p. 18.

39 Friends of Australian Rock Art, *Submission 14*, p. 2.

40 Ms Lyndy Scott, *Submission 12*, p. 1.

41 Professor John Black, *Submission 13*, p. 17. See also Professor John Black, *Committee Hansard*, 17 February 2017, p. 18.

42 PM₁₀ refers to particulate matter that is 10 micrometres or less in diameter.

is expected to emit 15 milligram per cubic metre of PM₁₀ or smaller sized ammonium nitrate particles—which Professor Black described as more than 1000 times more than the recommended maximum concentration for particle emissions.⁴³

3.44 Professor Black also noted that modelling of PM₁₀ concentrations within the boundary fences of the TANPF, and at publicly accessible areas such as Hearson Cove and Deep Gorge showed measurements that exceeded the WHO annual limit by 1.5 to 2 fold.⁴⁴

3.45 Professor Black noted that Yara Pilbara's licence agreement with the Western Australian Government sets the PM₁₀ limit at 15 milligrams per cubic metre, however:

...for human health what is set in Australia is 25 micrograms, and in Victoria and in some other states it is set at 20 micrograms. That is about a 1,000-fold difference. So either they are saying that you can have 1,000 times more particles in the air for people on Burrup Peninsula or it is a misprint in the documentation that is there.⁴⁵

3.46 A further issue raised in evidence was the lack of information provided to local communities about PM₁₀ particles. The Bob Brown Foundation stated that 'there is no analysis of the likely impact of the release of ammonium nitrate on human health'.⁴⁶

3.47 Professor Black also expressed concern that the TANPF would release 41 tonnes per year of carbon monoxide, and that the risk to human health, and the wellbeing of other living organisms in the surrounding environment should be considered.⁴⁷

43 Professor John Black, *Submission 13*, p. 16.

44 Professor John Black, *Submission 13*, p. 16.

45 Professor John Black, *Committee Hansard*, 17 February 2017, p. 22.

46 Bob Brown Foundation, *Submission 11*, p. 4.

47 Professor John Black, *Submission 13*, p. 17.

Response from Yara Pilbara

3.48 Mr Chris Rijksen, General Manager, Yara Pilbara, told the committee that the 25 milligrams per cubic metre standard refers to ambient air concentration while the 15 milligrams per cubic metre referred to in the TANPF's work approval refers to the plant's stack emission. Mr Rijksen concluded:

So it is incorrect to take the assumption that the emission at the stack is equivalent to the ground level concentration that a person will be exposed to.⁴⁸

3.49 Yara Pilbara also responded to concerns raised in relation to the release of PM₁₀ particles by noting that the effect of emission levels from its operations on human health were assessed under criteria which set objective parameters for measurement. It stated that its emissions modelling methodology and outcomes were assessed by the then Western Australian Department of Environmental Regulation (DER) during the TAN Plant Works Approval application. The Works Approval Environmental Assessment Report concluded that 'the PM₁₀ emissions were determined to be insignificant'.⁴⁹

3.50 Yara Pilbara noted that the impacts of carbon monoxide (CO) emissions from the TANPF were assessed in the public environmental review (PER) published in 2010. Dispersion modelling found CO emissions to be insignificant when compared with the relevant standard established under the National Environmental Protection Measure and Impact Statement for Ambient Air Quality (Air Quality NEPM). Specifically, the predicted worst-case CO ground level concentration was found to be 0.01 per cent of the 8-hour average NEPM standard. As such, 'the conclusion reached in the PER was that CO emissions from the TAN Plant do not pose a significant risk to humans, flora or fauna in the environment'.⁵⁰

3.51 Yara Pilbara further noted that the impacts of CO emissions from the Ammonia Plant were reassessed in 2015 by the Environmental Protection Authority (EPA) WA and the Western Australian DER as part of an amendment to Ministerial Statement 586, which was approved in August 2015 by the Minister pursuant to section 45C of the *Environmental Protection Act 1986* (WA). The reassessment determined that the worst-case predicted ground level CO concentrations from the operation of the Ammonia Plant were less than 0.2 per cent of the NEPM. Yara Pilbara concluded that:

The assessments conducted by the various regulatory agencies have imposed no conditions or requirements that require the Ammonia or the TAN Plant to reduce carbon monoxide emissions via capture before discharge.

48 Mr Chris Rijksen, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 35.

49 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, pp. 6–7.

50 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 7.

Ammonia and nitric acid leaks

3.52 Submitters commented on ammonia and nitric acid leaks from existing plants. It was noted that Yara Pilbara operations have already suffered ammonia leaks and as a consequence, 'the community can have no confidence in the company's estimates or proposed control of fugitive emissions from either the Yara Fertiliser Plant or the explosives plant'.⁵¹

Ammonia leaks

3.53 The Bob Brown Foundation and FARA both noted that a number of ammonia leakages had resulted in the hospitalisation of staff.⁵² The Bob Brown Foundation commented:

There were at least 24 reportable incidents from January to 17 November 2015. Ammonia leak was a common cause of the incidents. Between 16–20 January 2016, 4,601 tonnes of gas were released into the atmosphere.⁵³

3.54 Ms Lyndy Scott submitted that 'local Aboriginal people have complained of ammonia smell and stinging eyes when they are downwind of the current fertiliser plant'.⁵⁴

Response from Yara Pilbara

3.55 Yara Pilbara stated that in 2016 there were four releases of ammonia gas and one release of liquid ammonia from its liquid ammonia plant, and that there were no reportable incidents in 2015. It went on to comment that in 2016 'it was determined that none of the ammonia releases had any offsite impacts'.⁵⁵ Mr Brian Howarth, Health, Environment, Safety and Quality Manager, Yara Pilbara, explained to the committee that the four ammonia leaks in 2016:

...all had a root cause, which is a defectively-calibrated process safety valve. These are valves that sit on top of our ammonia tanks. They are designed to release in the event of high-pressure levels or an exceedance in the tank capacity. The calibration on those devices was low and incorrect, which meant that they released at a lower set limit.⁵⁶

3.56 Mr Howarth explained that these valves were installed using the services of a contractor. Following the first incident, an investigation was initiated, however due to

51 Bob Brown Foundation, *Submission 11*, p. 6.

52 Bob Brown Foundation, *Submission 11*, p. 6; Friends of Australian Rock Art, *Submission 14*, p. 2.

53 Bob Brown Foundation, *Submission 11*, pp. 6–7.

54 Ms Lyndy Scott, *Submission 12*, p. 2.

55 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 14.

56 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 34.

the specialised nature of the devices an expert was required to be flown in from the United States of America. It was determined that the valves were faulty and all 12 units present in the facility have since been replaced.⁵⁷

3.57 In addition, Mr Howarth told the committee that though there has not been any person admitted to hospital as a result of ammonia exposure, operating procedures at the plant mandate a medical referral for any staff in the event of exposure to ammonia. Mr Howarth stated:

In the first case, we had some painting crew working nearby; they were exposed to ammonia. If someone reports being exposed to ammonia on our site, it is an automatic medical referral. I can say that we have never had, in the time I have been there, any person admitted to hospital as a result of ammonia exposure. The automatic precaution if someone reports a whiff of ammonia is a medical referral.⁵⁸

3.58 Yara Pilbara also noted that it is required to report any release of ammonia under a number regulatory provisions. These include:

- notification under section 72(1) of the *Environmental Protection Act 1986* (WA);
- licencing conditions which require a summary of any environmental incidents to be included in the Annual Environmental Report (AER), and licence conditions which require Yara Pilbara to report as soon as possible, any start up, shutdown or 'upset condition'; and
- the submission of National Pollution Inventory data to the federal Department of the Environment and Energy which is subsequently submitted to the Clean Energy Regulator.⁵⁹

3.59 Table 3.2 provides an overview of the ammonia releases which occurred in 2016, and the reporting process that Yara Pilbara undertook after each event.

57 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 34.

58 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 39.

59 Yara Pilbara, Answers to Questions on Notice 3.4, 17 February 2017, p. 14.

Table 3.2 – Overview of ammonia releases in 2016

Year	#	Date	Volume of ammonia gas	Reporting Process
2016	1	03/12	3.50 tonnes (note: liquid ammonia, not ammonia gas)	AER
	2	03/06	0.70 tonnes	s72 notification
	3	30/05	1.10 tonnes	s72 notification
	4	25/03	1.40 tonnes	s72 notification
	5	03/02	1.72 tonnes	AER

Source: Yara Pilbara, *Answers to Questions on Notice 3.4*, 17 February 2017, p. 14.

3.60 Yara Pilbara also provided the committee with an overview of the eight circumstances of 'upset conditions' at the liquid ammonia plant that were reported to the Western Australian Department of Environmental Regulation. It stated that these eight circumstances accounted for 14 plant trips in total.⁶⁰

Nitric acid leaks

3.61 Bob Brown Foundation also submitted that there had been a number of nitric acid leaks during the commissioning phase of the TANPF. It stated that:

There have been at least two nitric acid leaks reported during commissioning of the ammonium nitrate plant. One leak on 27 April 2016 released NO_x that triggered the closest alarm at 100 ppm. The second leak on 30 April 2016 released an estimated 337 kg of oxides of nitrogen into the atmosphere with a concentration of 600 ppm (1,160 mg/m³).⁶¹

60 Yara Pilbara, *Answers to Questions on Notice 3.7*, 17 February 2017, p. 16.

61 Bob Brown Foundation, *Submission 11*, p. 7.

Yarra Pilbara response

3.62 Yara Pilbara acknowledged that it had submitted two Dangerous Goods Incident Report Forms in relation to nitric acid incidents during commissioning in 2016. It also stated that a number of other incidents occurred during commissioning, and despite these incidents not exceeding reportable quantities, it nevertheless drew them to the attention of the authorities. Yara Pilbara stated that:

These commissioning incidents were the result of localised spills which were effectively remediated with no identified impacts to human health, the environment or to offsite heritage values.⁶²

Yara Pilbara technology and design mitigation measures

3.63 In response to concerns raised in relation to the likely impact of pollution from the TANPF, Yara Pilbara submitted that the design of the TANPF incorporates 'best practice pollution control technology' with:

...the aim of achieving emission concentrations of ammonia and ammonium nitrate dust from the prilling tower and drum drier common stack below the levels stated in the Fertilizers Europe and European Commission best practice guidelines. It is considered that these guidelines (which have been incorporated into the DER issued Works Approval for the TAN Plant) represent the benchmark in describing best practice for industry on a global scale.⁶³

3.64 Mr Rijkssen, General Manager, Yara Pilbara, told the committee that Yara Pilbara has:

...installed the best available technology in that plant, which consists of a double wet scrubber system on the main stack of the plant. So there is a double system filtering out particles and also ammonium emissions if they are still in the fumes by using a chemical process in the stack to clean the gases.⁶⁴

3.65 Mr Rijkssen noted that this 'is worldwide best practice that is described by the European fertiliser association' and endorsed by European regulators.⁶⁵

3.66 Yara Pilbara noted that the predicted emissions from the TANPF were assessed through both State and Commonwealth environmental impact assessment processes and that approval conditions establishing air emission mitigation and

62 Yara Pilbara, *Submission 9*, p. 18.

63 Yara Pilbara, *Submission 9*, p. 13.

64 Mr Chris Rijkssen, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 38.

65 Mr Chris Rijkssen, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 38.

monitoring requirements were set by both regulators.⁶⁶ Mr Rijkssen, Yara Pilbara told the committee that:

Our commitment to environmental protection is reflected in many ways, including equipment enhancements, increased maintenance activities and process improvements at the ammonium plant, and accelerated competence development, and we use best practice emission control technology in the design of our new TAN plant...The TAN plant is subject to approvals granted under more than 10 state and Commonwealth acts and regulations. Predicted emissions from the plant were assessed through Commonwealth and state environmental impact assessment processes. Formal approval conditions prescribing air emissions mitigation and monitoring have been established by environmental regulators at both state and Commonwealth level to ensure protection of human health, the environment and the rock art.⁶⁷

3.67 Mr Rijkssen went on to state that 'full and proper risk analysis was undertaken in the planning and establishment of the TAN plant'. Mr Rijkssen concluded that this 'reflects the fact at Yara Pilbara we operate within the regulatory framework set for us'.⁶⁸

3.68 Yara Pilbara submitted that its most recent air quality modelling considers both normal operation and non-routine operation scenarios. It stated that outputs from dispersion modelling were combined with background concentrations measured in the local area. These combined results were then compared to adopted assessment criteria as set through state and Commonwealth assessment processes. The adopted air quality criteria include those for the protection of the environment, rock art, and human health. These criteria are based on the Air Quality NEPM, the New South Wales Department of Environment and Climate Change standards, and criteria established by CSIRO through the BRATWG.⁶⁹

66 Yara Pilbara, *Submission 9*, p. 13.

67 Mr Chris Rijkssen, Yara Pilbara, *Committee Hansard*, 17 February 2017, pp. 32–33.

68 Mr Chris Rijkssen, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 32.

69 Yara Pilbara, *Submission 9*, pp. 13–14. See also, Yara Pilbara, *Answers to Questions on Notice*, 17 February 2017, pp. 6–7.

- 3.69 Yara Pilbara stated that the results from modelling indicated that:
- ...for normal operations, predicted concentrations for all modelled gasses and for acid deposition at rock art sites were below the adopted assessment criteria. This indicates that during normal operation there would be no harm to the beneficial use of the atmosphere, specifically human health and the environment, and that impact to rock art in the local area is unlikely.⁷⁰
- 3.70 Yara Pilbara particularly highlighted that EPA WA has:
- ...concluded that the predicted emission of waste gasses from the TAN Plant is unlikely to have a significant impact on cumulative annual average concentrations of these gasses and is therefore unlikely to have a significant impact on rock art.⁷¹
- 3.71 Yara Pilbara submitted that the TANPF and the liquid ammonia plant contribute 2.1 per cent of nitrogen oxide (NO_x) emissions, 14.1 per cent of sulphur dioxide (SO₂) emissions, and 21.7 per cent of particulate (PM₁₀) emissions compared to the total environmental emissions of these substances on the Burrup Peninsula. It concluded that 'this data demonstrates that the most significant risks to rock art from nitrogen and sulphur dioxide emissions is not presented by the two Yara Pilbara plants'.⁷²

Risks associated with the location of the TANPF

3.72 A number of submitters expressed concern that the TANPF is located in a cyclone surge zone and too close to the existing liquid ammonium nitrate plant, and that the risk analysis was inadequate.

3.73 It was argued that the land used for the TANPF is unsuitable for industrial development due to flood impact associated with cyclonic tidal surge and climate change sea level impacts.⁷³ Submitters commented that a cyclonic tidal surge could result in an explosion. FARA stated that:

In spite of Yara Pilbara's ridiculously close proximity to the rock art, gas hub and major port, it is also in a cyclone surge zone and only 5.5m above sea level: uncontrollable winds and rising water could damage infrastructure, soak chemicals and result in spontaneous explosion...⁷⁴

70 Yara Pilbara, *Submission 9*, p. 14.

71 Yara Pilbara, *Submission 9*, p. 13. See also Environment Protection Authority of Western Australia, *Technical Ammonium Nitrate Production Facility, Burrup Peninsula: Report and Recommendations of the Environmental Protection Authority*, Bulletin 1379, January 2011, http://www.epa.wa.gov.au/sites/default/files/EPA_Report/Final%20EPA%20Report%20050111-web_0.pdf.

72 Yara Pilbara, *Answers to Questions on Notice*, 17 February 2017, p. 4.

73 The Hon Robin Chapple MLC, *Submission 15*, p. 2.

74 Friends of Australian Rock Art, *Submission 14*, p. 4. See also Bob Brown Foundation, *Submission 11*, p. 8; Dr John Black, *Submission 13*, p. 18.

3.74 Dr Black added that 'with projected sea level rise of at least 6 metres by 2040 and a cyclone storm surge of 7 metres, the security of the ammonium nitrate plant and storage facility looks extremely risky'.⁷⁵

3.75 Submitters argued that location of the TANPF in close proximity of other plants posed a danger of fire and explosion. The Bob Brown Foundation commented that 'explosions from ammonium nitrate plants are not uncommon' and that 'the likely impact on surrounding industry, on the petroglyphs and the towns of Dampier, Karratha and Roebourne from an explosion at the Technical Ammonium Nitrate plant would be catastrophic'.⁷⁶

3.76 The Bob Brown Foundation went on to note that 'usually there is a separation zone' but that the Western Australian Government had permitted the 'siting the explosives plant adjacent to the Yara Fertiliser Plant'. The Foundation questioned what level of risk analysis had been conducted prior to this decision.⁷⁷ Similarly, Mr Brynn Matthews submitted:

To put an ammonium nitrate plant next to one processing hydrocarbons has got to be unwise if not foolhardy. The failure to do a risk analysis of this adjacent placement of industries, as referred to in the committee terms of reference, is negligent to the extreme.⁷⁸

3.77 Ms Judith Hugo, Convenor, FARA, also expressed concern that a liquid spill, such as diesel, could pose danger to the TANPF as it could 'detonate an explosion'. Ms Hugo stated that a 'liquid spillage is far more dangerous than fire to the ammonium nitrate substance'.⁷⁹

3.78 Submitters expressed further concern that any analyses of these risks may have been inadequate. For example, the Bob Brown Foundation stated that 'it is extraordinary that risk analysis of establishing an explosives plant in close proximity to both the NW Shelf joint venture and the Pluto natural gas hubs has been so cursory'. It further submitted:

What analysis was done of the likelihood of cyclone storm surge and its impacts on the proposed explosives plant, since it is sited in the surge zone. With global warming driving sea level rise and more extreme weather events, was this taken into account?⁸⁰

75 Professor John Black, *Submission 13*, p. 18.

76 Bob Brown Foundation, *Submission 11*, p. 8.

77 Bob Brown Foundation, *Submission 11*, p. 8.

78 Mr Brynn Matthews, *Submission 7*, p. 1.

79 Ms Judith Hugo, Friends of Australian Rock Art, *Committee Hansard*, 17 February 2017, p. 43.

80 Bob Brown Foundation, *Submission 11*, p. 7. See also Friends of Australian Rock Art, *Submission 14*, p. 4.

3.79 Similarly, FARA stated that 'the WA government has pursued a long-term vision of inappropriately transforming the Burrup peninsula into the largest industrial precinct in the Southern Hemisphere as a magnet for foreign investment and huge royalties, without carrying out proper risk analysis'.⁸¹

3.80 Ms Lyndy Scott submitted that documentation from Yara has a number of 'omissions and inconsistencies' including that 'it does not cover the very real risk of explosion, a negligent oversight'. Further, 'there are no adverse-impact mitigation strategies' and 'it does not cover risks of carbon monoxide poisoning to humans, animals and plants'.⁸²

3.81 Both FARA and the Bob Brown Foundation also expressed doubt that Yara Pilbara would be able to adequately respond in the event of a fire or an explosion at its facilities.⁸³

3.82 The Bob Brown Foundation further submitted that though the EPA WA has stated that 'ammonium nitrate is difficult to detonate and that the risk of detonation would be controlled by "best practice" operations to be put in place by the company', it questioned the basis upon which EPA WA had reached this conclusion.⁸⁴

Response from Yara Pilbara

3.83 In response to these concerns, Yara Pilbara stated that it 'rejects the claim that there has been a failure to include adequate risk analysis in the planning and establishment of the TANPF.' It submitted that a range of risk assessments were conducted during the planning and design stages, as noted in the TAN Production Facility Public Environmental Review for Burrup Nitrates Pty Ltd (the PER), and other approval submissions. As a result of these planning assessments, a range of action plans have been developed and implemented.⁸⁵

3.84 Further, it noted that during initial site selection for the TANPF, three industrial estates in the Pilbara region were examined and ranked according to suitability. The assessment process considered issues including Aboriginal heritage, land tenure, environmental sensitivity, the proximity to local communities, and the suitability for TAN storage. Yara Pilbara submitted that:

Importantly, the selected site for the TAN Plant was already zoned for strategic industrial use under the then Shire of Roebourne Town Planning Scheme No.8. The industrial precinct that contains the TAN Plant, the

81 Friends of Australian Rock Art, *Submission 14*, pp. 3–4.

82 Ms Lyndy Scott, *Submission 12*, p. 4.

83 Bob Brown Foundation, *Submission 11*, p. 8. See also Friends of Australian Rock Art, *Submission 14*, p. 4.

84 Bob Brown Foundation, *Submission 11*, p. 8

85 Yara Pilbara, *Submission 9*, p. 19.

Ammonia Plant and Woodside's Pluto LNG Plant had been previously assessed for strategic industrial purposes through the Burrup Peninsula Land Use Plan and Management Strategy.⁸⁶

3.85 Yara Pilbara explained that the Western Australian planning approvals regime includes a risk-based approach to the location of industrial facilities. As such, there is no standard recommended separation distance required between ammonium nitrate and other industrial or residential facilities. Yara Pilbara noted that such a risk-based approach is utilised in the European Union, and other Australian states and territories. It also noted that its insurance providers conduct annual inspections and reviews of the facilities and are aware of the distance between the two plants.⁸⁷

3.86 Yara Pilbara submitted that the PER for the TANPF 'clearly acknowledged the risks associated with sympathetic explosion and over pressure effects, ammonia gas releases and extreme weather events such as cyclones'. Further, the PER makes 'specific reference to the management measures' to be implemented to address the risks raised by concerned submitters. These include:

- a safe distance between the bulk storage area at the TANPF and the ammonia storage tanks located at the Ammonia Plant;
- the elevation of the site to a minimum of 5.5 metres above the Australian Height Datum (AHD), which is about the 1-in-100 year flood line of 4.8 metres AHD;
- buildings constructed to withstand a wind velocity of 300 km/hr in any direction at 10 metres above ground;
- stormwater drains constructed for 105 mm/hr rainfall;
- design features to accommodate the potential for future sea level rise over the 20 year plus operational phase;
- segregation valves in the ammonia pipeline to limit loss of product in the event of a leak; and
- the development of an Emergency Response Management Plan covering emergency scenarios for all phases of the TANPF project.⁸⁸

3.87 Mr Brian Howarth, Yara Pilbara, rejected descriptions of the TANPF as an 'explosive plant' and explained that technical ammonium nitrate is simply an ingredient in explosives. Mr Howarth stated that 'technical ammonium nitrate itself, in

86 Yara Pilbara, *Submission 9*, p. 19. See also Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 8. See also, *TAN Production Facility Public Environmental Review for Burrup Nitrates Pty Ltd*, p. 14, section 4.4.

87 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, pp. 8–9.

88 Yara Pilbara, *Submission 9*, pp. 19–20.

its raw form, is safe to handle. It was used as a fertiliser for many, many years'.⁸⁹ Yara Pilbara similarly submitted that:

For ammonium nitrate to be an explosive, it needs to be sensitised. Sensitisation for Yara Pilbara's TAN product only occurs at the customer's mine site, in preparation for use of the product in blasting. All ammonium nitrate at the Yara Pilbara site is equivalent to a fertiliser grade ammonium nitrate held at a hardware store.⁹⁰

3.88 Yara Pilbara also noted that the Western Australian Department of Mines and Petroleum Code of Practice for Safe Storage of Ammonium Nitrate states that pure ammonium nitrate (AN) is 'difficult to detonate, and flame, spark, rough handling, impact or friction are not known to cause a propagated detonation'.⁹¹

3.89 Mr Howarth explained that in the event of a fire, ammonium nitrate 'will not ignite' as it 'does not have that property'. Further, should a fire occur at the TANPF, neither the ammonium nitrate nor the facility would explode and that there would not be 'a sympathetic detonation of every piece of ammonium nitrate on that site'. Mr Howarth stated:

There are multilayered safety systems that are defined in our safety case and safety report, which is approved by the Department of the Mines and Petroleum, that detail the 21 safety critical elements in place. There are multiple layers of protection, automatic shutdowns, fire systems protection and all sorts of things...⁹²

3.90 Yara Pilbara indicated that the TANPF was designed and constructed in accordance with the requirements of the *Dangerous Goods Safety Act 2004* (WA). In addition, it complies with the requirements of the Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007, the Dangerous Goods Safety (Security Risk Substances) Regulations 2007, and the Dangerous Goods Safety (Major Hazards Facilities) Regulations 2007.⁹³

3.91 Further, the TANPF was determined to be a Major Hazard Facility by the then Western Australian Department of Minerals and Petroleum (DMP) and as such, must operate in accordance with an approved Safety Report which 'demonstrates that the site's safety management system includes appropriate controls, mitigation and incident response'. The Safety Report for the TANPF was approved by the DMP on 26 May 2015.⁹⁴

89 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 38.

90 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 11.

91 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 11.

92 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 38.

93 Yara Pilbara, *Submission 9*, p. 21.

94 Yara Pilbara, *Submission 9*, p. 21.

3.92 Yara Pilbara stated that it is 'committed to the storage of ammonium nitrate products in a manner that avoids sympathetic detonation risk and in accordance with Yara and industry accepted standards'. Further that:

...explosion risk was an issue that was specifically considered as part of the planning and development of the TAN Project, and which is the subject of specific management measures to further minimise the risk posed.⁹⁵

3.93 Yara Pilbara stated that risk assessments conducted during the design and planning phase of the TANPF were required to demonstrate, to the DMP's satisfaction, that the TANPF's proposed location and operation would not pose unacceptable levels of risk to neighbouring land users. This included local communities. Yara Pilbara noted that 'importantly, those risk assessments were conducted separately to the preparation of the PER and considered these other risks in great detail'.⁹⁶

3.94 As a designated Major Hazard Facility, the TANPF has 'multiple layers of safety systems, engineering controls and procedures for the safe production, storage and handling of Technical Ammonium Nitrate. Each of these systems applies one or more Safety Critical Elements (SCEs). SCEs are devices, systems or action that would likely disrupt the change of events following an initial incident, or that would mitigate the impacts of an event so that serious harm or the likelihood of serious harm is reduced'.⁹⁷

3.95 The TANPF's design and safety management systems include provisions for mitigation and emergency response. Critical to the prevention of over-pressure scenarios at the TANPF are measures to ensure fire prevention and control. This includes fire detection and suppression systems which have been considered in the design reviews conducted for the facility, including as part of the Fire Risk Assessment. Yara Pilbara submitted that in the event of an emergency which has the potential for offsite impacts, it has emergency response plans which were formulated in consultation with the Department of Fire and Emergency Services.⁹⁸

95 Yara Pilbara, *Submission 9*, p. 21.

96 Yara Pilbara, *Submission 9*, p. 21.

97 Yara Pilbara, *Answers to Questions on Notice*, 17 February 2017, p. 11.

98 Yara Pilbara, *Submission 9*, p. 22.

Chapter 4

Monitoring programs

4.1 As noted in Chapter 2, the Yara Pilbara Technical Ammonium Nitrate Production Facility (TANPF) was approved with a number of conditions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These conditions included the requirement for an air monitoring program, and a spectral mineralogy monitoring program to be implemented.

4.2 This chapter explores evidence received from submitters detailing concerns that the monitoring programs have been inadequate and that the reports produced as a result have been inaccurate. Criticisms include experimental design flaws, and the inappropriate application of scientific evidence.

Independent monitoring

4.3 Independent monitoring of colour change and spectral mineralogy of the Burrup rock art has been undertaken by CSIRO since 2004. CSIRO has prepared annual reports that compare the results of each year's monitoring program with results since the program's inception in 2004. Dr Helen Cleugh, Director, CSIRO Climate Science Centre explained to the committee that:

CSIRO was selected to undertake three projects to monitor the heritage rock art sites on the Burrup Peninsula after responding to the WA government tenders. The parameters or design of each of the three projects, including the scale and scope, were set by the WA government at the outset, in 2004. The three projects were to monitor air pollution and dust deposition rates, to measure colour change and mineral spectroscopy, and to undertake accelerated ageing tests.¹

4.4 CSIRO also conducted a series of air quality monitoring studies in 2004–2005 and 2007–2008 to assess the likelihood that air pollution from the Burrup industrial area would affect the rock art. In addition, between 2004 and 2006, CSIRO conducted a series of accelerated erosion tests using fumigation chambers to assess the impact of different pollutant scenarios, and to evaluate the role that dust may have in rock surface modification.²

4.5 The Burrup Rock Art Technical Working Group (BRATWG), which ceased on 30 June 2016, was responsible for reviewing the data collected from the annual monitoring program (and other studies) and made recommendations to the Western Australian Minister for the Environment and the Western Australian Department of

1 Dr Helen Cleugh, CSIRO, *Committee Hansard*, 17 February 2017, p. 23.

2 <https://www.der.wa.gov.au/our-work/programs/36-burrup-rock-art-monitoring-program>

Environment Regulation (DER) prior to the data being published on the BRATWG website.³

4.6 The committee received evidence from Professor John Black detailing concerns with the accuracy and adequacy of the monitoring work undertaken by CSIRO. In particular, concerns were raised that the three key CSIRO reports used by government and industry to 'justify' the establishment of the TANPF and to set its emissions limits 'are flawed in terms of scientific methods, analyses and/or interpretations'. In addition, 'there are serious concerns about the appropriateness of instruments [and] methods used to measure colour and mineralogy changes at Burrup rock art sites'.⁴

4.7 In an article exploring the 'inadequacies' of research undertaken by CSIRO, Professor Black and co-authors, stated that:

The large number of inadequacies identified in the reports indicates the authors failed to follow the scientific method, including undertaking a thorough review of the literature in relation to the nature of the rock surfaces to be measured or the suitability of the instruments used to make measurements. The authors also appear to have failed to design the experiments, particularly in relation to the variance in measurements, factors associated with experimental procedures, the external environment that would influence the measured values and the number of replicates needed to prove a specified percentage...⁵

Air quality monitoring studies

4.8 Dr Ken Mulvaney, an archaeologist and heritage expert, commented on the limitations of the air quality monitoring studies conducted by CSIRO in 2004–2005 and 2007–2008. He noted that the studies were conducted before the Woodside Pluto LNG plant went into production and at that time when the Yara Pilbara liquid ammonia plant was not in full production.⁶ Dr Mulvaney told the committee that:

When those studies were done there were intermittent activities occurring, but the two main companies at the time were the Karratha gas plant and Rio Tinto's Hammersley Iron port facilities. They were the two main places. That study stopped in 2008. But during that time what was known as the

3 Western Australian Department of Environment Regulation, *Burrup Rock Art Technical Working Group Terms of reference and membership*, April 2015, p. 1, <https://www.der.wa.gov.au/images/documents/our-work/programs/TOR-and-membership.pdf>, (accessed 14 June 2017).

4 Professor John Black, *Submission 13*, p. 4. See also Professor John Black, *Committee Hansard*, 17 February 2017, p. 14.

5 J. Black, I. Box, S. Diffey, 'Inadequacies of Research Used To Monitor Change To Rock Art and Regulate Industry on Murujuga ('Burrup Peninsula'), Australia', *Rock Art Research 2017 – Volume 34, Number 2*, p. 145.

6 Dr Ken Mulvaney, *Submission 10*, p. 1.

Burrup fertiliser plant, which Yara now controls, was constructed. However, for various reasons, it was not in full production. In fact, for one time it was out for a good while, and that was before the Pluto gas plant development had gone ahead.⁷

4.9 Dr Mulvaney concluded that 'it is unlikely that there is an accurate capture of the total pollution load from existing industrial activities'.⁸

4.10 Dr Mulvaney expressed concern that as a result of these studies, the state government and BRAMMC had promoted that 'the industrialised areas on the Burrup Peninsula have considerably lower concentrations of air pollutants than cities in Australia'. Dr Mulvaney noted that:

Considering that at the time of these studies, the Karratha Gas Plant at Withnell Bay and the shipping of iron ore through King Bay, were the only resource industries in operation. Such levels of pollutants being on par with a two-four million population city; surely would raise alarm not complacency over rock art preservation. It may have been an independent committee, however with public statements like these, it raises concern as to whom within the committee may have had sway; the State Development Department perhaps.⁹

2007 Fumigation studies

4.11 Both Dr Mulvaney and Professor John Black were critical of the CSIRO report, *Field studies of rock art appearance. Final Report: Fumigation and Dust Deposition. Progress Report: Colour Change and Spectral Mineralogy*, published in March 2007.¹⁰ Criticisms included poor experiment design such as an inadequate selection of rock samples and inadequate replication for statistical analysis.

4.12 Dr Mulvaney and Professor Black provided evidence on the implications for the outcomes of the studies of inadequate selection of rock samples. Dr Mulvaney firstly explained that the petroglyphs occur on a range of rock types on the Burrup Peninsula, and that they were produced using a variety of methods. Dr Mulvaney told the committee that:

...the art is produced wherever there is a surface expression of rock. There are a number of major geologies; basalt is one, there are volcanics as well out on the outer islands, in addition to the gabbro and granophyre. In each, the images are produced differently. One of the other features of the rock

7 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 10.

8 Dr Ken Mulvaney, *Submission 10*, p. 1.

9 Dr Ken Mulvaney, *Submission 10*, p. 2.

10 Lau et al, *Field Studies of Rock Art Appearance. Final Report: Fumigation and Dust Deposition. Progress Report: Colour Change and Spectral Mineralogy*, March 2007, CSIRO, http://web.archive.org/web/20091002111652/http://www.dsd.wa.gov.au/documents/BI_BurrupRockArtCSIROFieldStudies.pdf, (accessed 15 June 2017).

art of this place that makes it different to anywhere else is that the petroglyphs are produced in a wide range of techniques, and that partly reflects the rock. So some are hammered or pecked into the rock, some are abraded and others are just lightly scratched. Some are just, literally, bruising the rock surface. They are all reflective, in part, of the physical properties of the rock they have been produced on, but there are also clearly cultural aspects at play in the production of the art.¹¹

4.13 Dr Mulvaney noted that the fumigation experiments were 'conducted on samples from a single gabbro rock with only a thin weathering rind' rather than on 'a range of lithologies known to have rock art (granophyre, dolerite and gabbro, nor on differing surface weathering states)'.¹² Dr Mulvaney concluded that 'it is problematic to confirm from such an inadequate study exactly what the effects of emissions are having on the rock art or what increased loads may cause'.¹³

4.14 Similarly, Professor Black stated that the study 'measured the effects of immersing iron ore in either dilute or concentrated organic compounds, acids or ammonia and measuring changes in colour and mineralogy'. Professor Black submitted that the results of this study 'have no relevance to rock art because the measurements were made on iron ore and not Burrup rock surfaces'.¹⁴ Professor Black told the committee that these experiments:

...looked at acid, which was concentrated acid, and other organic compounds, concentrated or in a dilute sense, and they tested those on iron ore. It is completely irrelevant to what we are talking about, which is a test on the surface, the patina, of the rock art. It is completely useless for understanding anything about the impact on rock art because it was done on iron ore.¹⁵

4.15 CSIRO, in defending its use of iron ore samples, stated that it required suitable non-invasive methods which did not damage the rock art, and which had the approval of the Indigenous custodians of the land. As it was unable to directly test the rocks in the protected area, iron ore was selected as an appropriate proxy to examine discolouration as it 'contains a similar mineralogical profile to the rock patina' which has a major composition of hematite with minor goethite, quartz and kaolinite.¹⁶

4.16 Professor Black was also critical of another fumigation experiment in this study which involved 'hourly cyclical temperature and humidity changes during fumigation of Burrup rock samples with a combination of gases at two concentrations,

11 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 10.

12 Dr Ken Mulvaney, *Submission 10*, p. 2.

13 Dr Ken Mulvaney, *Submission 10*, p. 2.

14 Professor John Black, *Submission 13*, p. 4.

15 Professor John Black, *Committee Hansard*, 17 February 2017, p. 18.

16 CSIRO, *Answers to Questions on Notice*, 17 February 2017, p. 4.

with and without dust'. Professor Black stated that the study used 'gas concentrations below those projected for the ammonium nitrate plant and existing Burrup industry'.¹⁷

4.17 In addition, Professor Black was critical of the experiment design, stating that the 'study included either no treatment replication or insufficient replication for statistical analysis and was of no value for drawing conclusions'.¹⁸ Professor Black explained to the committee that CSIRO:

...used emissions that they suspected would be 10 times what industry—the level of emissions is below what the companies are saying that it will be, so even the concentrations were not at a high enough level. But what was particularly non-scientific about it is that they did one set of experiments with dust and another experiment without dust, and they measured before and after these 30 days of going through cycles of temperature and humidity. But, because there was no replication for the dust and there was only one replication, and the values were quite different for the two replicates, you cannot analyse it statistically, so there could be no statistical analysis of it. My big criticism was that all of the claims were made without any statistical analysis.¹⁹

4.18 CSIRO, in response to these concerns, submitted that the fumigation experiment design was based on The Air Pollution Model (TAPM)²⁰ and CALPUFF²¹ dispersion models provided by the Western Australian Government in the experiment tender document. It noted that the tender document had stated that 'the CALPUFF models are likely to be under-estimates and TAPM models are likely to over predict'. As a result, 'CSIRO tested the concentrations of the fumigant gases at 10 times the peak emission levels generated by the TAPM dispersion models.' It also noted that it 'is unaware of any information from industry that supports Professor Black's statement "...the level of emissions are below what the companies are saying that it will be"'.²²

4.19 CSIRO also submitted that the dust experiments were 'performed using the accepted scientific approach to observing spectral change by difference and were

17 Professor John Black, *Submission 13*, p. 4.

18 Professor John Black, *Submission 13*, p. 4.

19 Professor John Black, *Committee Hansard*, 17 February 2017, p. 18.

20 The Air Pollution Model (TAPM) is a user-friendly model for the prediction of air quality, with a strong scientific basis with verified performance. It is used under licence by more than 240 national and international users in 28 countries. See <https://www.csiro.au/en/Research/OandA/Areas/Assessing-our-climate/Air-pollution>.

21 CALPUFF is a dispersion model which simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal. The CALPUFF modelling system is an important tool for regional haze (visibility) and fine particulate matter (e.g. PM_{2.5}) impact assessments over distances hundreds of kilometres from emission sources and also applies for certain near-field applications involving complex meteorological conditions. See <http://www.src.com/>.

22 CSIRO, *Answers to Questions on Notice*, 17 February 2017, p. 4.

designed with sufficient statistical power for the required analysis'. Specifically, the experiments included one case of dust exposure on two types of rock surfaces. In addition, 'on each of the eighteen samples of rock, replicate measurements were made at three different points, each separate point approximately 2mm in diameter'.²³

4.20 CSIRO explained that the spectral comparison involved assessing the numerical differences between individual peaks that are normalised. It noted that 'the spectra is normalised to ensure that the differences measured are due differences in the sample rather than variable factors such as moisture.' Further, the spectral comparison is involved in overall spectral comparison to identify differences in peaks. It concluded that 'a statistical analysis of these kinds of results is not a necessary approach and spectral comparison is a widely accepted methodology'.²⁴

2008 Burrup Peninsula air pollution study

4.21 A number of submitters expressed concern in relation to one of the conclusions reached in CSIRO's *Burrup Peninsula Air Pollution Study: Report for 2004/2005 and 2007/2008*, released in 2008. This study was designed to assess the likelihood that air pollution from the industrial area on the Burrup Peninsula may damage the petroglyphs found in the area and was authored by Dr Rob Gillett.

4.22 One of the conclusions of the study relied on a 1998 global assessment of ecosystem sensitivity to acidic deposition authored by Cinderby et al. The conclusion stated:

The critical load concept can be used to compare with deposition fluxes to determine if adverse effects could result to rock or aboriginal rock art. For a fuller discussion of this see Ayers et al. (2000). The critical load has been defined as "a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified elements of the environment do not occur according to our current knowledge" (Nilsson and Grennfelt, 1988). In a global assessment of ecosystem sensitivity to acidic deposition Cinderby et al. (1998) have determined a critical load or deposition flux of 25 meq m⁻² yr⁻¹ for the most sensitive areas of the world...In fact the assessment by Cinderby et al. (1988) lists 5 sensitivity classes consisting of 25 meq m⁻² yr⁻¹, 50 meq m⁻² yr⁻¹, 100 meq m⁻² yr⁻¹, 150 meq m⁻² yr⁻¹, 200 meq m⁻² yr⁻¹ and >200 meq m⁻² yr⁻¹, and places the Burrup area in the least sensitive class. This means that the critical load for the Burrup area is at least 200 meq m⁻² yr⁻¹, and since this is significantly more than the observed deposition fluxes at the sites they are unlikely to cause any deleterious effects to rock or rock art on the Burrup Peninsula.²⁵

23 CSIRO, Answers to Questions on Notice, 17 February 2017, p. 4.

24 CSIRO, Answers to Questions on Notice, 17 February 2017, p. 4.

25 Rob Gillett, *Burrup Peninsula Air Pollution Study: Report for 2004/2005 and 2007/2008*, September 2008, CSIRO, pp. 115–116, [https://web.archive.org/web/20091002135029/http://www.dsd.wa.gov.au/documents/2008_Burrup_Peninsula_Air_Pollution_Study\(1\).pdf](https://web.archive.org/web/20091002135029/http://www.dsd.wa.gov.au/documents/2008_Burrup_Peninsula_Air_Pollution_Study(1).pdf), (accessed 16 June 2017).

4.23 This conclusion in particular was criticised by Professor Black, and Dr Johan Kuylenstierna, one of the authors of the Cinderby report. Dr Kuylenstierna submitted that Dr Gillett's assertion that the critical load for the Burrup area is at least 200 meq/m²/year is incorrect. Dr Kuylenstierna submitted that:

...the use of the Cinderby et al 1998 global sensitivity map and critical loads to say anything of relevance to the rock art in the Burrup Peninsula is just plain wrong—for many reasons and should not be used in evidence to the committee. It cannot be used by industry or governments to justify acid load emissions of 200 meq/m²/year. Rather a careful analysis of the rock art and its sensitivity to acidic inputs is needed.²⁶

4.24 Dr Kuylenstierna explained to the committee that:

The maps which we developed were based on soil type and the idea was that, if you have something which has lots of minerals that can weather quickly, then the ecosystem will be safe. That is a different end point than the weathering of rocks with rock art and therefore it is not really relevant in this case. As I understand it, some detailed work on the impact on rock art is required rather than referring to what is a global assessment to give a broadbrush idea of what is sensitive to the ecosystems such as streams and lakes can be to acid rain.²⁷

4.25 Dr Kuylenstierna went on to comment that the basis of the critical load assessment was soil type only and did not examine the characteristics of rocks. Dr Kuylenstierna noted that in most cases, soil type reflects parent material (i.e. rocks) however it can be significantly affected by weathering processes and the build-up of organic matter. Dr Kuylenstierna concluded:

But the main point is that the [critical load assessment] map does not directly reflect the rock type and therefore cannot be used to say anything about the rocks where the rock art is carved.²⁸

4.26 In addition, the sensitivity referred to in the Cinderby et al report refers to the sensitivity of ecosystems (i.e. the vegetation or surface waters such as lakes and streams) and does not refer to the sensitivity of rocks to weathering. Dr Kuylenstierna explained that:

If anything the inverse is true, as more rapid weathering of minerals in the soil leads to better buffering and less damage to ecosystems – but the process would be more rapid weathering in these areas. Either way this is an inappropriate use of the critical loads – the rocks in a highly buffered region would weather faster.²⁹

26 Dr Johan Kuylenstierna, *Submission 1*, p. 2.

27 Dr Johan Kuylenstierna, *Committee Hansard*, 17 February 2017, p. 1.

28 Dr Johan Kuylenstierna, *Submission 1*, p. 2.

29 Dr Johan Kuylenstierna, *Submission 1*, p. 2.

4.27 Dr Kuylenstierna noted that weathering processes are complex and specific to rock types. In order to determine how the surfaces of rocks on which art is carved would be affected by acidic inputs, Dr Kuylenstierna submitted that it is necessary to develop an understanding of the weathering processes of those specific rocks.³⁰

4.28 Further, Dr Kuylenstierna stated that the scale of the global soil maps used in the Cinderby et al study was 1:5 million which shows broad patterns rather than local detail. Dr Kuylenstierna again reiterated that 'these are soil maps and not geology maps, and so still misses the point—the method is not based on an assessment of the geology'.³¹

4.29 Professor Black described the experiments conducted as part of the Gillett report as sound, noting that the data was well analysed and the report well written. However, Professor Black expressed concern that the report had utilised the findings of the Cinderby study to conclude that the rock art of the Burrup Peninsula would withstand the highest critical acid load on the international scale. Of especial concern was the fact that this conclusion had been reached without measuring the buffering capacity of Burrup rocks.³²

4.30 Professor Black submitted that the total acid load emitted from the TANPF should be less than 25 meq/m²/year in order to protect the rock art of the Burrup Peninsula.³³ Professor Black stated that no measurements of critical acid load for rock patina on the Burrup Peninsula have been made because the buffering capacity of the rock surfaces has never been measured. Therefore, there is no empirical evidence for critical acid load for rock surfaces on the Burrup Peninsula. As such, an acid load of 25 meq/m²/year is based on comparisons of critical loads for other parent rock types and ecosystems.³⁴

4.31 Professor Black particularly noted that the rocks of the Burrup Peninsula are igneous and formed under great pressure, which makes them extremely hard, and are amongst the slowest eroding rocks in the world. Consequently, little soil is formed where petroglyphs occurs and erosion of parent rocks is strongly related to buffering capacity. Professor Black submitted that the slower erosion rate of rocks on the Burrup Peninsula would create critical loads which are less than those for granite rocks.³⁵

4.32 Professor Black also stated that scientific principles and empirical evidence shows that rock patina dissolution commences once pH falls into the acidic range and

30 Dr Johan Kuylenstierna, *Submission 1*, p. 2.

31 Dr Johan Kuylenstierna, *Submission 1*, p. 2.

32 Professor John Black, *Submission 13*, p. 4.

33 Professor John Black, *Submission 13*, p. 19.

34 Professor John Black, *Answers to Questions on Notice*, p. 7.

35 Professor John Black, *Answers to Questions on Notice*, p. 7.

that the acidity of rock surfaces on the Burrup Peninsula are already in the strongly acid pH range of 4–5. As such, the total acid load emitted from the TANPF should be as low as possible.³⁶

4.33 CSIRO responded to criticisms of the air pollution studies and submitted that measuring the acid load of the Burrup rocks was not in the scope of the work it was contracted to carry out. Rather, it was contracted to undertake independent air monitoring where it 'determined the total deposition of sulfur and nitrogen from the atmosphere by measuring sulfur and nitrogen compounds in samples of gases, particle and rainwater at several locations'. It then compared the data it measured as part of this work to other locations including similar sites in Malaysia and the Northern Territory.³⁷

4.34 CSIRO, in defending its choice to utilise the Cinderby et al critical load framework, and the level of 200 microequivalents, stated that it was intended to provide context for the air monitoring data collected.³⁸ Dr Melita Keywood, Principal Research Scientist, CSIRO, told the committee:

As in any scientific study, when you produce information and data it is really important that the data and the use of that data be put into a context that the end user can understand. At the time that critical load framework was the best that we had available for us to put the data and information that we collected in context, and so that is what we used for that reference.³⁹

4.35 CSIRO stated that 'the critical load framework of 200 microequivalents cannot be used as impact assessment criteria, and this was never the intention of the comparison'. CSIRO further noted that the Gillett report was 'peer reviewed by an independent international reviewer and [the Cinderby et al framework] was the best comparison to use at the time'.⁴⁰ Dr Helen Cleugh, Director, CSIRO Climate Science Centre, stated:

I would also remind the committee that the project design and the results have been published in a report that was peer reviewed and has been published in a peer-reviewed journal paper as well, which included the set-up of this design and this framework as well. As Dr Keywood said, it was the best available framework at the time and we have not been advised that there was a better approach that we could or should have used.⁴¹

36 Professor John Black, Answers to Questions on Notice, p. 7.

37 CSIRO, Answers to Questions on Notice, 17 February 2017, p. 5.

38 CSIRO, Answers to Questions on Notice, 17 February 2017, p. 5.

39 Dr Melita Keywood, CSIRO, *Committee Hansard*, 17 February 2017, p. 27.

40 CSIRO, Answers to Questions on Notice, 17 February 2017, p. 5.

41 Dr Helen Cleugh, CSIRO, *Committee Hansard*, 17 February 2017, p. 27.

Extreme weathering experiments – 2017

4.36 In 2017, CSIRO published *Extreme weathering experiments on the Burrup Peninsula/Murujuga weathered gabbros and granophyres* authored by Erick Ramanaidou, Gay Walton and Derek Winchester.⁴²

4.37 The report was initially published in May 2017 by the WA Government. However, following a critique provided by Dr Ian MacLeod, Dr John Black, Dr Simon Diffey, and Dr Stephane Hoerle, the report was removed from the website of the Department of Environmental Regulation.⁴³

4.38 Subsequently, an amended report was published. This report stated that:

This is a preliminary study using novel sample preparation methods to provide a new approach to determining the effects of solutions of different compositions and concentrations on rock weathering. As a scoping tool, it was very valuable in targeting future work. This study was conducted on 110 samples and the results found here should be confirmed using a larger dataset. It was not intended to serve as an exhaustive or definitive analysis of the impacts of the chosen leach solutions on granophyre and gabbro rocks nor was it intended as an indication for permissible pollution levels. The precautionary principle should apply here and emission capable of producing pH below 5.5 (the pH of rainwater) should be considered potentially harmful.⁴⁴

4.39 Professor Black assessed this report as 'of little value for assessing the effect of nitric acid, sulphuric acid, ammonia or ammonium nitrate load on dissolution of rock surfaces or petroglyphs on Murujuga'. Professor Black was both critical of the conclusions reached in the report and the experiment design.⁴⁵

Rock art monitoring 2004–2014

4.40 The committee received evidence critical of the regular independent monitoring of colour and spectral mineralogy of the Burrup rock art which was carried out by CSIRO from the program's inception in 2004. CSIRO prepared annual reports that compared the results of each year's monitoring program with the results collected in previous years.

42 E. Ramanaidou, G. Walton, D. Winchester, *Extreme weathering experiments on the Burrup Peninsula/Murujuga weathered gabbros and granophyres*, 2017, <https://www.der.wa.gov.au/images/documents/our-work/consultation/Burrup-Rock-Art/Extreme-Weathering-Burrup-Report-2017-.pdf>, (accessed 28 November 2017).

43 Professor John Black, Response to CSIRO reports, 27 November 2017, p. 2.

44 E. Ramanaidou, G. Walton, D. Winchester, *Extreme weathering experiments on the Burrup Peninsula/Murujuga weathered gabbros and granophyres*, 2017, p. xiii, <https://www.der.wa.gov.au/images/documents/our-work/consultation/Burrup-Rock-Art/Extreme-Weathering-Burrup-Report-2017-.pdf>, (accessed 28 November 2017).

45 Professor John Black, Response to CSIRO reports, 27 November 2017, p. 2.

4.41 Professor Black submitted that the authors of these reports 'claimed there had been no change in colour of background rock or engravings over the time of measurement without appropriate statistical analysis'.⁴⁶ Professor Black commented further that from 2004 until 2013, CSIRO 'were making claims of no colour change by not looking at the fundamental measurement that comes out of a spectrophotometer'.⁴⁷

4.42 Professor Black explained that spectrophotometers measure:

...three components which we call colour space variables. One is L, which says how light it is, with zero the blackest black and 100 the whitest white. So it says: how light is it? The second one is A, which is the red-green opposing colours. If it is positive, it is red; if it is negative, it is green. The third one is B, which is the blue-yellow opposing colours. If it is positive, it is yellow; if it is negative; it is blue. They are the fundamental measurements. As a scientist, you would say you should measure and statistically analyse the change of those fundamental colours over time.⁴⁸

4.43 However, Professor Black stated that CSIRO did not measure and statistically analyse the change in these fundamental colours. Professor Black submitted that instead, CSIRO measured and compared colour changes from one year to the next rather than from original measurements. Professor Black told the committee that:

What they did was to then take those colours and measure what was called colour change. That is another formula that you can use to say: how did that colour change from this point to that point? But what they did in those early publications was to say, 'Let me compare the change of this year with that year, and that year with the next year, and that year with the next year, but not the first year with the last year.' Because each year goes up and down a bit, they said, 'Well, there's no change,' but they did not ever do an analysis from the top to the bottom.⁴⁹

4.44 Professor Black noted that the BRATWG had provided him with a copy of the 2013 report. An initial analysis of the report led Professor Black to state that:

...they needed to do a thorough statistical analysis and to do it over the whole period. And then they sent me back the one the next year, and they had done some statistical analyses, but they still had not done the fundamental statistical analysis of colour change across time. If that is not done, you are not getting the fundamental description of the data and what it means. And that is what we did when we reanalysed the data.⁵⁰

46 Professor John Black, *Submission 13*, p. 4.

47 Professor John Black, *Committee Hansard*, 17 February 2017, p. 20.

48 Professor John Black, *Committee Hansard*, 17 February 2017, p. 20.

49 Professor John Black, *Committee Hansard*, 17 February 2017, p. 20.

50 Professor John Black, *Committee Hansard*, 17 February 2017, p. 20.

4.45 Professor Black undertook to reanalyse the data collected by CSIRO and stated that 'CSIRO conclusions have been shown to be wrong'. Further, that 'an independent reviewer of the original reports and the data reanalysis report questions seriously the integrity of the CSIRO data'.⁵¹

4.46 Professor Black told the committee that the reanalysis was provided to the BRATWG through the Western Australian Government, and that CSIRO reviewed and provided comments on the reanalysis. Professor Black stated that 'CSIRO said that the statistical model that we had used was not the best model'. In response Professor Black requested that CSIRO provide a model for use in the reanalysis. Professor Black stated:

...of course with statistics you can have different models, so we asked them to provide us with the model that they would like us to use. Unfortunately, they never ever sent us a model that we could use. We then had the meeting with BRATWG, at which CSIRO were present. At that meeting, there was a question about whether all of the changes were in a similar direction, and the committee asked us to work with CSIRO to establish a statistical model and to prepare a paper for publication for refereeing.⁵²

4.47 Professor Black noted that the reanalysis work was only conducted after he signed a confidentiality agreement with the Western Australian Government and that he has been prevented from sending this work to a peer-review journal.⁵³

4.48 Professor Black concluded that 'the scientists involved in studies initially accepted the errors identified, but refused to acknowledge them after consultation within CSIRO'. Further that CSIRO 'appears to be more concerned about its reputation than the fate of the world significant archaeological heritage of Burrup rock art'.⁵⁴

Independent review process

4.49 CSIRO's monitoring and analysis work has been reviewed a number of times: first by Professor Black and co-authors, and then by Data Analysis Australia as requested by the Western Australian Government. This section will outline some of the key findings of this review process and the implementation of recommendations.

Data Analysis Australia—2016 review

4.50 In 2016, Professor Black and Dr Simon Diffey conducted an analysis of the CSIRO monitoring program. This analysis resulted in a draft paper⁵⁵ (henceforth

51 Professor John Black, *Submission 13*, p. 4.

52 Professor John Black, *Committee Hansard*, 17 February 2017, p. 20.

53 Professor John Black, *Committee Hansard*, 17 February 2017, p. 20, p. 15.

54 Professor John Black, *Submission 13*, p. 4.

55 Black, J, Box, I, Diffey, S, 2016, *Reanalysis of the Colour and Mineralogy Changes from 2004–2014 on Burrup Peninsula Rock Art Sites* (Unpublished).

called the Draft Paper) which suggested that significant changes had taken place in the in the rock art of the Burrup Peninsula. This was in contrast to the findings of the CSIRO reports. As a result, the then Western Australian Department of Environment Regulation (DER) engaged Data Analysis Australia (DAA) to review the statistical issues raised in the Draft Paper, utilising the data itself, and CSIRO reports.⁵⁶

4.51 DAA found that the statistical methods utilised by Black et al in the Draft Paper to be 'highly appropriate (with some minor modifications) and they represent[ed] a substantial step forward in effective monitoring of the Burrup Peninsula rock art sites'. However, the DAA also concluded that the analysis could not 'overcome the lack of confidence' in the data utilised and that it would not be appropriate for the Draft Paper to be published in its form at the time of the review.⁵⁷

4.52 DAA noted that the Draft Paper utilised a significantly different approach to the analysis of monitoring data than that utilised by CSIRO and that this approach 'should be been used for some years'. DAA stated that the approach taken in the Draft Paper 'provides the opportunity to examine longer term trends, to understand whether there are issues affecting multiple sites and to potentially contrast sites close to and far from the industrial developments'. In doing so, Black et al were able to highlight a number of inadequacies in the CSIRO reports—particularly the absence of proper statistical analysis in earlier reports. DAA expressed regret that the Draft Paper was affected by the problems with the data provided to the authors.⁵⁸

4.53 DAA's review of the CSIRO reports and data also highlighted 'significant problems of cross-calibration between instruments, inconsistent error-prone data management, and clear errors in the data'.⁵⁹ It stated that although the twelve years of data collected by the CSIRO are a valuable resource that should not be discarded, 'it is not appropriate for any decisions—including whether or not changes have taken place on the Burrup Peninsula—to be based on it in its current form'.⁶⁰

4.54 DAA made a number of recommendations as a result of its analysis of the Draft Paper, and CSIRO data and reports. These recommendations were as follows:

1. The historical data collected by the CSIRO should be systematically archived and held by DER, with consistent naming conventions, both to provide a baseline record and to facilitate comparisons with future data.

56 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, p. 1.

57 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, Executive Summary.

58 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, p. 25.

59 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, p. 25.

60 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, Executive Summary.

The archival data format should enable ready access to the data via standard statistical software such as R1.

2. The CSIRO should be asked to revisit the cross calibration issues with the BYK-Gardner (BYK) portable spectrophotometer and the Konica Minolta (KM) spectrophotometer, both to ensure that the historical data is properly understood and to confirm whether or not the historical BYK data is capable of comparison with current and future measurement instruments.
3. An analysis similar to that of Black and Diffey should be conducted using verified ASD estimates of L^* , a^* , b^* ideally using the original ASD spectra rather than the averaged spectra.
4. The publication of the Black and Diffey paper should ideally wait until the problems with the BYK data are resolved or should use the ASD data.
5. Future work by the CSIRO should be based upon an agreed analysis plan certified by a competent statistician. Since each year the CSIRO Reports have covered the full data set since 2004, it would be appropriate for the next published Report to incorporate this improved analysis and in doing so, make it clear that it should replace the analyses in their previous Reports.
6. Consideration should be given to expanding the number of measured sites and in doing so, improving the balance of the design to include more effective controls, if feasible.
7. To maintain scientific rigour, future data collection should follow a fully documented and detailed protocol, and ensure that departures are documented.⁶¹

Data Analysis Australia—2017 review

4.55 In 2017, DAA was requested to review a CSIRO draft report, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016* (CSIRO Draft Report), authored by Noel Duffy, Erick Ramanaidou, David Alexander and Deborah Lau. The CSIRO Draft Report covered the data collection and analysis conducted since 2004 as part of the Burrup rock art monitoring program, with a focus on the possible effects of industrial developments. The CSIRO Draft Report represents the latest in a number of reports developed by the same CSIRO group that has presented earlier data from the monitoring program.⁶²

4.56 DAA noted that the contract for the 2016 monitoring program required CSIRO to address the recommendations of the 2016 DAA review. As such, the

61 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, Executive Summary.

62 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

CSIRO Draft Report aimed to address the shortcomings of earlier work highlighted by the 2016 DAA review.⁶³

4.57 The 2017 DAA review found that:

...a considerable amount of work has been done to address some of the concerns. In particular there have been substantial improvements to the statistical analysis of colour changes using linear mixed models and greater care has been taken to highlight the problems associated with the BYK spectrophotometer used in the early years of the monitoring program. There also appears to have been action taken to better manage the data, both to make it available for analysis and to preserve it for future years.⁶⁴

4.58 However, DAA also concluded that 'significant work remains if the 2016 Recommendations are to be addressed'. It noted that:

- Recommendations 4, 5 and 6 had not been met;
- Recommendation 2 was not addressed;
- Recommendation 3 was partially met; and
- Recommendation 1 was largely met.⁶⁵

4.59 DAA recommended that if this work cannot be completed for the CSIRO Draft Report then 'it should at the very least be highlighted as work in progress so the reader is not given to think that the Draft Report is complete or its conclusions final'.⁶⁶

4.60 DAA also made a number of observations in relation to the report:

- 'The use of the BYK data is highly problematic' and 'it is a reasonable statement that little if any scientific weight can be given to it'. Further, 'this needs to be made more prominent, and indeed the right solution is probably to assign the BYK data to a historical note'.⁶⁷
- The ASD spectrograph data and its derived colour measures have been collected with reasonable consistency with one instrument since 2004, though there are some concerns with the 2004 data. The Draft Report gives

63 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

64 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

65 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

66 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

67 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

prominence to the spectra from this instrument and to the spectral parameters, but little attention is given to the ASD colour measurements.⁶⁸

- However, the presentation of the ASD spectral parameters via 'numerous small barely readable plots' is 'not particularly helpful'. Further, no statistical analysis is conducted. As such, 'there is little purpose presenting them as done in the Draft Report and no purpose if they are not going to be statistically analysed'.⁶⁹
- The application of linear mixed models to the ASD colour data should be commended, and is a 'marked improvement' on previous reports. However, the presentation of the models is unclear. Further, the most basic test of whether the contrast between engravings and their backgrounds are changing at different rates depending on whether they are situated closer industry was not included.⁷⁰

4.61 CSIRO's Draft Report concluded that 'the data is scarcely unequivocal and there are reservations on the conclusions of the statistical analysis', however DAA considered that this statement 'could be considered misleading' as it gives the impression that the data is incapable of giving clarity 'whereas a more thorough statistical analysis may be able to resolve the question more completely'.⁷¹

4.62 DAA was also critical of the design of the monitoring program and stated that:

It is unfortunate that, for whatever the reasons, this was not based upon firmer statistical principles. More sites should have been monitored, especially more control sites and the number of replicate measurements taken at each point seems excessive (or unnecessary). Furthermore, as there are concerns that the measurement process is damaging the engravings, a fractional design is indicated where not all spots were measured each year. It is not possible to fix the historically collected data but moving forward consideration should be given to redesigning the monitoring scheme.⁷²

4.63 DAA concluded that:

...we are of the opinion that while the Draft Report demonstrates substantial efforts on the part of the CSIRO to improve the reporting of the

68 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

69 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

70 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

71 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

72 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, Executive Summary.

data collection and to present better analysis, more needs to be done. In particular, in its current form the Draft Report is unable to dispel what might be described as reasonable concerns about the impact of industry on the rock art.⁷³

CSIRO 2004–2016 report

4.64 As a result of the 2017 DAA Review, a number of changes were made to the CSIRO Draft Report. The final version, the *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016* (Final Report) was released by the Western Australian Government in September 2017.

4.65 Dr John Steele, Director, Science Impact and Policy, CSIRO explained to the committee that in effect, CSIRO had 'used the DAA commentary as a peer review for the purposes of producing a final report'. Dr Steele also noted that its Final Report supersedes all prior analysis done by CSIRO as part of the rock art monitoring program.⁷⁴

2016 DAA Review recommendations

4.66 The following section outlines the ways in which CSIRO responded to each of the 2016 DAA Review recommendations in its Final Report.

Recommendation 1 – archiving of data

4.67 CSIRO noted that it has fully implemented DAA's recommendation to systematically archive the historical data. CSIRO's Final Report stated that:

All the historical data collected for the all the spectrometers have been systematically archived and were sent to DER with consistent naming conventions, in a data format that is easily read by standard statistical software.⁷⁵

Recommendation 2 – cross-calibration issues

4.68 CSIRO submitted that the recommendation to revisit cross-calibration issues with the BYK and KM spectrophotometers was no longer relevant in light of its analysis of the data. As such, CSIRO's Final Report concluded that:

...as data from the BYK spectrophotometer appears unreliable for drawing conclusions on colour change in the rock art, the cross calibration issues with the BYK – Gardner (BYK) portable photospectrometer and the Konica

73 Data Analysis Australia, *Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring*, May 2017, p. 15.

74 Dr John Steele, CSIRO, *Committee Hansard*, 17 November 2017, p. 12.

75 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, p. 42. See also CSIRO, CSIRO Responses to 2016 DAA Recommendations, p. 1 (tabled 17 November 2017).

Minolta (KM) photospectrometer will not be undertaken. All the photospectrometer data have been provided to DER for safekeeping.⁷⁶

Recommendation 3 – analysis using verified ASD estimates of L,a*,b**

4.69 CSIRO submitted that the Final Report undertook an analysis using verified ASD estimates of L*,a*,b* as recommended by DAA. CSIRO's Final Report stated:

For this report, combining the last two years of measurements (2015 and 2016), a complete statistical analyses of all the data (each individual measurement for the three instruments, a total of 24,000 colour measurements from 2004 to 2016) has been undertaken.

Measurement of the annual colour changes used two spectrophotometer techniques, the ASD and the BYK and KM. An examination of the colour measurements as a function of time, as well as a comparison of the two measurement techniques, has been conducted.

For both the KM and the ASD instruments, three-dimensional L*a*b* colour space (L* - degree of lightness, a* - degree of red/green, b* - degree of yellow/blue), identifying a tristimulus value (L*a*b*) for each sample point have been calculated.⁷⁷

4.70 CSIRO also explained that CSIRO's Final Report included other models recommended by DAA. Further, the change in measurement practice for the ASD spectrophotometer (replacing it for each measurement from 2015 onwards) was documented and included in each of these analyses.⁷⁸

76 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, p. 78. See also CSIRO, CSIRO Responses to 2016 DAA Recommendations, p. 1 (tabled 17 November 2017).

77 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, p. xiii. See also CSIRO, CSIRO Responses to 2016 DAA Recommendations, p. 1 (tabled 17 November 2017).

78 CSIRO, CSIRO Responses to 2016 DAA Recommendations, pp. 1–2 (tabled 17 November 2017).

Recommendation 4 – agreed analysis plan for future work

4.71 CSIRO agreed that statistical analysis should be a key part of planning for future analysis work, whether this work is conducted by CSIRO or other organisations. It noted that statistical analysis was only one of a number of technical issues that should be included in a plan for future analysis and that a number of technical practicalities would need to be taken into account. CSIRO's Final Report noted that for all future work it is recommended that:

A complete statistical analyses is done on the full spectrum of each individual ASD spectrum (not just the visible part i.e. L*, a* and b*).⁷⁹

Recommendation 5 – expanding the number of sites

4.72 CSIRO agreed that consideration should be given to expanding the number of measurement sites and in doing so, improving the balance of the design to include more effective controls. CSIRO's Final Report recommended that for future work:

A study be conducted to assess how many new sites and how many new engravings and backgrounds should be added to the current locations to increase the quality of the monitoring in the Burrup Peninsula. In particular, new control sites with similar rock types should be added to the current ones (for instance Depuch Island). It should also be noted that by increasing the number of independent measurement on each spot (in doing so improving statistical analysis) could also have an adverse effect on the petroglyphs. There were signs in 2015 and 2016 that instruments measurements might be affecting the measured spots. A balance should be found between statistical endeavour and petroglyph protection.⁸⁰

Recommendation 6 – data collection should follow a protocol

4.73 CSIRO noted and agreed with the DAA recommendation that in order to maintain scientific rigour, future data collection should follow a fully documented and detailed protocol. It submitted that such protocols 'will continue to be important, including for future analysis work (whether to be conducted by CSIRO or other organisations)'.⁸¹

4.74 CSIRO's Final Report included commentary on the protocols used by CSIRO during collection.⁸²

79 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, p. xiv.

80 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, p. xiv.

81 CSIRO, CSIRO Responses to 2016 DAA Recommendations, p. 2 (tabled 17 November 2017).

82 CSIRO, CSIRO Responses to 2016 DAA Recommendations, p. 2 (tabled 17 November 2017).

2017 DAA Review recommendations

4.75 The following section outlines the ways in which CSIRO responded to each of the 2017 DAA Review recommendations in its Final Report.

Recommendation 1 – succinct description of measurement framework

4.76 CSIRO implemented the recommendation to include a succinct description of the measurement framework used. The Final Report included both detailed descriptions of the measurement framework, detailed instrument information, and a succinct description of aspects of the study relevant to the statistical analysis.⁸³

Recommendation 2 – address issue of poor quality of BYK data

4.77 In accordance with both the recommendations in the 2016 and 2017 DAA reviews, CSIRO directly addressed the issue of the poor quality of BYK data in both the Executive Study and the Conclusion. Further, BYK data was not used in the analysis of trends.⁸⁴

Recommendation 3 – less reliance should be placed on the ΔE measure

4.78 CSIRO noted that the report's conclusions are not based on the ΔE measure but rather on the statistical analysis of individual colour components ($L^*a^*b^*$).⁸⁵

Recommendation 4 – need for a proper statistical analysis of spectral parameters

4.79 CSIRO's Final Report extended its statistical analyses in order to test whether there have been any changes in colour over time, and whether these changes are at different rates at sites near to or far from industry, and whether the difference applies equally to background rock and engravings.⁸⁶

Recommendation 5 – prominence of findings regarding the BYK data

4.80 As noted above, CSIRO gave prominence to the findings that the BYK data has limited if any value in both the Executive Study and the Conclusion.⁸⁷

Recommendation 6 – comments regarding BYK data and colour change

4.81 CSIRO explained that the recommendation that comments that the BYK data does not indicate change should be deleted was in error. Rather, the Draft Report had noted that the BYK data had not indicated a different rate of change between the

83 CSIRO, Answers to Questions on Notice, 17 November 2017, p. 6.

84 CSIRO, Answers to Questions on Notice, 17 November 2017, pp. 6–7.

85 CSIRO, Answers to Questions on Notice, 17 November 2017, p. 7.

86 CSIRO, Answers to Questions on Notice, 17 November 2017, p. 7.

87 CSIRO, Answers to Questions on Notice, 17 November 2017, pp. 7–8.

northern and southern sites. However, in light of the recommendation, CSIRO added stronger caveats into the Final Report, including those which identify the aforementioned issues with the BYK data.⁸⁸

Recommendation 7 more information on statistical models

4.82 CSIRO noted that further information on statistical models was included in the Final Report in order that the models can be fully replicated by anyone with the access to the data.⁸⁹

Recommendation 8 – proper documentation of measurement practices

4.83 CSIRO noted that all changes in measurement practices were fully documented in the Final Report as recommended by DAA. Further these were also incorporated into analyses.⁹⁰

Recommendation 9 and 10 – formal design and analysis plans

4.84 CSIRO noted that Recommendation 9 and 10 were recommendations for the next period of data collection rather than the current report. These recommendations were that a formal design document and a formal analysis document be developed prior to the next period of data collection. CSIRO noted these recommendations.⁹¹

Monitoring and conclusions

4.85 CSIRO's Final Report concluded that the monitoring undertaken of the rock art indicated that there has been some small but statistically significant change to the rocks in some dimensions of colour. It found that:

For both the KM and the ASD instruments, three-dimensional $L^*a^*b^*$ colour space (L^* - degree of lightness, a^* - degree of red/green, b^* - degree of yellow/blue), identifying a tristimulus value ($L^*a^*b^*$) for each sample point have been calculated.

Data from the KM spectrophotometer shows a trend over time in the L^* measurements. The lightness (L) decreasing at a modelled average rate of 0.31 units per year (a total decrease of about 2 units on this scale is just noticeable to the human eye). However no trend is indicated in either a^* (degree of red/green) or b^* (degree of yellow/blue).

Data from the ASD spectrometer shows trends indicated in L^* (degree of lightness) and a^* (degree of red/green) but not on b^* (degree of

88 CSIRO, Answers to Questions on Notice, 17 November 2017, p. 9.

89 CSIRO, Answers to Questions on Notice, 17 November 2017, p. 10.

90 CSIRO, Answers to Questions on Notice, 17 November 2017, p. 10.

91 CSIRO, Answers to Questions on Notice, 17 November 2017, p. 10.

yellow/blue), though the evidence is not as strong as with the KM instrument.⁹²

4.86 However, importantly, it noted that the results are not fully conclusive but are nonetheless important and warrant further attention. Further, none of the instruments demonstrate a difference in the rate of change between control sites and those closer to industry. The report stated:

The results are not fully conclusive and if the measurements do reflect real colour change, as the data suggest, then continued observations would continue to mark out the trend more clearly; and if not, observations will likely continue to fluctuate over time, making the randomness of the recorded variation more apparent...Nonetheless, the indication of significant colour change is important, and warrants closer attention. None of the instruments demonstrates a difference in the rate of change between the northern control sites and the southern sites closer to industry.⁹³

4.87 CSIRO noted that the report does not explicitly address the reasons for the colour changes and the possible reasons for such small changes could include natural weathering. CSIRO stated that the report:

...does not provide a basis to confirm or to exclude an attribution to the industrial development, other than to note that the measured changes are not statistically significantly different at sites near to or far from industry.⁹⁴

Critique of report

4.88 Following the publication of *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, Professor John Black provided the committee a critique of the report.

4.89 Professor Black argued that the report includes an 'important admission to substantial errors in analysis and interpretation of all previous reports'. Of particular concern was that:

...these reports have been used by the Western Australian and Federal governments and industry to place the ammonium nitrate production facility in the midst of the rock art and to justify its high levels of emissions.⁹⁵

4.90 Professor Black noted that the results indicated a colour change of approximately 13 per cent over the past 13 years, and that this represents a major

92 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, p. xii. See also CSIRO, Answers to Questions on Notice

93 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, pp. xiii–xiv.

94 CSIRO, Answer to Questions on Notice, 17 November 2017, p. 1.

95 Professor John Black, Response to CSIRO reports, 28 November 2017, p. 1.

change which should be of concern in the preservation of rock art. Further, statistical analyses demonstrate 'significant changes in lightness of the rocks' and both the KM and ASK instruments found significant changes in colour despite the high variance in measurements from year to year.⁹⁶

4.91 However, Professor Black argued that the CSIRO report attempts 'to diminish the value of the significant findings relating to colour changes and to changes in lightness of the rocks'.⁹⁷

4.92 Professor Black noted that an improved design of experimental procedures would significantly reduce the year on year variation in measurements. Further, Professor Black maintained that the use of two sites located in the north of the Burrup Peninsula as control sites for monitoring colour change is inappropriate given the close proximity of ships entering and leaving the Dampier Port.⁹⁸

Draft Burrup Rock Art Strategy

4.93 Following the work undertaken by DAA and the release of CSIRO's Final Report, the Western Australian Government released the *Draft Burrup Rock Art Strategy* (the Draft Strategy) in early September 2017 for public comment.

4.94 The Draft Strategy outlines a long-term framework for the management and protection of the Aboriginal rock art of the Burrup Peninsula. It acknowledges the concerns raised by Professor Black, and the work undertaken by DAA. It states that 'the framework in this strategy is intended to address the limitations of the past monitoring and analysis program'.⁹⁹

4.95 The Draft Strategy proposes that 'improved monitoring of colour contrast and spectral mineralogy should be continued on an annual basis with review after five years'.¹⁰⁰ It states that the Western Australian Government will develop a revised method for the collection and analysis of data that incorporates the recommendations of the DAA reviews. The revised method will be based on a number of principles including:

- research questions will be developed in consultation with key stakeholders;
- equipment and procedures used for monitoring will be reviewed to ensure that they are best practice;

96 Professor John Black, Response to CSIRO reports, 28 November 2017, p. 1.

97 Professor John Black, Response to CSIRO reports, 28 November 2017, p. 1.

98 Professor John Black, Response to CSIRO reports, 28 November 2017, p. 1.

99 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 7.

100 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 9.

- the number of measurement sites will be calculated to ensure that statistically significant conclusions can be reached from analysis of the data collected;
- the sampling method and analysis will be reviewed at least every five years by experts who are independent of the key stakeholders;
- data analysis will be certified by a suitably qualified statistician;
- statistical analysis will support the examination of long-term trends to understand if there are issues affecting multiple sites, and to contrast sites situated near and far from pollutant emission sources; and
- additional control sites away from all major sources of emissions including industry and shipping will be incorporated into the monitoring program to the greatest extent practicable. Where possible, it should also be possible to discern between both of these emission sources.¹⁰¹

4.96 The Draft Strategy proposes that data collection and analysis should be undertaken by separate parties, with the statisticians undertaking the analysis acquiring and maintaining an adequate understanding of the data collection processes and techniques. It states that the annual monitoring program will be based on a number of principles which detail how data should be stored, published and reviewed.¹⁰²

Other studies

4.97 In addition to the program for the monitoring of the rock art, the Draft Strategy makes a number of recommendations for other studies which will assist in protecting the Aboriginal rock art of the Burrup Peninsula.

Acid deposition

4.98 The Draft Strategy notes the evidence given by Dr Kuylenstierna at the committee's hearing on 17 February 2017 that the Cinderby et al report is not relevant to understanding the sensitivity the rocks of the Burrup Peninsula to acid deposition. As such, the Draft Strategy recommends that a better understanding of: the sources of pollutants; the current and likely future pollutant load; and the impact of pollutants on the rock art is required.¹⁰³

101 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 10.

102 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, pp. 10–11.

103 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 11.

Air quality

4.99 The Draft Strategy describes current air and meteorological monitoring on the Burrup Peninsula as 'reliable and targeted' but notes that 'improvement would inform a detailed cumulative spatial analysis'. As such, the Draft Strategy recommends the introduction of a long-term and coordinated monitoring network across all industries to expand the knowledge base required to manage the air quality in the region. It recommends that the network should measure exposure of the rock art to air pollutants.¹⁰⁴

pH

4.100 The Draft Strategy states that regular measurements of the pH of the surface of gabbro and granophyre rocks on the Burrup Peninsula would assist in the early detection of conditions that would impact the rock art. It recommends the installation of monitoring stations including rainwater gauges to measure rainfall, pH, cations and anions as well as deposition flux of nitrogen and sulfur.¹⁰⁵

Microbiology

4.101 The Draft Strategy recognises the potential impact that microbial action may have on the weathering of rock art. Noting the expansion of industry on the Burrup Peninsula in the years since the last study was conducted, the Draft Strategy recommends that a study to assess microbiological numbers and composition would be valuable, particularly as the TANPF becomes operational. The Draft Strategy also recommends that this study should be repeated from time to time to ensure that knowledge of microorganisms present on the rocks of the Burrup Peninsula is up-to-date.¹⁰⁶

Source of pollutants

4.102 The Draft Strategy recommends that monitoring to measure levels of pollutants at particular sites should be conducted to enable a determination of the source of the pollution, and link any changes in the condition of the rock art to critical loads for pollutants and their source (industry, shipping, or other). The Draft Strategy also recommends that other causes of change to rock art such as guano should also be investigated.¹⁰⁷

104 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 12.

105 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 12.

106 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 13.

107 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, p. 13.

Burrup Rock Art Stakeholder Reference Group

4.103 The Draft Strategy includes the terms of reference for a newly established consultative committee called the Burrup Rock Art Stakeholders Reference Group (BRASTRG).¹⁰⁸ This group will assist in overseeing the design and implementation of the strategy, and includes representatives from the Murujuga Aboriginal Corporation, state agencies, local government, industry and the community.¹⁰⁹

4.104 The terms of reference note that the role of the BRASTRG is to consult, inform and educate other stakeholders on matters referred for input or comment by the Western Australian Department of Water and Environmental Regulation. The BRASTRG will also contribute constructively to the monitoring and management of the rock art.¹¹⁰

108 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, Appendix B, p. 19.

109 <https://www.mediastatements.wa.gov.au/Pages/McGowan/2017/09/New-strategy-to-better-protect-Burrup-rock-art.aspx>

110 Department of Water and Environmental Regulation (WA), *Draft Burrup Rock Art Strategy*, Appendix B, p. 19.

Chapter 5

Compliance and monitoring

5.1 This chapter canvasses issues raised in relation to the compliance, monitoring and management of Yara Pilbara's facilities on the Burrup Peninsula. This includes the rigour and adequacy of work carried out by both the Western Australian and Commonwealth governments under legislative frameworks.

Approval conditions and compliance monitoring

5.2 The Department of the Environment and Energy is responsible for compliance monitoring under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Its compliance approach is described in the *Compliance and Enforcement Policy: Environment Protection and Biodiversity Conservation Act 1999* and its compliance activities for EPBC Act approvals are reported in the annual *Compliance Monitoring Report*.¹

5.3 Although the facilities are in an area listed as a National Heritage Place, submitters questioned Yara Pilbara's commitment to ensuring that its operations would not have an impact on the environment, and its willingness to engage with the legislative requirements established under the EPBC Act. First, submitters noted that Yara Pilbara had failed to self-refer the proposal for the technical ammonium nitrate production facility (TANPF) for assessment, and secondly, it has failed to comply with a number of its approval conditions.

5.4 As noted in Chapter 2, the approvals for Yara Pilbara's facilities on the Burrup Peninsula were granted with a number of conditions attached: 27 set by the Western Australian Government under relevant state legislation and 15 by the Commonwealth. However, Yara Pilbara had not initially sought assessment under the EPBC Act. The Department of the Environment and Energy submitted that in 2008 it became aware that the proposed TANPF had not been referred for assessment under the EPBC Act. The Department contacted Yara Pilbara, and as a result the company voluntarily referred the proposed action for assessment and approval.²

1 Department of the Environment and Energy, *Submission 8*, p. 4.

2 Department of the Environment and Energy, *Submission 8*, p. 4. See also Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 54.

5.5 In relation to the Commonwealth conditions, the Department noted that there have been issues of administrative non-compliance in relation to the TANPF.³ These include:

- Notification of commencement of construction was received two months late, in contravention of Condition 1. The Department determined that as there were no impacts to matters of national environmental significance arising from the late notification, the matter would only be recorded.⁴
- The 2015 annual compliance report and rock art monitoring report were produced one month late in contravention of Condition 3 and Condition 10. Despite there being no impacts to matters of national environmental significance as a result of the late production of these reports, the Department issued a formal caution to the company as this was the second breach of EPBC Act approval conditions.⁵
- An infringement notice was issued on 10 May 2017 for failing to provide the 2015/2016 annual compliance report by May 2016.⁶
- In February 2017, the Department became aware that Yara Pilbara had not fully met the approval conditions in relation to air quality monitoring. An infringement notice was issued on 24 August 2017 and a directed variation was issued on 13 September 2017.⁷

5.6 Yara Pilbara self-reported the late production of the 2016 annual compliance report as required under Condition 3, and difficulties in producing the 2016 rock art monitoring report as required under Condition 10. The latter report could not be produced in time due to the Western Australian Government undertaking a review of the state program part funded under the project.⁸

5.7 The Department undertook a routine site inspection of the TANPF in September 2016 and identified that the Operations Management Plan was in need of revision.⁹

3 Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 54.

4 Department of the Environment and Energy, *Submission 8*, p. 4. See also Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 54.

5 Department of the Environment and Energy, *Submission 8*, p. 5. Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 54.

6 Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 4.

7 Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 4.

8 Department of the Environment and Energy, *Submission 8*, p. 5. Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 54.

9 Department of the Environment and Energy, *Submission 8*, p. 5. Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 54.

5.8 The Department submitted that it is considering how to improve the capacity of Yara Pilbara to comply with the approval requirements in relation to Condition 10 noting the previously identified issues in relation to the Western Australian Government review. The Department also noted that it continues to engage with the company on a regular basis as part of its compliance monitoring program.¹⁰

Survey of rock art sites—variation of conditions, and compliance

5.9 Submitters also raised concern that the conditions of approval for the TANPF have been varied since they were initially granted, and that the variations reduce the effectiveness of monitoring programs. For example, the Bob Brown Foundation stated:

When YARA is found to not comply with various Commonwealth conditions, the Commonwealth varies the conditions to facilitate compliance. The Federal Minister needs to explain why the conditions are varied to suit the company and not upheld, given approval for construction and operation were contingent upon those conditions being met.¹¹

Heritage monitor and two kilometre survey

5.10 Dr Ken Mulvaney, heritage expert, submitted that Condition 8d of Yara Pilbara's original approval (dated 14 September 2011) required the engagement of a heritage specialist to survey rock art sites within a two kilometre radius of the project area. Dr Mulvaney noted that the intention of this condition was to identify the rock art in the area, and to provide advice on the state of the art and any observable changes on an annual basis.¹² The Bob Brown Foundation described this condition as critical 'as it provides the baseline for measuring the ongoing impacts of the emissions from the plant on the whole area'.¹³

5.11 Dr Mulvaney stated that he became aware that no such 'suitably qualified Heritage Monitor' or survey had occurred within the required period and had conveyed his concerns to the Department of the Environment and Energy in 2012. Dr Mulvaney expressed shock that this condition was subsequently twice amended, once in 2013 and once in 2014. Dr Mulvaney stated 'the department's role is to administer the requirements of the act not to facilitate resource company non-compliance'.¹⁴

10 Department of the Environment and Energy, *Submission 8*, p. 5. Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 54.

11 Bob Brown Foundation, *Submission 11*, p. 6.

12 Dr Ken Mulvaney, *Submission 10*, p. 3. See also Professor John Black, *Submission 13*, p. 20.

13 Bob Brown Foundation, *Submission 11*, p. 6.

14 Dr Ken Mulvaney, *Submission 10*, p. 3. See also Bob Brown Foundation, *Submission 11*, p. 6. See also Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, pp. 8–9.

5.12 Similarly, Professor John Black, submitted that the condition was amended 'on request by the company, to reduce the level of surveillance'. Professor Black concluded that:

The changes made to conditions in licences given by both the Western Australian and Federal governments to Yara Pilbara in relation to construction and operation of the TANPF suggest to the public that short term financial returns from industry are more important than saving for future generations the priceless, irreplaceable and world significant rock art on Burrup Peninsula.¹⁵

5.13 Dr Mulvaney noted that Condition 10c(i) still requires Yara Pilbara to engage a Heritage Monitor to carry out a survey within a two kilometre radius, and that this requirement is separate to that of the work carried out by the Western Australian Department of Environment Regulation.¹⁶ Similarly Friends of Australian Rock Art (FARA) submitted that:

Yara Pilbara was required to conduct a survey of the rock art within a 2km radius of the plant before production could begin. We understand that it sought amendment of the Commonwealth conditions to only require a sample survey.¹⁷

5.14 Dr Mulvaney submitted that comprehensive monitoring is 'essential to gauge the impact on the rock art, and should be of sufficiently high scientific standard to be able to measure subtle changes to the rock art'. Dr Mulvaney explained that based on the location and size of Yara Pilbara's site, it is estimated that between 8–15 thousand rock art images exist within the required survey site, which includes a number of significant sites such as Deep Gorge. Dr Mulvaney stated that 'unless you have specific skills in identifying the Burrup rock art, the majority of the petroglyphs will not be recognised'.¹⁸

5.15 Dr Mulvaney stated that to date Yara have not complied with the requirement to carry out a comprehensive survey and that 'the sampling of just six petroglyphs across the entire area is not an appropriate response to Yara's obligations'.¹⁹ Dr Mulvaney told the committee that the original conditions required that a 'comprehensive survey' be conducted where 'they have to comment on the condition of the rock are within that two-kilometre radius'. Dr Mulvaney commented that:

Basically, selecting rock art panels at six sites, as it is published—three that had been incorporated in an earlier study; adding three more that happened to be within that radius—is not a comprehensive comment on the condition of the rock art and, regardless of the validity or otherwise of the

15 Professor John Black, *Submission 13*, p. 20.

16 Dr Ken Mulvaney, *Submission 10*, p. 3.

17 Friends of Australian Rock Art, *Submission 14*, p. 3.

18 Dr Ken Mulvaney, *Submission 10*, p. 4.

19 Dr Ken Mulvaney, *Submission 10*, p. 4.

methodologies in the colour recording, it is not a comment on the conditions of the art. It tells us nothing but what the measurement by a machine of a colour is.²⁰

5.16 Similarly, the Bob Brown Foundation submitted:

There is no evidence that the survey by a suitably qualified person has been done. It is not adequate to consider a representative sample as the survey needs to be of the whole area. YARA is non-compliant with the fundamental condition on which approval was contingent.²¹

5.17 The Bob Brown Foundation also challenged Yara Pilbara's claim that it has been unable to provide information on the rock art survey in its latest compliance report as it has not received the information from the Western Australian Government. The Bob Brown Foundation submitted that:

The Burrup Rock Art Technical Working Group (BRATWG) report to which they refer, relates to colour monitoring of the rock art which is condition 10a. It does not relate to the survey of rock art within a 2 km radius.²²

5.18 Dr Mulvaney concluded that:

It is essential that the DoEE enforce compliance with condition 10(ci), that Yara immediately engage a professionally qualified and capable person/s to commence the identification and recording of the physical condition of the rock art in the lands surrounding the TAN plant.²³

5.19 However, Yara Pilbara told the committee that the 'conditions in the EPBC approval do not require, and do not mention, comprehensive survey'.²⁴ The Department of the Environment and Energy similarly submitted that Condition 10c only 'requires rock art monitoring at six locations within 2km of the project site'. Further, the Department noted that this work has been carried by the CSIRO since 2014, and that the results from the first monitoring event are published on the Yara Pilbara website.²⁵

5.20 Similarly, the Chamber of Minerals and Energy of Western Australia submitted that 'selected sites were determined in consultation with members of

20 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 9.

21 Bob Brown Foundation, *Submission 11*, p. 6.

22 Bob Brown Foundation, *Submission 11*, p. 6.

23 Dr Ken Mulvaney, *Submission 10*, p. 4.

24 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 33. See also Yara Pilbara, *Answers to Questions on Notice*, p. 10.

25 Department of the Environment and Energy, *Answers to Questions on Notice*, 17 February 2017, p. 13.

Murujuga Aboriginal Corporation to respect the cultural laws of the traditional owners for the entitlement of access'. Further, that:

The selected sites were evaluated for their appropriateness for scientific study, including petroglyph size and quality, direction of exposure, elevation, dominant winds direction within the TAN project location. From the six selected monitoring sites; three were already part of the decade-old and ongoing BRATWG monitoring program and an additional three sites were also selected.²⁶

5.21 The Chamber of Minerals and Energy of Western Australia noted that in July 2014, the three additional sites were incorporated into the existing BRATWG monitoring program. It explained that for each monitored site, eight sampling areas were selected—four of which are classified as 'engraving', and four of which are classified as background (rock surface unmarked by a petroglyph). During monitoring, three types of measurement are taken: colour contrast monitoring; spectral mineralogy; and 3D visual imaging to assess the surface of the petroglyphs. It noted that 'based on two years of monitoring, no significant change has been detected'.²⁷

Air quality monitoring—compliance with conditions

5.22 The committee received evidence which questioned the level of compliance in relation to air quality monitoring, as required under approval granted by the Western Australian Government.

5.23 It was noted that Yara Pilbara's compliance reports to both the Western Australian Government and the Australian Government 'show significant areas of non-compliance' with requirements to measure emissions. In particular, the requirement to 'measure PM₁₀ particles, NH₃, NO_x and SO_x concentrations at five sites, including three rock art sites'.²⁸

5.24 Professor Black expressed concern that Yara Pilbara's 2016 compliance report only included the results from one of the five air quality monitoring stations, and that results were only for the period of 1 January 2015 until 17 February 2015. Further, the rest of the table stated 'No Data' for the rest of the table to 30 June 2015.²⁹

5.25 Professor Black also stated that the report contained measurements of PM₁₀ particles which were 'minus 90,000 micrograms per cubic metre'.³⁰ Professor Black submitted that:

Although the company is obliged to provide concentrations of listed chemicals in the air at the sites, no results relating to chemical emissions

26 Chamber of Minerals and Energy of Western Australia, *Submission 2*, p. 5

27 Chamber of Minerals and Energy of Western Australia, *Submission 2*, p. 6.

28 Professor John Black, *Submission 13*, p. 5.

29 Professor John Black, *Submission 13*, p. 5.

have yet been provided. Thus, the background emissions prior to the plant being commissioned have not been reported. The results provided in the company report for PM10 particles are unrealistic, with a maximum value of 112,020.5 µg/m³ and a minimum value of -90,649.28 µg/m³, when the limit established by the Australian Environment Ministers on 15 December 2015 was 25 µg/ m³. Negative values for PM10 particle emissions are impossible. Reliability of the data presented in these reports is clearly extremely poor.³¹

5.26 Professor Black expressed further concern that the report submitted to the Western Australian Government did not appear to have been 'thoroughly reviewed'. Professor Black stated that 'no action appears to have been taken by the Western Australian government in relation to the extensive areas [of] non-compliance'.³²

5.27 However, Yara Pilbara responded to these concerns by explaining that air quality monitoring stations are located in 'in the middle of a very harsh environment'. As such, the equipment can break down or be taken down for maintenance. Mr Brian Howarth, Yara Pilbara, told the committee that the company is in the process of having any 'erroneous' negative data assessed by an independent expert. Mr Howarth stated:

Where that negative data, which is raw data, was produced with negative values, we are actually in the process of having all air quality raw data in our entire program assessed by an independent air quality management expert at the moment. Their job is to interpret the data and come up with the analysis.³³

5.28 Yara Pilbara explained that it engaged an Air Quality Monitoring consultant in mid-November 2016 to undertake a review of all air quality monitoring data and baseline data sets. It went on to comment that when instrumentation is not available at the time when a measurement is required to be made, the equipment is considered to be 'down'. Yara Pilbara told the committee that despite incidents of equipment being 'down', it has met its requirements under Condition 9 of its approval—that is, a minimum of 24 months of monitoring and at least one reading four times per year for NH₃, NO₂, SO₂, Total Suspended Particulate (TSP) (at one off site monitoring station), and dust (dust deposition).³⁴

5.29 However, Yara Pilbara also explained that negative values caused by 'instrument drift are not considered erroneous and are retained in the data set for calculation of 24-hour average concentrations'. It stated that such a practice is an Australian/New Zealand standard (AS/NZS 3850.9.8-2008) 'recommendation for

30 Professor John Black, *Committee Hansard*, 17 February 2017, p. 22.

31 Professor John Black, *Submission 13*, p. 23.

32 Professor John Black, *Submission 13*, p. 23.

33 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 40.

34 Yara Pilbara, *Answers to Questions on Notice*, p. 18.

treating continuous PM₁₀ data from TEOM instruments, which is typically adopted for other continuous monitoring methods for ambient dust'. Yara Pilbara noted that for 24 hour TSP sampling, 'negative values reflect gravimetric errors and those data are rejected'. However, for 'passive sampling of gases, negative data obtained by the laboratory is reported as less than the method detection limit'.³⁵

Other issues in relation to the EPBC Act

5.30 The committee received evidence in relation to a number of other matters relating to the EPBC Act including the precautionary principle and lack of consideration given to the cumulative effects of development during assessment processes.

Precautionary principle

5.31 As noted in Chapter 2, the EPBC Act includes the principles of ecologically sustainable development, including the precautionary principle.

5.32 Submitters argued that application of the precautionary principle should have prevented the approval of the TANPF by the Minister and further, the evidence relied upon to make such a decision is both inadequate and unreliable.³⁶

5.33 Ms Christine Milne, Bob Brown Foundation, argued that the precautionary principles create an obligation for Commonwealth to protect the petroglyphs of the Burrup Peninsula. However, the Commonwealth and the Western Australian Government have approved the construction and operation of the TANPF without the scientific evidence to support the conditions of approval.³⁷

35 Yara Pilbara, Answers to Questions on Notice, p. 18. See also, Yara Pilbara, Answers to Questions on Notice, Table 7, Appendix A, p. 24.

36 Ms Christine Milne, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 43.

37 Ms Christine Milne, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 43.

5.34 In an article published in *Rock Art Research*, Professor Black and co-authors, argued that the errors in research 'are so great that most of the results in the reports are useless'. As such:

The Western Australian Government remains in a state of knowledge deficit as if no study on colour change and mineralogy has been conducted, despite the large amount of time and money spent. No sound decisions about the effects of industry on the rock art on Murujuga can be made using the reports. This conclusion has political implications for governments because decisions allowing further industrialisation of Murujuga have been made on the assumption that the reports correctly state there has been no change to rock art sites over time and current and proposed concentrations of emissions are unlikely to damage the rock art.³⁸

5.35 Professor Black and co-authors argue that the precautionary principle necessitates a review of all decisions made by regulators in relation to industry on the Burrup Peninsula.³⁹

Consideration of existing facilities during the approval process

5.36 Submitters raised concern that the Minister or their delegate, in approving the construction and operation of the TANPF may have failed to take into account relevant considerations which they were obliged to take into account.

5.37 The Commonwealth Minister, in approving an action which is likely to have a significant impact on National Heritage values of a National Heritage place, must take into account the mandatory relevant considerations set out in section 136 of the EPBC Act. These considerations include 'any other information that the Minister has on the relevant impacts of the action'.

Standalone development

5.38 Some submitters argued that the TANPF should not have been treated as a single standalone development.

5.39 The Law Council of Australia (LCA) noted that under section 74A of the EPBC Act, the Minister has the discretion to decide not to accept a referral if the Minister is satisfied that the action is a component of a larger action. The LCA noted that this section is designed to deter proponents from making split referrals to circumvent the requirements of the EPBC Act.⁴⁰

38 J. Black, I. Box, S. Diffey, 'Inadequacies of Research Used To Monitor Change To Rock Art and Regulate Industry on Murujuga ('Burrup Peninsula'), Australia', *Rock Art Research 2017 - Volume 34, Number 2*, p. 145.

39 J. Black, I. Box, S. Diffey, 'Inadequacies of Research Used To Monitor Change To Rock Art and Regulate Industry on Murujuga ('Burrup Peninsula'), Australia', *Rock Art Research 2017 - Volume 34, Number 2*, p. 145.

40 Law Council of Australia, *Submission 3*, p. 4.

5.40 The Bob Brown Foundation argued that as the TANPF is associated with the existing liquid ammonia plant, the combined impacts of both should have been assessed by the Commonwealth.⁴¹

5.41 The Bob Brown Foundation argued that the Commonwealth, by treating the TANPF as a standalone development, 'failed to take account of relevant considerations which it is obliged to take into account'.⁴²

5.42 However, the LCA stated that:

...the fact that the previous facility had been referred under the EPBC Act and constructed many years earlier indicates that these were two separate actions, rather than components of one larger, single 'action'.⁴³

5.43 Mr Tregurtha, Acting First Assistant Secretary, Environment Standards Division, Department of the Environment and Energy outlined to the committee the issues that the Minister or their delegate must take into account when deciding whether to 'split an action' or 'to join one together'.

5.44 Mr Tregurtha explained that if there is a clear dependence of one action on another or if 'one action actually can't happen or would be...nonsensical without another' then the Minister or delegate would likely consider this to be one action. However, if the link between the two projects could be replaced by other sources (e.g. feeder stock for the TANPF will come from the liquid ammonia plant, however it could alternatively come from other sources) then it is likely that the Minister or delegate would assess these as two separate actions.⁴⁴

Cumulative impacts

5.45 Submitters also raised concern that the approval process for the TANPF did not consider the cumulative impacts of emissions from both the liquid ammonia plant and the TANPF.

5.46 The LCA provided evidence on this issue and commented that 'it is not clear whether the existing ammonia facility was considered when the technical ammonium nitrate plant was referred under the EPBC Act in 2008'. It noted however that the referral documentation included reference to the ammonia plant and stated that 'it appears that the Commonwealth was or should have been aware that the TANPF proposal was related to the liquid ammonia facility'.⁴⁵

41 Bob Brown Foundation, *Submission 11*, p. 2.

42 Bob Brown Foundation, *Submission 11*, p. 2.

43 Law Council of Australia, *Submission 3*, p. 4.

44 Mr James Tregurtha, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 10.

45 Law Council of Australia, *Submission 3*, p. 4.

5.47 The LCA commented that because the reasons for the TANPF approval decision have not been published, the extent to which the Commonwealth considered the cumulative impacts of the TANPF combined with the existing ammonia facility is 'unclear'. The LCA did however note that the approval conditions for the TANPF refer to air quality monitoring which must be undertaken for 24 months prior to construction to establish baseline data. This would include emissions from the existing plant, and other industry on the Burrup Peninsula.⁴⁶

5.48 The LCA also noted that the legal requirement to consider cumulative impacts under the EPBC Act is limited.⁴⁷ The LCA also commented that:

Given the Commonwealth's knowledge of the liquid ammonia facility, which was the subject of the Minister's decision in 2001, it comprised 'information on the relevant impacts of the action', and its cumulative impact with the TAN plant was, by necessary inference, part of what was obliged to be considered as part of the impact of the action. A failure to take that into account was a failure to take into account a relevant consideration.⁴⁸

5.49 However, the committee received evidence that the cumulative impacts of industry in an area can be considered during the approval process for projects. Mr James Tregurtha, Department of the Environment and Energy explained to the committee that 'in making any decision under the EPBC Act in relation to an action, the decision-maker is able to have regard to any of the matters that are currently happening at that time'. Further, 'in terms of the cumulative impact in a place, the impact of current development is taken into account when the EPBC approval is undertaken'.⁴⁹ Mr Tregurtha stated:

You can't consider a project just sort of in its little box in isolation. You're thinking about what's happening and the risk that the additionality of that project has on the protected matter. The protected matter may already be suffering a degree of impact, whether that's minute or not. Then you're adding something onto that, so that means that that impact may rise.⁵⁰

5.50 The committee received evidence that the cumulative impacts of industry on the Burrup Peninsula were considered during the approval process for the TANPF. For example, Yara Pilbara told the committee that 'contrary to what has been

46 Law Council of Australia, *Submission 3*, p. 4.

47 Law Council of Australia, *Submission 3*, p. 4.

48 Law Council of Australia, Answer to Question on Notice No. 1.

49 Mr James Tregurtha, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 10.

50 Mr James Tregurtha, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 11.

suggested...the total cumulative emissions was modelled and taken into account in the works approval process'.⁵¹

5.51 Similarly, the Department of the Environment and Energy told the committee that:

Cumulative impacts were assessed in the Public Environment Report and the Assessment Report (the Report and Recommendations of the Environmental Protection Authority dated January 2011) for the assessment and approval process under the EPBC Act, and were taken into consideration in the approval of the action. The Public Environment Report is published on the website of the Western Australian Office of the Environmental Protection Authority.⁵²

5.52 Mr Tregurtha also assured the committee that if any future development on the Burrup Peninsula was determined to be a controlled action then 'as part of the assessment and approvals process the activity that was [already] occurring on the peninsula would be taken into account'.⁵³

Amendment or revocation of conditions

5.53 The LCA noted that the Minister has the power to revoke or amend the TANPF approval. It also noted that if the approvals conditions were amended to require that no emissions be permitted from the TANPF (which would result in it unable to operate at its current location) or to require the TANPF to relocate, then there would not be any obligation on the Commonwealth to provide compensation to any party.⁵⁴

5.54 The LCA explained that compensation would only be required in the event of the Commonwealth compulsorily acquiring property, and that precedent would indicate that the alteration or extinguishment of a right does not constitute an acquisition of property in circumstances such as an approval under the EPBC Act.⁵⁵

5.55 As such, the Minister has the power under the EPBC Act to revoke the approval of the TANPF, to require its relocation, or to require it to operate without emission, and this would not result in any obligation for the Commonwealth to compensate Yara Pilbara.⁵⁶

51 Mr Chris Rijksen, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 33.

52 Department of the Environment and Energy, Answers to Questions on Notice, pp. 4–5. See also Mr James Tregurtha, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 10.

53 Mr James Tregurtha, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 11.

54 Law Council of Australia, Answer to Question on Notice No. 1, p. 3.

55 Law Council of Australia, Answer to Question on Notice No. 1, pp. 3–4.

56 Law Council of Australia, Answer to Question on Notice No. 1, p. 4.

Confidence in assessment and approval

5.56 The committee explored the issue of whether the Department of the Environment and Energy has confidence in the approval for the TANPF given the issues which have subsequently emerged with the rock art monitoring program.

5.57 Ms Monica Collins, Chief Compliance Officer, Department of the Environment and Energy told the committee that at the time the approval decision took 'into consideration extensive assessment information'. The decision 'was made on the best available information at the time'.⁵⁷

5.58 Mr Tregurtha, Department of the Environment and Energy, explained that a range of information is relied upon when making approval decisions. Mr Tregurtha stated:

...what happens generally is that the department will make a recommendation to the minister or to his or her delegate in relation to making an approval decision based on the information and the assessment that's done. That can include state assessments and information. It can also include information from a range of other sources and generally also includes a range of public commentary around an issue.⁵⁸

5.59 In the event that new information emerges, which wasn't available at the time that the decision was made, the Minister 'has the power to consider the new information and can make a decision to vary conditions to respond to that'. Mr Tregurtha told the committee that the Minister:

...has the power to suspend or revoke an approval in particularly egregious cases. So those remedies are available under the EPBC Act. They're used very rarely and always used with a high degree of caution because, of course, that introduces a degree of jeopardy to approvals the Commonwealth has already made. So decisions like that are generally not taken lightly. But that's the power.⁵⁹

57 Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 5.

58 Mr James Tregurtha, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 7.

59 Mr James Tregurtha, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 7.

5.60 Ms Collins told the committee that despite there being questions raised in relation to the adequacy of the monitoring conducted by CSIRO, there has not been sufficient evidence to trigger a ministerial review of the approval. Rather, the directed variation to the TANPF approval provides a mechanism for a ministerial direction in the event that evidence of damage to the rock art as a result of emissions is found. Ms Collins stated:

Yes, I understand you're saying that it's been pointed out that the monitoring, to date, is flawed, but without any evidence we don't have the trigger for the minister to be in that position. One of the things that the directed variation does is insert a new condition which says that, if such information [that the rock art has been damaged] was made available, there's a process that can be stepped through in relation to management's response or the minister's ability to direct a reduction in emissions at the point in time that the information was made available.⁶⁰

60 Ms Monica Collins, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 7.

Chapter 6

Preservation and management of rock art

6.1 This chapter explores the evidence that beyond current industrial activity conducted on the Burrup Peninsula the preservation of Aboriginal rock art faces threats from vandalism, both intentional and unintentional, and unrestricted public access to the area. It also acknowledges the significant damage inflicted by early industrial activity undertaken in the area.

6.2 This chapter also examines the legislative protections that could be afforded to Aboriginal rock art, particularly through the World Heritage listing process. It also canvasses the evidence received from the region's Indigenous custodians, and the local government in relation to public education programs and enforcement activity designed to ensure the protection of the petroglyphs.

Impact of early industry and preservation attempts

6.3 Evidence was received that the rock art collection sustained significant damage from early industrial projects on the Dampier Archipelago.

6.4 Development of the area was initiated by the need for a deep-water port to serve the Pilbara's developing resource sector. Originally, Depuch Island was proposed, however due to the island's exceptional Aboriginal heritage, it was determined that the location was inappropriate. In 1963, the Dampier Archipelago was selected as a location for the deep-water port to service Hamersley Iron's Tom Price mine. At the time, little was known about the heritage values of the Dampier Archipelago.¹

6.5 In 1966 Hamersley Iron began iron ore processing and shipping from the Dampier Archipelago and in 1971 its operations expanded to include East Intercourse Island. Throughout the 1970s, railways were constructed to deliver iron ore to the port facilities, and salt evaporation facilities were established on the south of the Burrup Peninsula.²

6.6 Despite growing knowledge of the heritage values of the Dampier Archipelago, industrial expansion continued over the following decades.³ The Australian Heritage Council noted that at the same time that Withnell Bay and King

1 Australian Heritage Council, 'The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to the Site', p. 46.

2 Australian Heritage Council, 'The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to the Site', p. 46.

3 Australian Heritage Council, 'The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to the Site', p. 46.

Bay were recommended as locations for the North West Shelf LNG development, the Clough report on port and land planning on the Burrup Peninsula concluded that there was no serious conflict between industrial needs and conservation requirements. The Clough report was adopted by the Western Australian government as a guide for future development on the Burrup Peninsula. This was despite a report by Bruce Wright in 1980 which identified the Dampier Archipelago as a major archaeological resource with high scientific value, and which recommended consultation with Aboriginal people.⁴

6.7 It is estimated that thousands of petroglyphs were destroyed during the construction of facilities on the Burrup Peninsula, and a number of others were collected and relocated. It is estimated that during surveys conducted in the 1980s for the Karratha gas plant situated in Withnell Bay, 9,500 petroglyphs were recorded, with approximately 4000–5000 destroyed during construction. Attempts were made to preserve some 1,700 engravings which were removed from the site of the gas plant and placed in a compound with the intention to create an open air museum. Further, Woodside engineers altered some of the plans for the gas plant to preserve a number of sites within the plant.

6.8 However, Dr Ken Mulvaney explained that removing petroglyphs from their original sites, even for preservation, is highly problematic as the location within the landscape is also of significance.⁵

6.9 Dr Mulvaney also noted that the removal of rock art from their original sites has spiritual and cultural implications. Dr Mulvaney told the committee that:

Often those images are the dreaming beings, the creator spirits, of that landscape and that is where they reside. So if you pluck them out of that landscape and put them somewhere else not only are you destroying their residency but you open the risk of those spirits then wandering and becoming malevolent. And certainly a number of illnesses and deaths in that area are attributed, by the Aboriginal people, to the damage that has been done to the place. So it is certainly not an option. I think you would be hard pressed to find a reputable archaeologist today who would partake of that. I was involved in those original moves, but we did see it as better than having them crushed by the bulldozers.⁶

6.10 Dr Mulvaney also highlighted that projects undertaken by Hamersley Iron in the 1960s occurred prior to both heritage protection and Aboriginal rights legislation, and it is conceivable that between 10,000 and 15,000 engravings have been lost.⁷

4 Australian Heritage Council, 'The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to the Site', p. 47.

5 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 7.

6 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 7.

7 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, pp. 6–7.

6.11 It was argued that the impact of these losses on the rock art collection as a whole should not be underestimated. Though there is a general pattern of art work across the collection, each location and image is unique and a single image, or area cannot be taken to be representative of the whole. Dr Mulvaney told the committee that:

When I say 10,000 to 15,000 may have been lost, there might have been the equivalent of the Mona Lisa, for example, that has been destroyed.⁸

Industrial estates

6.12 A number of submitters expressed concern that industry on the Burrup Peninsula continues to be developed—beyond Yara Pilbara's projects—and that the area has been designated by the state government as an appropriate site for future industrial developments.

6.13 The Burrup Strategic Industrial Area (Burrup SIA) is a long established industrial estate with vacant land designated for the development of industry in close proximity to gas, port and other key infrastructure in the Pilbara region.⁹ Submitters noted that the Burrup SIA is part of 'a development plan that has remained in place since the 1970s and that it is 'not only the Yara industry that is a potential threat, the state government has gazetted an additional 21.48km² of Burrup and 9.76 km² of adjacent island for industrial growth'.¹⁰

6.14 The Friends of Australian Rock Art (FARA) stated that:

The WA government has pursued a long-term vision of inappropriately transforming the Burrup peninsula into the largest industrial precinct in the Southern Hemisphere as a magnet for foreign investment and huge royalties, without carrying out proper risk analysis.¹¹

6.15 It was highlighted that the impact of industry in the area goes beyond a 'physical footprint destroying cultural heritage' and includes the 'visual, audio and atmospheric pollution that have a much greater reach'.¹²

6.16 Submitters argued that the TANPF should be relocated to, and any additional industrial development should occur in, the Maitland Strategic Industrial Area (Maitland SIA) rather than in the Burrup SIA. Also known as the Maitland Industrial Estate, this area comprises 2500 hectares of land strategically located to promote and facilitate the processing of natural resources in the Pilbara region. The Maitland SIA

8 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, p. 7.

9 For more information see <https://www.landcorp.com.au/Industrial-and-Commercial/Burrup-SIA/>.

10 Dr Ken Mulvaney, *Submission 10*, pp. 2–3.

11 Friends of Australian Rock Art, *Submission 14*, pp. 3–4.

12 Dr Ken Mulvaney, *Submission 10*, p. 3.

has been identified as a long-term strategic industrial development capable of accommodating industries such as gas or petroleum processing, power production and other downstream processes such as urea, ammonia and ammonium nitrate production. The Western Australian Department of Jobs, Tourism, Science and Innovation (previously Department of State Development) is the lead agency for the development of the SIA. The Maitland SIA is located approximately 24 km west of Karratha and 39 km south of the Dampier Port.¹³

6.17 FARA submitted that the TANPF should have been located 'on the purposely cleared Maitland Industrial Estate just south of Karratha', however:

...as the ammonia-based industry was reluctant to spend extra money on piping the gas there, the WA government declared that the expense of establishing the infrastructure made it unviable.¹⁴

6.18 Ms Christine Milne, Bob Brown Foundation, went further and told the committee that the TANPF should be moved to the Maitland Industrial Estate 'where it should have gone in the first place'.¹⁵

6.19 However, Yara Pilbara told the committee that though the TANPF was constructing using certain pre-assembled parts, it cannot be dismantled and reassembled without incurring costs which would be equal to relocating a similar chemical plant which was constructed in a traditional manner. It explained that:

Despite what the name 'modular' may suggest, the TAN plant is not a "plug and play" device. On the contrary, the end result after construction is a plant with thousands of interconnected pipes, tubes and cables which run all through the plant like in any other plant in the chemical industry.¹⁶

6.20 Yara Pilbara further noted that the TANPF also requires the use of utilities available in the Burrup SIA including cooling water and waste water treatment systems. It explained that any relocation, such as to the Maitland SIA, would require the construction of an ammonia pipeline from the liquid ammonia facility. It noted that 'operating a very long ammonia pipeline increases risk' and that the current pipeline between the facilities is 'short and is protected, secured and maintained'.¹⁷

13 For more information see <https://www.landcorp.com.au/Industrial-and-Commercial/Maitland-SIA/>.

14 Friends of Australian Rock Art, *Submission 14*, p. 4.

15 Ms Christine Milne, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 42.

16 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 15.

17 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 15.

6.21 Yara Pilbara concluded that the relocation of the TANPF, which must operate in a competitive market, would result in significant financial loss and the loss of employment opportunities in the local community. It stated:

...the cost of relocation and the losses related to the extra operational downtime would likely be financially unacceptable and result in the loss of the significant sums invested by Yara and Orica to construct the TAN Plant (being approximately AUD\$1 billion. Such a course of action would also result in the loss of many jobs which have been created by the project in Karratha, where the workforce lives.¹⁸

6.22 Some submitters noted that Yara Pilbara has announced plans for further development on the Burrup Peninsula, and argued that this development should also occur in the Maitland SIA rather than in the Burrup SIA.¹⁹

6.23 Yara Pilbara acknowledged that it is undertaking a feasibility study for a pilot project for the production of hydrogen utilising the electrolysis of seawater, and electricity produced from solar energy. It explained that the hydrogen produced by the pilot plant would be used to produce ammonia using existing ammonia production infrastructure, and is intended to be used in the existing plant to partially replace the use of natural gas. This would slightly reduce the emission of nitrogen oxide and carbon dioxide.²⁰

6.24 Yara Pilbara noted that it is also undertaking a feasibility study for a larger scale renewable ammonia/hydrogen project which would be commissioned as a stage development. It acknowledged that the second stage of this project may require the use of an adjacent site within the Burrup SIA for the installation of solar panels. Yara Pilbara submitted that any development beyond this stage would require the use of larger areas of land for solar panels, and that these areas are likely to be situated away from the Burrup Peninsula.²¹

6.25 Yara Pilbara highlighted that:

This project has the potential to reduce NO_x and CO₂ emissions from Yara Pilbara's existing operations in the area. It is also seen as a first step in developing a "green ammonia" market that is less reliant on natural gas as a feedstock²²

18 Yara Pilbara, Answers to Questions on Notice, 17 February 2017, p. 15.

19 Ms Christine Milne, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 46.

20 Yara Pilbara, Answer to Questions on Notice, 17 February 2017, p. 10.

21 Yara Pilbara, Answer to Questions on Notice, 17 February 2017, p. 10. See also Yara Pilbara, *Submission 9*, p. 7.

22 Yara Pilbara, Answer to Questions on Notice, 17 February 2017, p. 10. See also Yara Pilbara, *Submission 9*, p. 7.

6.26 Councillor Peter Long, Mayor of the City of Karratha told the committee that Yara Pilbara is seen as 'a really good citizen' and that the development of a solar hydrogen plant would be a welcome development to the town. Councillor Long highlighted the benefits of 'totally renewable, totally clean' process with 'jobs forever' and stated that 'if we can get a renewable hydrogen industry' then 'it would be just fantastic. It would be such a benefit to the town'.²³

6.27 Councillor Long also noted that Yara Pilbara is exploring the development of a 'Sahara forest project, which is a solar greenhouse project where you use renewable energy to purify water and grow fruit and vegetables, which we could export, so that would give us an export industry'.²⁴

Indigenous management

6.28 This inquiry has highlighted some of the tensions which exist in balancing the need for preservation of cultural and historical heritage, investment in and management of local industry, and the rights of local Indigenous communities to self-determination in the management of country.

Native title

6.29 In January 2000, the Western Australian government gave notification of its intention to acquire land for the construction of heavy industrial estates on the Burrup Peninsula and adjacent Maitland areas. In 2002, the WA government, entered into the *Burrup and Maitland Industrial Estates Agreement Implementation Deed* (the Burrup Agreement) with the three native title claimant groups on the Burrup Peninsula: the Wong-Goo-Tt-Oo, Ngarluma Yindjibarndi and the Yaburara Mardudhunera peoples.²⁵

6.30 The Burrup Agreement included a range of economic and community benefits, including education and training, for the Wong-Goo-Tt-Oo, Ngarluma, Yindjibarndi and the Yaburara Mardudhunera peoples. This Agreement enabled the Western Australian Government to compulsorily acquire any native title rights and interests in the area of the Burrup Peninsula and other parcels of land near Karratha.²⁶

6.31 The Murujuga Aboriginal Corporation (MAC) was subsequently formed to represent five Indigenous groups in the Murujuga area (Dampier Archipelago and

23 Councillor Peter Long, City of Karratha, *Committee Hansard*, 20 April 2017, p. 12.

24 Councillor Peter Long, City of Karratha, *Committee Hansard*, 20 April 2017, p. 12. See also Yara Pilbara, *Submission 9*, p. 7.

25 Western Australian Department of Premier and Cabinet, [Burrup and Maitland Industrial Estates Agreement](#), (accessed 9 January 2017).

26 Australian Heritage Council, [The Potential Outstanding Universal Value of the Dampier Archipelago Site and Threats to that Site](#), p. 14. See also Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 1.

Burrup Peninsula): the Ngarluma people, the Mardudhunera people, the Yaburara people, the Yindjibarndi people and the Wong-Goo-Tt-Oo people.

6.32 The MAC owns freehold title for the Murujuga National Park, a 4913 hectare area adjacent to the industrial estate, however this was compulsorily leased back to the state on a 99 year lease. The Murujuga National Park is jointly managed as Western Australia's 100th national park.²⁷

6.33 Ms Raelene Cooper, Chairperson, MAC, told the committee that the MAC recognises that working on country includes coexisting with the resources industry, however the 'MAC holds the key responsibility for stewardship and management of the land and sea country according to Aboriginal law and culture'. Ms Cooper noted that MAC rangers work on country across the Murujuga National Park and 42 islands of the Dampier Archipelago. The rangers are responsible for 'conducting patrols and collecting environment and heritage records to assist with the compiling of data relevant to the law and culture in the sacred sites'.²⁸

6.34 In addition, the MAC has formed the Murujuga Circle of Elders as the key body for cultural knowledge and guidance for the community. Ms Cooper stated that the work of the Circle of Elders has increased community awareness and delivered an enhanced understanding of culture to their rangers and the wider Murujuga community. This increased community awareness 'allows the community to speak with one spiritual and cultural voice and with strong cultural integrity'.²⁹

Inadequacy of consultation

6.35 However, despite the role of the MAC in managing the area, the committee received evidence that there has been a failure to adequately consult and inform the MAC in relation to the expansion of industry in the area. Ms Cooper told the committee that the MAC has 'received very little advice in relation to the potential damage that may be caused by industrial emissions to our rock art'. Further, the MAC has 'no way of obtaining independent scientific advice or evidence that damage has occurred' and it is 'forced to trust that the past, current and future monitoring regimes will ensure that ensure that no damage is done'.³⁰ Ms Cooper stated that:

It seems that for some time the Murujuga has been left out a lot regarding the Burrup. Speaking on behalf of our elders, it is quite rude, to be frank, that nobody has come to MAC and spoken to our elders, the board of

27 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 1.

28 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 1.

29 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 2.

30 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 2.

directors and our CEO, in particular, so that we can have a collaborative relationship and iron out the issues that need to be ironed out in terms of the emissions and whatever rock art damage there is. We know there is damage but we do not know how significant it is. But, at the same time, we have an obligation and a duty to care for what is out there. In working with government or anyone who takes on that position, it would be fantastic for MAC to have quite a substantial and significant input because, at the end of the day, we all want the same outcome.³¹

6.36 The MAC indicated to the committee that, at least in recent years, it feels it has not had appropriate access to the information collected through monitoring programs, and was not represented through the Burrup Rock Art Technical Working Group (BRATWG).³²

6.37 Both Ms Cooper and Mr Craig Bonney, Chief Executive Officer, MAC, told the committee that relationships with a range of stakeholders have also been marred by issues such as a failure to respect cultural protocols and parameters through the publication of images of the rock art, and a perceived failure to treat Elders with due respect. Mr Bonney and Ms Cooper both expressed a desire to see the voices of the Murujuga Indigenous custodians given priority in discussions regarding the management of the area.³³

Unrestricted access and vandalism

6.38 The committee received evidence that the Aboriginal rock art of the Burrup Peninsula is not only under threat from an expansion of industrial activity. It is also under threat from unrestricted access to the area resulting in vandalism such as graffiti and damage from vehicular and leisure activities such as four-wheel driving and camping.

6.39 Access to the Northern Burrup has been largely restricted due to the topography of the area. However, Mr Bonney noted that four-wheel drive vehicles have been used to access the area via the 'Jump Up', a steep, almost impassable track. Those who utilise the Jump Up are then able to access the Burrup Peninsula for activities such as camping. Mr Bonney explained that:

...what has happened over the years—for everyone's awareness—is that those who have a four-wheel-drive vehicle that they do not mind getting damaged will take it up to the jump-up and get it damaged and then continue on and do whatever they want up there, pretty much. We have had instances, even in recent times, where a group has driven their vehicles up

31 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 5.

32 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 6.

33 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 2; p. 6. See also Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 6.

there and gone camping for the weekend. They basically turned a sand dune beach area into a waterslide by laying down a plastic sheet from the top of the dune right down to the water. They had a water pump in the sea pumping the sea water up. That created the slide.³⁴

6.40 Mr Bonney explained that this activity, though 'it looked like it would be something that most of us would enjoy doing' should not have occurred 'on our country and in that place'.³⁵

6.41 FARA similarly submitted that in November 2016 it found that machinery had been used to ease access through the Jump Up. It stated that:

...heavy earthmoving equipment has been used to remove rocks to permit access. The claw marks of D9 type machine are still evident as are the drill holes in one large rock opposite the clawed area. It is now open slather for four-wheel drive vehicles into an Aboriginal Protected Area, rich in rock engravings but only superficially surveyed by archaeologists.³⁶

6.42 This was also noted by Councillor Peter Long, Mayor of the City of Karratha, who told the committee that since this occurred, 'there has been a lot of damage to the rock art. There has actually been graffiti on the rock art and there are a lot of weeds going up the north end'.³⁷

6.43 A number of submitters expressed disquiet that very few prosecutions occur as a result of damage occurring to the rock art.³⁸ Dr Mulvaney told the committee that:

Time and again I have reported damage to sites and the heritage values, including that of a scrub fire in May 2012 and subsequent cutting of fire-breaks with a machine that bulldozed through a number of sites. Apart from the one case in 2010 of the CEMEX rock quarry, no substantive action has been taken against perpetrators of desecration.³⁹

6.44 Dr Mulvaney concluded that existing legislative protections are inadequate to prevent damage to the rock art of the Burrup Peninsula. Dr Mulvaney stated:

Neither the *Aboriginal Heritage Act 1972* (WA) nor the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) afford real protection. There has been an exponential increase in [the] occurrence of graffiti, and unregulated vehicle and people movement across the Burrup.

34 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 9.

35 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 9.

36 Friends of Australian Rock Art, *Submission 11*, Attachment 1, p. 2.

37 Councillor Peter Long, City of Karratha, *Committee Hansard*, 20 April 2017, p. 11.

38 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 9.

39 Dr Ken Mulvaney, *Submission 10*, p. 3.

Without any effective control, all are impacting the cultural heritage values of the place.⁴⁰

6.45 The MAC explained that the Murujuga Rangers who patrol the Murujuga National Park have not been given legislative powers to undertake any enforcement activity. For example, if the rangers encounter visitors camping in inappropriate locations or undertaking inappropriate activities, the rangers 'simply have no power to move them on, to make them cease or to issue fines'.⁴¹ Mr Bonney, MAC, explained that:

The current scenario is that if somebody is doing the wrong thing, our rangers can identify that person, warn them against doing whatever they are doing. If that person does not cease, then we can ring up a DPaW—Department of Parks and Wildlife—ranger, who will have that authority, and that ranger then needs to respond. That is not an acceptable process from our point of view. We have got traditional owners who are rangers on their own country seeing people do the wrong thing, and they have no power to move them off their own country.⁴²

6.46 Mr Peter Hicks, Board Member, MAC, told the committee that it was originally intended that the Murujuga Rangers be granted the same powers as those employed by the state government, however these powers have not been granted. Mr Hicks explained that the MAC has raised this issue with the state government but that it has not been resolved and the Western Australian Government will not grant enforcement powers to the rangers.⁴³

6.47 Similarly, Councillor Long, City of Karratha, told the committee that it is vitally important that the Murujuga National Park is better managed. Councillor Long suggested that gates, a visitor centre and rangers with authority would assist in improving protection.⁴⁴

World Heritage listing

6.48 Throughout the inquiry, it was suggested that the Aboriginal rock art of the Burrup Peninsula is of such significant cultural and historical value that the government should pursue World Heritage listing of the site. Further, that World Heritage listing would provide much needed additional protection for the rock art. However, the evidence also indicated that there is a lack of consensus amongst the Indigenous groups represented by the MAC as to whether World Heritage listing should be pursued. A number of stakeholders emphasised the need to conduct a

40 Dr Ken Mulvaney, *Submission 10*, p. 3.

41 Mr Peter Hicks, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 4.

42 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 4.

43 Mr Peter Hicks, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 4.

44 Councillor Peter Long, City of Karratha, *Committee Hansard*, 20 April 2017, pp. 11–12.

comprehensive consultation with local Indigenous custodians on the World Heritage process and that any World Heritage nomination must be led by traditional owners.

Listing attempts and consultation

6.49 Submitters highlighted that the Burrup Peninsula was first assessed for heritage listing in the 1980s but that the process has stalled over subsequent decades due to a number of factors including reluctant state governments, and a lack of support amongst the local Indigenous communities.

6.50 Dr Mulvaney noted that despite the Australian Heritage Commission assessing the Burrup Peninsula as meriting World Heritage nomination in 1980, 'this legal obligation has still to be evidenced'. Rock art is included as one of the values in 34 World Heritage properties around the world and Dr Mulvaney argued that:

...the Dampier Archipelago including Burrup Peninsula is a cultural landscape that is demonstrably superior in relation to Indigenous cultural heritage including the petroglyphs to any of these World Heritage properties.⁴⁵

6.51 Ms Cooper, MAC, told the committee that although 'discussions were held eight to 10 years ago with various Murujuga members or elders—the current board and most elders did not participate in those discussions'. Further, the members of the current board:

...are unaware of the opportunity for or benefit of World Heritage listing, and we do not know if there is a downside or possible negative impact which could result. We are also unaware of the process or what resources we would require to be fully participative in the process. We currently own all of the Murujuga National Park land. Some of this land falls under the tier of an Aboriginal protected area. Although the title seems to indicate enhanced protection, it is actually less protected than the neighbouring national park which falls under a different legislation regime. This example helps to inform our scepticism in relation to the World Heritage listing.⁴⁶

6.52 Mr Bonney, MAC, explained that the current MAC board has not discussed World Heritage listing at a board level and formed a view. Mr Bonney stated that:

Again, that is related to that lack of information and awareness. We believe in making informed decisions at the board level, and, because we have not got the information, we have not discussed it.⁴⁷

6.53 Similarly, Mr Peter Hicks, MAC told the committee that no consultation with the MAC on the issue of World Heritage listing had occurred. Mr Hicks stated:

45 Dr Ken Mulvaney, *Submission 10*, p. 1.

46 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 2.

47 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 6.

We have not had anybody come in and sit at the board table with us and talk with us about what is going on here. There are a lot of people running around the parliament, and everywhere else, that we hear about but there is nobody coming to sit down and talk with us.⁴⁸

6.54 In February 2017, the Department of the Environment and Energy (the department) noted that it has had some discussions with the MAC 'on and off for the last couple of years about their attitude to World Heritage listing'. However, Mr Chris Johnston, Assistant Secretary, Heritage Branch, told the committee that:

Their view has been that the board has as its first priority bedding down the sustainability of the ranger program and getting its cultural management plan completed. In our most recent discussions we had with them here in Canberra, they were talking about wanting to get some enforcement powers for the rangers under the WA parks so that they could patrol the area and issue enforcement notices. On the matter of World Heritage, I think they wanted to understand more the implications of being a World Heritage site. We have offered to put them in touch with some of the other World Heritage sites so that they could share some experiences with them. We have mentioned places like Purnululu but also some of the ones that our department manages—Kakadu and Uluru. They have not yet come back and asked us to do that, but it is a standing offer.⁴⁹

6.55 In November 2017, the department informed the committee that subsequent consultation occurred in July 2017 where the MAC sought information from the Department on what approach the Commonwealth may take in relation to World Heritage listing.

6.56 Mr David Williams, Branch Head, Heritage Branch, explained that at the time of the meeting the MAC had not formed a view on whether it would support World Heritage listing. Mr Williams noted that the department explained to the MAC that the Australian Government 'places a high degree of reliance on full, informed consent of the traditional owners of the area' and that 'the issue of World Heritage listing was in their [the MAC's] hands'.⁵⁰

6.57 Councillor Long indicated that the City of Karratha supports the listing of the Burrup Peninsula as a World Heritage Area and that such a listing would bring benefits such as tourism and increased protection for the rock art. Councillor Long told the committee that:

The city is very supportive of it. We actually passed a motion a few meetings ago that we nominally support World Heritage status for the

48 Mr Peter Hicks, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 7.

49 Mr Chris Johnston, Department of the Environment and Energy, *Committee Hansard*, 17 February 2017, p. 58.

50 Mr David Williams, Department of the Environment and Energy, *Committee Hansard*, 17 November 2017, p. 11.

Burrup. We think that would be terrific for all the same reasons of helping protect it and increasing tourism, as long as existing industries up there are not compromised. They seem to all be in support of that themselves, so we did not see that as a problem. The city has been very supportive. We see it as a very important part of our city and we would like to protect it.⁵¹

6.58 However, Councillor Long added the caveat that the council's support for World Heritage listing is conditional upon support from the local Indigenous custodians. Councillor Long highlighted that 'Aboriginal people are concerned that, if it [the Burrup Peninsula] is World Heritage, they may lose some control over it'. Councillor Long explained that the City of Karratha 'certainly would not want to overrule them...we should not do anything without Murujuga being fully on board. If they do not want it, we will support them'.⁵²

6.59 Councillor Long also highlighted the difficulties that the MAC faces in achieving a consensus view amongst the Indigenous groups it represents.⁵³ Similarly, Ms Milne, Ms Judith Hugo from FARA, and Dr Mulvaney noted that there are some members of the local Aboriginal community who are supportive of World Heritage listing, and who have participated in consultation on the issue.⁵⁴

6.60 Yara Pilbara submitted that it would be supportive of World Heritage listing, but like the City of Karratha, this support would be conditional upon support from local Indigenous custodians. Mr Brian Howarth, Yara Pilbara stated:

The key point for us with World Heritage listing—we have always said we would support it—is that that decision for us lies with the traditional owners, the Murujuga Aboriginal Corporation. In our discussions with Murujuga, or MAC, the discussion has been that they are not sure yet of the pros and cons of World Heritage listing. We are going to leave that decision completely to them, but if the traditional owners wish for World Heritage listing, then we will certainly support the same.⁵⁵

Other sites

6.61 Submitters argued that if other, arguably less significant rock art sites around the world are afforded the protections of World Heritage listing, then the rock art of the Burrup Peninsula should also be listed and protected accordingly.

51 Councillor Peter Long, City of Karratha, *Committee Hansard*, 20 April 2017, p. 11.

52 Councillor Peter Long, City of Karratha, *Committee Hansard*, 20 April 2017, p. 13.

53 Councillor Peter Long, City of Karratha, *Committee Hansard*, 20 April 2017, p. 13.

54 Ms Judith Hugo, Friends of Australian Rock Art, *Committee Hansard*, 17 February 2017, p. 46. See also Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, pp. 46–47; Ms Christine Milne, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 45.

55 Mr Brian Howarth, Yara Pilbara, *Committee Hansard*, 17 February 2017, p. 37.

6.62 The cave paintings found in the Vézère Valley, France, most notably those found in the Lascaux cave complex were World Heritage listed in 1979. It was highlighted that these paintings are only 17,000 years old, while the rock art of the Burrup Peninsula is approximately 40,000 years old. Further, the French government took steps to protect the rock art from a range of threats including from:

...tourists whose breath raised levels of damaging carbon dioxide and other nutrients, which stimulated the growth of fungi and other microorganisms covering the art in black spots and causing serious degradation.⁵⁶

6.63 Professor Black noted that the French authorities closed the cave complex to tourists 25 years ago and created a replica nearby to allow tourists to visit without damage to the cave art.⁵⁷

6.64 Similarly, in early 2017 the British Government announced measures to protect Stonehenge, a 4500 year old site, from damage caused by acid pollution from nearby motorway traffic. The government announced that a £1.4 billion tunnel would be built to divert traffic from the area. Professor Black described it as 'incongruous' that in comparison, 'the Australian Government is doing virtually nothing to protect' the rock art of the Burrup Peninsula, 'one of the oldest and largest congregation of rock art in the world'.⁵⁸

56 Professor John Black, *Submission 13*, p. 15.

57 Professor John Black, *Submission 13*, p. 15. See also R. Bednarik, 'Editorial – Solving the Dampier controversy', *Rock Art Research 2017 - Volume 34, Number 2*, p. 128.

58 Professor John Black, *Submission 13*, p. 15. See also R. Bednarik, 'Editorial – Solving the Dampier controversy', *Rock Art Research 2017 - Volume 34, Number 2*, p. 128.

Chapter 7

Committee view

7.1 Murujuga, also known as the Burrup Peninsula, is home to one of the largest collections of rock art in the world. The petroglyphs are of immense cultural and spiritual significance to Aboriginal people, and of equally immense national and international archaeological and heritage value.

7.2 The Murujuga is a sacred place for five local Indigenous groups: the Ngarluma, the Mardudhunera, Wong-Goo-Tt-Oo, the Yaburara, and the Yindjibarndi. The area contains dreaming sites, ceremonial sites, shell middens, quarries, standing stones and burial grounds. The Murujuga is described as a place of worship and understanding where stories and law are written through the petroglyphs and the stone. Aboriginal people throughout the Pilbara believe that the petroglyphs are the work of creation spirit-beings known as Marrga who formulated the rules of social conduct for humans to follow. The petroglyphs are a permanent visual reminder of how the law should be followed, and are places of continuing spiritual power.

7.3 The petroglyph collection which includes the earliest known depiction of a human face, documents human presence in the area over an estimated 45,000 year timespan—the longest continuous production of rock art in the world. It includes images of extinct mega-fauna, Tasmanian tigers, hunting traditions, and mathematical and geometric forms. The collection also documents changes in the way humans reflected their presence in the landscape and their cultural practices over time. The petroglyphs reflect changes in environmental conditions with early artwork depicting terrestrial fauna and artwork from the Holocene period including images of marine fauna such as turtles, and fish.

7.4 The Australian Heritage Council reported in 2011 that the rock art collection represents a masterpiece of human creative genius and is one of the most exciting and significant collections of rock engravings in the world.

7.5 The committee recognises and acknowledges the vast cultural and historical values of the rock art of the Burrup Peninsula and is of the view that it is critical that the petroglyphs should be protected and conserved for current and future generations.

7.6 The committee acknowledges the substantial amount of work contained in this report and the information and opinions it contains. Senators have reached differing views on the issues presented and these will be outlined in additional comments. The committee thanks all those who participated in this inquiry.

Senator Peter Whish-Wilson
Chair

Australian Greens' additional comments

Cultural and heritage value

1.1 The Burrup Peninsula was assessed as meriting World Heritage listing in the 1980s. But due to industry and state government reluctance progress has stalled. Globally, smaller and arguably less significant rock art sites have been afforded the protections of World Heritage listing. As such, it is a failure that the rock art of the Burrup Peninsula has not been listed and protected accordingly.

1.2 The Greens acknowledge the concerns expressed by the Murujuga Aboriginal Corporation that it has not been consulted on World Heritage listing and that a consensus view has not been formed as to whether it would support such a listing. The Greens also note concerns that World Heritage listing may lead to changes or a reduction in the ability for the Murujuga Aboriginal Corporation to manage the area.

1.3 The Greens acknowledge the vital work that the Murujuga Rangers undertake in maintaining and protecting the Murujuga National Park from physical destruction and vandalism, and that the rangers have not been afforded appropriate legislative powers to undertake much needed enforcement activity within the park. The Greens considers this to be an oversight by the Western Australian Government.

Recommendation 1

1.4 Australian Greens Senators recommend that the Western Australian Government immediately approach the Australian Government to seek the listing of the Burrup Peninsula on Australia's Tentative World Heritage List, following appropriate consultation with the Murujuga Aboriginal Corporation.

Recommendation 2

1.5 Australian Greens Senators recommend that following listing on the Tentative World Heritage List, the Australian Government and the Western Australian Government work together to nominate the Burrup Peninsula for World Heritage listing.

Recommendation 3

1.6 Australian Greens Senators recommend that the Murujuga Indigenous Ranger program be given appropriate funding by both the Australian Government and the Western Australian Government, and the Murujuga Rangers be granted the power to undertake the same enforcement activities as state-employed rangers.

Industry and shipping

1.7 The Burrup Peninsula is the site of a number of significant industrial complexes including a major iron ore port, liquefied natural gas production, salt production, and Yara Pilbara's liquid ammonia plant and technical ammonium nitrate facility (TANPF). These industries are sources of pollutants such as sulphur dioxide, ammonium nitrate particles, nitrogen oxide, nitrous oxide, methane, ammonia, and carbon dioxide. These pollutants are known to have negative consequences for human health, create environmental changes such as algal growth, and create acid rain. Such consequences may have negative effects on the cultural and environmental values of the Burrup Peninsula.

Shipping

1.8 The Port of Dampier is one of the busiest bulk ports in the world with over 5,000 vessels per year entering and leaving the port within a few kilometres of a number of important rock art sites. Bulk vessels utilise high-sulphur content fuel and it is estimated that a single vessel releases approximately 5,200 tonnes of sulphur dioxide in a year. These emissions are highest during start-up and shut-down which occur at anchorage.

1.9 Sulphur dioxide when combined with moisture in the air forms sulphuric acid and precipitates as acid rain or fog which is known to have severe effects on stone buildings, rocks and rock art. The effects have been recognised in Australia, with the New South Wales Government introducing a legislative requirement for cruise ships to use low sulphur content fuel (or an approved means of achieving the required emissions reduction) within the boundaries of Sydney Harbour. This echoes the requirements for vessels operating in Emissions Control Areas declared under Annex VI to IMO MARPOL 73/78 Convention (Prevention of Air Pollution from Ships).

1.10 The Greens are of the view that given the known impact of sulphur dioxide on rock art, and the high volume of traffic at the Dampier Port, the rock art of the Burrup Peninsula should be afforded similar protections.

Recommendation 4

1.11 Australian Greens Senators recommend that the Western Australian Government implement measures to ensure that ships entering and leaving the Port of Dampier use low sulphur content fuel or an approved means of achieving required emissions reductions. The maximum sulphur content of fuel utilised by ships entering and leaving the port should be 0.10 per cent, as required for Emissions Control Areas declared under Annex VI to IMO MARPOL 73/78 Convention.

Existing industry and the need for baseline measurements

1.12 Evidence provided to the committee highlighted that concerns about the impact of emissions from industrial activity on the Burrup Peninsula are not new. Various researchers have identified that industry has discharged significant amounts of acid-forming pollutants into the Burrup Peninsula environment. Pollutants, including sulphur dioxide, have a deleterious effect on desert patina, and rock art.

1.13 The work of Robert G. Bednarik, who has conducted decades of study on the rock art of the Burrup Peninsula, was highlighted. In 2002, he predicted that the current rate of emissions from existing industry on the Burrup Peninsula will lead to the destruction of the petroglyphs by the second half of the 21st century.

1.14 The Australian Heritage Council which commented on the expansion of existing industry, new industrial development and associated infrastructure. It stated that it had the potential to directly impact on large areas of the Dampier Archipelago site and concluded that, given the scale of impact that continued industrial development may have, the impact rating was 'Critical'.

1.15 It is apparent that there has been evidence of damage to the Burrup Peninsula rock art for many years. This evidence has been ignored and industrial development has continued to be approved.

1.16 Further, evidence suggested that the total emission load for existing industries has not been adequately quantified and measured to determine environmental and public health impacts of current emissions.

1.17 The Greens considers this an oversight by both the Western Australian Government, and the Commonwealth Government.

Recommendation 5

1.18 Australian Greens Senators recommend that the Commonwealth Government, in conjunction with the Western Australian Government, establish measurements of existing emissions as a matter of priority.

1.19 Australian Greens Senators recommend that the Western Australian Government implement measures to ensure that the emission load on the Burrup Peninsula is reduced.

Projected emissions from the TANPF

1.20 Submitters expressed concern that the projected increase in emissions from the TANPF would contribute to the destruction of the rock art of the Burrup Peninsula within a relatively short period of time. It was argued that the expected acid load into the atmosphere from the TANPF would be at the highest category of the international scale for environments susceptible to acids.

1.21 Rock patina, or desert varnish is particularly susceptible to damage from an increase in the presence of acids in the environment which dissolve manganese and iron compounds. As desert varnish is destroyed it becomes lighter in colour, and engraved surfaces are particularly vulnerable to such damage as the desert varnish is thinner than on the non-engraved rock surface.

1.22 In addition, the TANPF is expected to emit 2.52 tonnes per year of ammonium nitrate particles which are known to stimulate the growth of plants and other organisms through the provision of nitrogen. These plants and organisms include lichen, bacteria, fungi and adventitious bacteria which grow on the surfaces of rocks. Such plants and organisms produce organic acids which increase the acidity of rock surfaces and will lead to damage to the petroglyphs. Further, the hyphae of growing fungi penetrate the soft weathering rind below the desert varnish layer and break away the edges of petroglyph engravings.

1.23 Increased nitrogen in the environment from existing industry has already led to an increase in algal growth in the region's waterways, and future emissions are also likely to lead to an increase in vegetation which would make the area more susceptible to fires from lightning strikes.

1.24 Permitting any further environmental changes as a result of emissions from the TANPF is unacceptable. The rock art, and the surrounding environment should be protected from uncontrolled vegetation growth and any increase in the acidity of the environment.

1.25 Airborne ammonium nitrate particles at PM₁₀ size or smaller are also known to have detrimental effects on the health of those who live, visit and work in the area. Submitters argued that Yara Pilbara's proposed PM₁₀ outputs exceed limits which are known to be toxic to humans. Further, the TANPF is expected to emit 41 tonnes per year of carbon monoxide and that this too poses a risk to human health, and the wellbeing of other living organisms in the area.

1.26 Yara Pilbara responded to such concerns by noting that its emissions modelling was assessed by the Western Australian Department of Environmental Regulation during the TAN Plant Works Approval application, and its PM₁₀ emissions were determined to be insignificant. Further, its carbon monoxide emissions were assessed twice by the Western Australian Department of Environmental Regulation and the Environmental Protection Authority Western Australia. It was found that the worst-case predicted ground level carbon monoxide concentrations from the operation of the TANPF were less than 0.2 per cent of the National Environmental Protection Measure and Impact Statement for Ambient Air Quality.

1.27 Professor Black recently provided the committee with a qualitative opinion on the potential human health risks associated with emissions from Yara Pilbara, which was undertaken by Adelaide University in February 2018. The opinion noted the photographic evidence of a nitrogen dioxide cloud emanating from the nitric acid plant and stated that for NO₂ to be visible, concentrations would be at least four-times

the recommended health standards. The opinion also noted records from the plant which show that the emission rates of NO₂ associated with a visible cloud were exceeded 76 times, and were frequently for more than 15 minutes.

1.28 Professor John Black and Dr Ilona Box reviewed this opinion and concluded that 'the emissions have produced gas concentrations in the vicinity of the road to Hearson's Cove up to 23 times higher than stated in the Australian health standard guidelines'.

1.29 The Greens acknowledge that relevant state authorities have assessed the TANPF emissions. However, we consider that it is not a question of whether the TANPF meets current emissions standards but whether those standards are adequate to ensure the protection of one of the most significant collections of rock art in the world, which are also central to the law and traditions of the local Indigenous people. The Greens does not consider that this is the case.

1.30 The Greens believe that urgent action should be taken to eliminate ammonium nitrate emissions. We considers that the most effective way of achieving this outcome is for the Commonwealth to vary the conditions of approval to impose a zero emissions requirement.

Recommendation 6

1.31 Australian Greens Senators recommend that given the significant impact of ammonium nitrate and other acidic emissions on both the environment and human health, the Australian Government vary the conditions of approval of the Yara Pilbara TANPF to impose a zero acidic emissions requirement.

1.32 Australian Greens Senators recommend that the Western Australian Government require all other industry and shipping on the Burrup Peninsula to comply with zero acidic emissions standards within one year.

Appropriateness of location

1.33 Successive Western Australian governments have pursued a long-term vision of transforming the Burrup Peninsula into the largest industrial precinct in the southern hemisphere, attracting foreign investment and royalties. As such, The Burrup Strategic Industrial Area (Burrup SIA) was developed to provide an area for industry in close proximity to gas, port and other key infrastructure.

1.34 However, submitters argued that an expansion of industry in the area to include the TANPF will contribute to the destruction of cultural heritage, and will contribute visual, audio and atmospheric pollution to what is an extremely sensitive environment. The Greens notes that Yara Pilbara is also exploring a number of other projects for the area such as a large scale renewable ammonia/hydrogen project and a pilot project for the production of hydrogen utilising the electrolysis of seawater and solar electricity.

1.35 The Maitland Strategic Industrial Area (Maitland SIA) located south of Karratha has also been identified as a long-term strategic industrial development capable of accommodating industries such as gas or petroleum processing, power production and other downstream process such as urea, ammonia and ammonium nitrate production.

1.36 The Greens are of the view that the TANPF would have been more appropriately located on the Maitland SIA rather than the Burrup SIA. The Greens acknowledge that there would be costs associated with relocating the TANPF to the Maitland SIA, however it is of the view that such an option should be explored given the critical importance of the protection of Aboriginal rock art from damage caused by emissions from the TANPF.

1.37 The Greens are also of the view that the expansion and development of the Burrup SIA should no longer be pursued by the Western Australian Government given the potential for significant damage to the rock art. Instead, any future industrial development should occur on the Maitland SIA.

1.38 In addition, the Western Australian Government should pursue the development and promotion of a tourism industry that would provide important long-term employment and economic activity whilst also acknowledging the natural, cultural and heritage values of the area.

Recommendation 7

1.39 Australian Greens Senators recommend that the TANPF be relocated to the Maitland SIA.

Recommendation 8

1.40 Australian Greens Senators recommend that no further industrial development be approved for the Burrup Peninsula.

Recommendation 9

1.41 Australian Greens Senators recommend that the Western Australian Government promote tourism to the Burrup Peninsula as a long-term employment and economic opportunity.

Monitoring programs

1.42 Industry on the Burrup Peninsula is subject to regulation by both state and Commonwealth legislative frameworks. As such, the TANPF was approved with a number of conditions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These conditions include the requirement for an air monitoring program, and a spectral mineralogy program to be implemented.

1.43 The committee received evidence which indicated major flaws in the work undertaken by CSIRO on behalf of the Western Australian Government. This work has been used to establish approval conditions for the TANPF, and by proponents who

argue that industry on the Burrup Peninsula has not resulted in damage to the rock art collections.

1.44 This evidence included that:

- the 2007 fumigation studies conducted by CSIRO suffered poor experiment design through an inadequate selection of rock samples, and inadequate replication;
- the 2008 air pollution study incorrectly used a study by Cinderby et al to conclude that the critical load for the Burrup rocks would be 200 meq/m²/year;
- the analysis of rock art monitoring conducted between 2004–2014 did not include adequate statistical analysis, and further the measurements taken were unreliable due to the equipment used.

1.45 Professor John Black raised these concerns with both CSIRO and the Western Australian Government and proposed improvements which could be made to the work of CSIRO. As a result, in 2016 the Western Australian government engaged an independent reviewer, Data Analysis Australia (DAA), to review the CSIRO monitoring reports and the work of Professor Black. DAA found that:

- the statistical methods proposed by Professor Black represented a substantial improvement in the effective monitoring of the rock art sites, and the CSIRO reports demonstrated a number of inadequacies such as a lack of statistical analysis; and
- there were significant problems with cross-calibration between measuring instruments, inconsistent error-prone data management, and clear errors in the CSIRO data. As such, the CSIRO data collected should be archived and DAA concluded that it is not appropriate for regulators to make any decisions based on that data.¹

1.46 In 2017, DAA was again engaged to review the draft *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016* CSIRO monitoring report. It found that four of its 2016 recommendations to improve the monitoring program had not been implemented, one recommendation had been partially implemented and one recommendation had been largely implemented. DAA acknowledged that while the 2017 report demonstrated substantial efforts on the part of CSIRO to improve the reporting of data collection and to present better analysis, more needed to be done. It concluded that the CSIRO report was unable to dispel reasonable concerns about the impact of industry on the rock art.

1.47 As a result of the 2017 DAA review, CSIRO made a number of changes to the *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy*

1 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, Executive Summary.

2004-2016 report. CSIRO noted that this final report supersedes all previous results published by CSIRO for the monitoring program and that it implemented all the recommendations of the 2016 and 2017 DAA reviews.

1.48 The *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016* concluded that there has been a small but statistically significant change to the rocks in some dimensions of colour. However, the committee received evidence that this conclusion seeks to diminish the value of these colour changes. It was argued that a colour change of approximately 13 per cent over 13 years is a major change which should be of concern in the preservation of rock art.

1.49 The Greens would particularly like to take the opportunity to thank Professor John Black and his colleagues for undertaking such comprehensive reviews of the CSIRO reports, and for continuing to raise their concerns with both CSIRO and the Western Australian Government. It appears that without the work of Professor Black, a number of issues would not have been identified.

1.50 Such work should not have to be undertaken by private citizens. There should be a legislatively required monitoring program that is fit for purpose. Professor Black's concerns should have been addressed by CSIRO when he first raised them.

1.51 The Greens note that in September 2017, the Western Australian Government released the Draft Burrup Rock Art Strategy which proposes to develop a revised method for the collection and analysis of data that incorporates the recommendations of the DAA review.

1.52 The Greens are of the view that the development and implementation of a new monitoring program should be a priority for the Western Australian Government.

1.53 The Greens also note that the Draft Strategy includes recommendations for improvements to air quality monitoring, the development of microbiology studies and pH monitoring, and new monitoring of other sources of pollutants.

Recommendation 10

1.54 Australian Greens Senators recommend that the incorrect use of the Cinderby et al report in the Gillett 2008 air pollution study, and the impact that this flawed report has had on the establishment of approval conditions be noted; and recommend that CSIRO acknowledge that it has produced fundamentally flawed assessments.

Recommendation 11

1.55 Australian Greens Senators recommend that the Western Australian Government prioritise the development and implementation of a new, fully funded independent monitoring program that meets all of the recommendations of the Data Analysis Australia reviews.

Recommendation 12

1.56 Australian Greens Senators recommend that the proposals for further monitoring included in the Draft Burrup Rock Art Strategy be implemented as soon as possible.

Compliance with approval conditions

1.57 The committee received evidence that Yara Pilbara has had a number of incidents of non-compliance with EPBC Act approval conditions. First, it failed to self-refer the TANPF proposal for assessment under the EPBC Act, and it has subsequently failed to comply with a number of its approval conditions.

1.58 The incidents of non-compliance with approval conditions include late production of annual compliance reports and rock art monitoring reports. The Department of the Environment and Energy (the department) told the committee that it is working with Yara Pilbara to improve the capacity of Yara Pilbara to comply with its approval conditions.

1.59 In September 2017, the department also issued a directed variation to the approval for the TANPF in response to non-compliance. This variation imposed new reporting requirements, new air quality monitoring and reporting requirements, and established a requirement that the approval holder must ensure that no measurable impacts from air pollution must occur within two kilometres of the site, for the life of the approval.

1.60 It is clear that there have been incidents of non-compliance and the Greens are of the view that such behaviour is unacceptable, particularly in an environment where the consequences may be catastrophic to the irreplaceable rock art collection. The Department of the Environment and Energy must ensure that Yara Pilbara's compliance is improved.

Survey

1.61 Submitters also raised concern that under its approval conditions Yara Pilbara should have engaged a heritage monitor to conduct a comprehensive survey of all rock art sites in a two kilometre radius. However, Yara Pilbara only monitors six petroglyph sites in its two kilometre radius and has not conducted a survey to identify all the sites that exist in this area. Submitters argued that this sample of sites is inadequate.

1.62 However, both Yara Pilbara and the Department of the Environment and Energy asserted that the approval conditions only required the monitoring of six sites and that there had been no instance of non-compliance in this regard.

1.63 The Greens accept the evidence that such a small sample is inadequate and contends that Yara Pilbara should be required to engage a Heritage Monitor to conduct a comprehensive survey to identify all rock art sites in the two kilometre radius which may be affected by emissions.

Recommendation 13

1.64 Australian Greens Senators recommend that the Australian Government vary the approval conditions for the TANPF to require Yara Pilbara to engage a Heritage Monitor to conduct a comprehensive survey to identify all rock art sites in a two kilometre radius from the site.

Air quality monitoring

1.65 The committee also received evidence that Yara Pilbara has failed to comply with air quality monitoring requirements as established by approval conditions granted by the Western Australian Government.

1.66 In particular, submitters argued that Yara Pilbara compliance reports demonstrate non-compliance with the requirement to measure PM₁₀ particles, NH₃, NO_x, and SO_x at five sites, including three rock art sites. There are instances in the report where 'No Data' is recorded, and measurements of negative amounts of PM₁₀ particles which are arguably impossible.

1.67 Yara Pilbara acknowledged that there have been periods of time where its air quality monitoring equipment has been unavailable due to breaking down or maintenance work. Yara Pilbara also acknowledged that it has engaged an air quality monitoring consultant to conduct a review of all its air quality monitoring data and baseline data sets.

1.68 The Greens are concerned that Yara Pilbara has failed to comply with its approval conditions to conduct adequate air quality monitoring and is especially concerned that the Western Australian Government does not appear to have taken any enforcement action to ensure such compliance.

Recommendation 14

1.69 Australian Greens Senators recommend that the Western Australian Government promptly review and assess Yara Pilbara's compliance with its approval conditions, and take any necessary enforcement action.

Cumulative effects

1.70 The committee received evidence that under the EPBC Act, the ability for the Minister or their delegate to consider cumulative effects when undertaking an approval assessment is limited.

1.71 Submitters expressed concern that the cumulative effects of existing industry on the Burrup Peninsula may not have been considered during the EPBC approval process. Further, submitters argued that without the release of the Minister's statement of reasons, it is unclear whether or to what extent the cumulative effects are considered.

1.72 The Greens notes that the Department of the Environment and Energy and Yara Pilbara provided evidence that the cumulative effects of existing industry on the Burrup Peninsula were considered during the approval process for the TANPF. The Department of the Environment and Energy also provided evidence that any future approvals for development on the Burrup would also include a consideration of the cumulative effects on matters of national significance.

1.73 Nevertheless the Greens are of the view that legislative certainty is required and that the EPBC Act should explicitly require the Minister or their delegate to consider cumulative effects when approving actions.

Recommendation 15

1.74 Australian Greens Senators recommend that the *Environment Protection and Biodiversity Conservation Act 1999* be amended to require the Minister or their delegate to consider the cumulative effects when approving decisions.

Senator Peter Whish-Wilson
Chair
Senator for Tasmania

Senator Rachel Siewert
Senator for Western Australia

Coalition Senators' additional comments

Importance of economic development on the Burrup Peninsula

1.1 The value of Western Australia's mineral and petroleum production cannot be understated. The sector is a major contributor to the state and the Australian economy with the estimated value of royalties the state received from the resources sector comprising almost 15 per cent of estimated total state revenue in 2015–16, or around \$3.8 billion.

1.2 The Burrup Peninsula is the gateway to Australia's biggest oil and gas operations—the \$42bn North West Shelf Joint Venture and the \$15bn Pluto LNG Project. Yara Pilbara has invested over US\$1.5bn to support and develop downstream processing in the area.

1.3 The North West Shelf project remains important to the economic development of Western Australia, as outlined in the recent comments made by WA Labor Premier Mark McGowan on 21 September 2017:

My main objective is to get Browse gas to come onshore at North West Shelf so I am working very hard with Woodside and the agency to ensure that Browse gas comes onshore. I do not want to do anything that jeopardises that particular outcome.

1.4 Throughout this inquiry, Coalition Senators have remained concerned over the committee's refusal to consider the weight of the evidence over the economic value the construction of the Yara Pilbara technical ammonia nitrate plant facility (TANPF) TANPF will bring to the Pilbara and Western Australia, and their continued support for a World Heritage listing of the Burrup Peninsula.

No credible evidence of adverse impact of emissions on rock art

1.5 The committee was informed that the Burrup Rock Art Technical Working Group was established by the Western Australian Government to monitor the heritage rock art sites on the Burrup Peninsula from 2004 to 2016 including to oversee the science of these studies. CSIRO's role has been to conduct the monitoring work that was designed and commissioned by the Burrup Rock Art Technical Working Group.

1.6 The committee was informed by CSIRO at the hearing of 17 November 2017 that the final report, dated June 2016 and released in September 2017, superseded prior reports. CSIRO's final report analysed colour monitoring of the rocks using a model that includes a time trend, looking for evidence for change over time.

1.7 CSIRO's final report concluded that a change in the colour characteristics of the rock surfaces had been identified during 13 years of monitoring the rocks, however, there was no statistically significant difference between the two control sites in Dolphin and Gidley islands and the sites close to industrial activity. CSIRO stated:

It should be noted that the report provides the colour measurements and hence changes in colour. The reasons for the colour changes are not addressed explicitly in this report.

1.8 The committee was informed by CSIRO that the small changes in the colour characteristics of the rock surfaces could be the results of natural weathering or other causes and that:

...while the indication of colour change is important, and warrants closer attention, it cannot be automatically assumed that it represents the impact of pollution from industrial plants. Sites further from the industrial development, included in the study in order to test whether change is more rapid at sites more prone to pollution effects, in fact showed no statistically significant difference from the other sites.¹

1.9 Coalition Senators acknowledge that the committee received differing theoretical evidence in relation to the measurement of the colour characteristics of the rock surfaces prior to the hearing held in November 2017. Commentary from a critic of the CSIRO analysis [Professor Black] requested CSIRO do a more comprehensive statistical analysis of the data², which was in alignment with the recommendation of an independent reviewer to the Burrup Rock Art Technical Working Group. CSIRO advised the committee at the hearing held in November 2017 that CSIRO's final report, published in September 2017, includes a full statistical analysis of the colour measurements and that CSIRO had addressed the recommendations that had arisen in the review process established by the Burrup Rock Art Technical Working Group.

1.10 CSIRO advised the committee at the hearing held in November 2017 that CSIRO's final report published in September 2017 includes measurements made in 2015 and 2016 in addition to those included in prior reports. CSIRO also provided to the committee statistical analysis of the CSIRO colour measurements for separate years back to 2010 in the CSIRO response to Questions on Notice from the November 2017 hearing, received 27 November 2017.

1.11 Coalition Senators consider that the committee has no evidence before it to call into question the final CSIRO report and note that CSIRO scientists have repeatedly reassured the committee of their confidence in the validity of their colour measurement results. Coalition Senators accept the advice from CSIRO that:

The CSIRO report does not provide a basis to confirm or to exclude an attribution to the industrial development, other than to note that the measured changes are not statistically significantly different at sites near to or far from industry.

1 CSIRO, *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016*, pp. xiii–xiv.

2 Professor John Black, *Committee Hansard*, 17 February 2017, p. 20.

1.12 Coalition Senators also note the evidence from CSIRO that:

The June 2016 CSIRO Report (released during 2017) includes the last two years of measurements (2015 and 2016) and a complete statistical analysis of all the data for both the KM and the ASD photospectrometers instruments. This also includes data for three new sites that were incorporated into the BRATWG monitoring program in 2014 and so the June 2016 CSIRO Report also includes three years of data for these sites....The June 2016 CSIRO Report provides statistical testing for the threeway interaction of trends over time on background and engraving at northern and southern sites...³

1.13 Further, the focus on one company, Yara Pilbara, appears an over-reaction given the committee has heard that whilst nitrogen and sulphur dioxide emissions pose the most significant risks to rock art—Yara Pilbara operations will contribute just over 2 per cent of nitrous oxide (NO_x) and 14 per cent of sulphur oxide emissions on the Burrup Peninsula.

1.14 Coalition Senators further note that the monitoring undertaken by the CSIRO since 2004 indicates that industrial emissions have had no measurable impact on rock art.

- Historical modelling carried out for the TAN Plant environmental approval predicted a maximum dry deposition rate of 68 mill equivalents/m²/year from a combination of plant emissions and background concentrations.
- The CSIRO identified a critical loading value of 200 mill equivalents/m²/year, below which harmful impacts to rock art were unlikely to occur. The CSIRO critical value was derived from consideration of a range of ecosystem sensitivities to acid deposition published by Cinderby, et al, 1998, with the relatively high value assigned on the basis of CSIRO's conclusion that Burrup ecosystem is relatively insensitive to acid deposition.

Professor John Black report

1.15 The committee was presented with a considerable number of claims and/or statements made by Professor John Black and others regarding the scientific credibility of this monitoring; specifically that:

- the 2007 fumigation studies conducted by CSIRO suffered poor experiment design through an inadequate selection of rock samples, and inadequate replication;
- the 2008 air pollution study incorrectly used a study by Cinderby et al to conclude that the critical load for the Burrup rocks would be 200 meq/m²/year;

3 CSIRO, *Answer to question on notice No. 2*, Public hearing, 17 November 2017, p. 14.

- the analysis of rock art monitoring conducted between 2004–2014 did not include adequate statistical analysis, and further the measurements taken were unreliable due to the equipment used.

1.16 Coalition Senators note the majority of claims and statements made by Professor Black and others as to the risk and/or actual degradation of rock art are not supported by scientifically valid evidence. Overall, the majority of claims and/or statements made by Professor Black and others about risks of/or actual damage are not supported by evidence from well-designed technical studies and investigations. As such, it is not possible at this time to conclude with adequate certainty that damage to rock art has or has not occurred from industrial emissions.

1.17 When presenting his theories to the inquiry, Professor Black proposed a critical loading value of 25 milliequivalents/m²/year as appropriate for protection of rock art from atmospheric emissions. The proposed critical loading value provided by Professor Black has not been validated by field studies, and represents the lowest of the sensitivity classes assigned by Cinderby, et al, 1998.

1.18 While it is acknowledged that there is criticism regarding the validity of the methodology used by the CSIRO, we note that improvements to any methodology do not imply that the current or previous methodology is flawed. As it is the nature of the scientific method that as knowledge is gained through experimentation, new knowledge provides the data to allow further refinement and improvement of the methodology, as can be reasonably argued that has occurred with this research. This is noted in the CSIRO's opening statement where Dr Helen Cleugh affirmed that 'our research undertaken in relation to the Burrup Peninsula rock art is no exception and was the first of its kind worldwide'.⁴

1.19 Coalition Senators note that the CSIRO measurements of rock surface pH and mineral dissolution suggest a decrease in pH has occurred since industry commenced operations on the Burrup, with an associated increase in dissolution of Mn and Fe in the patina. However, that work has not established a direct link between emissions from industrial sources and in particular Yara operations, and risks or actual damage to rock art. In addition, the relationship of acid deposition as measured from gases and deposition samples to changes in rock art has not been established and the appropriate critical loading has not been determined.

1.20 We also note that Professor Black's submission also addresses the health and safety effects of additional pollution from the TANPF, including nitrite poisoning, carbon monoxide poisoning, and risks of an ammonium nitrate explosion. None of these claims are supported by scientifically valid evidence.

1.21 Further, attempts have been made during various stages of the inquiry to question the safety of the new \$1 billion Yara Pilbara technical ammonium nitrate

4 Dr Helen Cleugh, Director, CSIRO Climate Science Centre, CSIRO, *Committee Hansard*, 17 February 2017, p. 23.

(TAN) plant; however, it has been pointed out that the product produced at the Yara Pilbara site is equivalent to a fertiliser grade ammonium nitrate held at suburban hardware stores across Australia.

1.22 Coalition Senators are deeply concerned that in ignoring expert, peer reviewed scientific advice and the findings of a decade of scientific research, the majority report will only serve to unjustifiably support the intention of a small minority who wish to stop the development of the TANPF.

Dr Rob Gillett report

1.23 The committee received commentary in relation to a CSIRO paper published in September 2008 entitled 'Burrup Peninsula Air Pollution Study, 2004/2005 and 2007/2008' by Dr Rob Gillett and the reference of that report in government approvals of industry activities.

1.24 The committee heard evidence from an author of a 1998 scientific report that was referred to by Gillett (Cinderby, S. et al)⁵. Dr Kuylenstierna told the committee that his work 'was not designed to look at the impact on rock art and I felt it was worth making clear that I do not think that this is appropriate to use as evidence in this case'.⁶

1.25 Coalition Senators note that the commentators on the Gillett 2008 paper limited their criticism to one aspect of the report and did not call into question the rest of that report. In response to questions as to the Gillett 2008 paper, Dr Kuylenstierna's evidence included:

I understand that the actual reference to our work was one paragraph in a much larger report, so I am not commenting on the work of the larger report which, as far as I understand it, was related to the atmospheric processes and measurements in the region.⁷

I understand that the CSIRO report was talking about some of those aspects. I did not read it in detail; just the bits about the use of our work in terms of the likely impact of acidic deposition on the rock art.⁸

And further:

CHAIR: That is fine. CSIRO is our pre-eminent Australian scientific body and it has a very good reputation internationally. Do you think this reflects badly on CSIRO's reputation?

5 Cinderby, S., Cambridge, H.M., Herrera, R., Hicks, W.K., Kuylenstierna, J.C.I., Murray, F. and Olbrich, K., *Global Assessment of Ecosystem Sensitivity to Acidic Deposition*. 20 p. + map. ISBN: 91 88714 58 6, 1998.

6 Dr Johan Kuylenstierna, *Committee Hansard*, 17 February 2017, p. 1.

7 Dr Johan Kuylenstierna, *Committee Hansard*, 17 February 2017, p. 2.

8 Dr Johan Kuylenstierna, *Committee Hansard*, 17 February 2017, p. 3.

Dr Kuylenstierna: I do not think I can say that because I have not studied all the literature that you have got. I have met with many colleagues at CSIRO and they are good scientists. I cannot comment, because I have not studied all of the literature that you have available.⁹

1.26 In relation to Gillett 2008, Professor Black opined:

...and that is that at the end of his paper...he misinterpreted by saying that he believed that the Burrup rock would withstand 200 milliequivalents of the highest acid load, but he had no justification for that because of the things we have talked about—because he did not measure buffering capacity

But also, in relation to the rest of Gillett 2008, Professor Black stated: 'which was a good paper and scientifically well done...'¹⁰

1.27 Coalition Senators note that CSIRO representatives were challenged as to 'whether the Gillett report should be withdrawn or amended in the light of that evidence?'. Coalition Senators note the evidence from CSIRO that:

We have not come to the view in any way, shape or form that there's any reason for us to withdraw that scientific publication of a decade or so ago. We recognise that that is one of the pieces of evidence that have been used in the subsequent process. We have no reason to believe that the original paper—which was the views of the authors and went through a peer review at the time—was inappropriate at the time. And obviously it's the evolution of the scientific understanding of the area which will determine whether or not it continues to be appropriate for that to be considered, including in the opinions of those people who are responsible for making the appropriate decisions around approvals et cetera.¹¹

And further:

I just repeat my evidence: we do not have a scientific basis to consider that that report has been withdrawn in any way, shape or form. We make the observation that it's in the public domain and people can draw their own conclusions. Indeed, it's clear that there's free commentary in relation to the matter.¹²

1.28 Coalition Senators consider that judgements as to the rigour of technical interpretations and conclusions drawn in the scientific literature are a matter for the consideration and judgements by scientific experts.

9 Dr Johan Kuylenstierna, *Committee Hansard*, 17 February 2017, p. 4.

10 Professor John Black, *Committee Hansard*, 17 February 2017, p. 19.

11 Dr John Steele, *Committee Hansard*, 17 November 2017, pp. 13–14.

12 Dr John Steele, *Committee Hansard*, 17 November 2017, p. 14

Adequacy of existing regulatory approvals and compliance

1.29 While the Burrup Peninsula is the location of rock art (petroglyphs) of major archaeological and cultural significance, it also shares its location with several industrial complexes including a major iron ore port, liquefied natural gas production, salt production, ammonia plant (fertiliser production) and a technical ammonium nitrate plant (TAN Plant).

1.30 The inquiry heard that successive Western Australian governments have pursued a long-term vision of transforming the Burrup Peninsula into the largest industrial precinct in the southern hemisphere, attracting foreign investment and royalties. As such, The Burrup Strategic Industrial Area (Burrup SIA) was developed to provide an area for industry in close proximity to gas, port and other key infrastructure.

1.31 As such, the industrial facilities on the Burrup Peninsula operate under a myriad of different state and federal approvals, including and not limited to:

- *Environmental Protection Act 1986 Part IV (WA)*
- *Environmental Protection Act 1986 (EP Act) Part V (WA)*
- *Aboriginal Heritage Act 1972 (WA)*
- *Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)*
- *National Environment Protection Council Act 1994 (Cth).*

1.32 Environmental approval under the EPBC Act was granted in September 2011, under then ALP Minister Tony Burke. The approval obtained under the EPBC Act sets out the required monitoring program for rock art sites, which includes a system for identifying and responding promptly to any changes in rock art.

1.33 The Western Australian Department of Environmental Regulation (DER) undertakes environment regulation functions under Part V of the EP Act. This agency has principal responsibility for licensing, approvals, compliance and enforcement in relation to emissions and discharges.

1.34 To ensure protection of the values of the Dampier Archipelago (including Burrup Peninsula) National Heritage Place, Yara Pilbara Nitrates has been required to submit both construction and operational environmental management plans which detail management measures for air quality and dust, water quality, erosion control and storm water, waste and traffic. Separate Aboriginal Heritage and Hazardous Materials management plans are also required.

1.35 In August 2002 the Western Australian Government established the independent Burrup Rock Art Monitoring Management Committee (BRAMMC). In 2003 the BRAMMC commissioned a number of studies to monitor the petroglyphs on the Burrup Peninsula. They included air dispersion modelling studies, air quality and

microclimate; colour change, dust deposition and accelerated weathering study and mineral spectroscopy carried out by CSIRO.

1.36 In 2009, BRAMMC reported to the Minister for the Environment that concentrations of air pollutants on the Burrup Peninsula were generally very low with the exception of atmospheric dust. It is important to note natural sources of emissions in the Pilbara region are also substantial, and that in the case of the Burrup Peninsula these natural sources include the land surface dust as a result of the semiarid environment and marine salts from the adjacent coast.

1.37 BRAMMC concluded from these studies there was no scientific evidence to indicate there was any measurable impact of emissions on the rate of deterioration of the petroglyphs. BRAMMC recommended monitoring of the colour contrast and spectral mineralogy be continued on an annual basis for ten years and be reviewed after five years. The Minister for the Environment accepted these recommendations and subsequently this committee was replaced by the Burrup Rock Art Technical Working Group (BRATWG) in 2010.

1.38 BRATWG completed its five-year term of engagement in 2016 and has drafted its findings and recommendations to the WA Minister for Environment. BRATWG concluded there is no scientific evidence indicating any measurable impact of industrial emissions on the rock art on the Burrup over the period 2004 to 2014. It was recommended monitoring of rock art using the CSIRO developed method continue on an annual basis to provide an early warning of any possible impacts to rock art from industrial emissions and BRATWG continue for another five year term.

1.39 Coalition Senators note that the new Labor WA Environment Minister Stephen Dawson released a draft Burrup Rock Art Strategy in September 2017 which was open for public comment to 1 December 2017. The draft strategy recommends establishing a Burrup Rock Art Stakeholder Reference Group to oversee the design and implementation of the strategy.

1.40 Coalition Senators also note that the failure to replace BRATWG in a timely manner leaves Yara with no approved mechanism in place under which monitoring can occur, as the approved heritage monitor, the CSIRO, will not carry out monitoring for Yara to allow the company to meet its compliance requirements.

Best practice monitoring

1.41 The inquiry heard that in addition to Commonwealth and State approvals and conditions, Yara Pilbara has actively sought to include what is known in industry as best available techniques (BAT) in the company's Burrup operations.

1.42 Yara Pilbara has incorporated best practice control technology in the design and construction of the TAN plant which reduces the emission of NO_x and N₂O gases by up to 90 per cent.

1.43 Emission concentrations of ammonia and ammonium nitrate dust from the TAN plant are predicted to be below the levels stated in the Fertilizers Europe and European Commission best practice guidelines. These guidelines represent the benchmark in best practice for industry on a global scale.

1.44 Yara has advised that emission monitoring during commissioning runs at the TAN plant show that the facility will run well below the required emission levels as set by the State and Commonwealth.

1.45 Since taking over as operator of the existing ammonia plant, Yara has carried out equipment enhancements, increased maintenance activities and several process improvements.

1.46 Coalition Senators acknowledge that Yara Pilbara Nitrates has received caution and infringement notices including:

- 7 June 2016 – Caution Issued to Yara Pilbara Nitrates (YPN) due to:
 - (a) missed deadline for annual compliance report and management plans unavailable on YPN website (Plans had previously been published but website was under maintenance at the time/compliance report submitted late to YPN by project EPBC contractor)
 - (b) Rock art monitoring report delayed (Release of CSIRO report to Yara Pilbara delayed by DER).
 - (c) Annual compliance report required under Condition 3 of EPBC approval provided to DoEE on 6 October 2016
- 10 May 2017 – Letter from DoEE containing Infringement Notice for \$10,800 for late submission of the Annual Compliance Report (Condition 3).
- 24 August 2017 – 2nd Infringement issued carrying fine of \$12,600 due to lack of monitoring for total suspended particulates (TSP). Yara Pilbara had informed DoEE at a meeting on 8 February 2017 that a review of the offsite air monitoring data had identified deficiencies. YP had subsequently, with regular updates to DoEE, developed a Baseline Model to satisfy compliance with the TSP monitoring requirement as per Condition 9 of the EPBC approval.

Cultural and heritage value protections

1.47 Coalition senators strongly support and recognise the cultural and spiritual significance of petroglyphs to Aboriginal people, and that Murujuga, also known as the Burrup Peninsula is a sacred place for the five traditional owner groups: the Ngarluma, the Mardudhunera, Wong-Goo-Tt-Oo, the Yaburara, and the Yindjibarndi, who are collectively represented by the Murujuga Aboriginal Corporation (MAC).

1.48 Given the cultural and spiritual significance of the petroglyphs to the traditional owners, Coalition Senators remain concerned over the lack of engagement, consultation, and inclusion of the Murujuga Aboriginal Corporation in the committee's

inquiry. Ms Raelene Cooper, Chairperson of MAC, stated during hearings on 20 April 2017:

On behalf of Murujuga, I want to express our frustration and disappointment to you due to the lack of any advice to, consultation with or involvement by MAC at any stage in the Senate committee's inquiry.¹³

1.49 In addition, MAC also expressed its frustration with the actions of the Friends of Australian Rock Art (FARA), and their lack of collaboration with Traditional Owners. Ms Cooper stated:

In relation to this inquiry, we have received very little advice in relation to the potential damage that may be caused by industrial emissions to our rock art. We did receive a presentation from the Friends of Australian Rock Art, FARA, in 2016 expressing their view that damage was occurring now and would increase in the future. However, we are not scientists or chemical engineers. We have also had a variable relationship with FARA. In our opinion, they have treated us paternalistically—more or less telling us what we need to do rather than respecting or listening to our views. On occasion, they have not adhered to our cultural protocols and displayed sacred images on their website and in other literature. Lately, to their credit, they have shown some remorse and understanding, and I am hopeful that we may work or share a collaborative relationship into the future.¹⁴

Conduct of Friends of Australian Rock Art and Bob Brown Foundation

1.50 Coalition Senators note with concern that while the rock art of the Burrup Peninsula was assessed as meriting World Heritage listing in the 1980s, the push for World Heritage Listing comes not from the Traditional Owners, but from two outside, non-Aboriginal groups; FARA and the Bob Brown Foundation.

1.51 On 17 February 2017 Ms Judith Hugo, Co-convenor, Friends of Australian Rock Art, and Ms Christine Milne, Spokesperson for the Bob Brown Foundation provided evidence to the committee regarding their respective organisation's involvement in the World Heritage Listing of the Burrup Peninsula.

1.52 According to Ms Hugo:

Friends of Australian Rock Art was established in 2006; we are a voluntary, not-for-profit organisation..

Since the Yara Pilbara TAN plant was conceived we have had huge anxiety about the effects of industrial emissions on the rock art, and since 2010 we have focused more on direct meetings with industry and government...The

13 Ms Raelene Cooper, Chairperson, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 2.

14 Ms Raelene Cooper, Chairperson, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 2.

one in April last year was particularly to emphasise the need for World Heritage listing to prevent further industrial expansion.¹⁵

1.53 According to Ms Milne:

The Bob Brown Foundation has a long history of support for World Heritage and World Heritage sites...and believes that the petroglyphs of the Dampier Archipelago—including the Burrup Peninsula, which is a national heritage-listed site—should now be nominated for World Heritage listing.

The Bob Brown Foundation is very concerned about the industrial emissions that are already covering the area but, furthermore, that the proposed emissions from the TAN plant will tip it over and we will now see a loss of those petroglyphs within a generation or two.

The view of the Bob Brown Foundation would be that no further heavy industry be permitted, that the TAN plant be moved—it is a modular plant; they have said very clearly that those five modules were built offshore and brought here onto a foundation that could be moved to the Maitland estate—and that all of the other areas that have already been zoned for industry but not allocated to a specific industry be revoked. So you would end up with no further heavy industry and you would have the Burrup as a World Heritage area and you would have the Maitland industrial estate being where further development would be.¹⁶

1.54 When asked about the level of engagement with Traditional Owners over the World Heritage Listing, Ms Hugo stated:

As I mentioned earlier, we had specific a meeting with the Murujuga Aboriginal Corporation in April last year spelling out to them why World Heritage listing was so important to stop further industrial expansion on the Burrup. They went away very enthused about it but, unfortunately, some of the people within MAC were not that keen. It is thought that large industrial interests are possibly offering them financial support particularly, in terms of building the Murujuga Living Knowledge Centre and that one of the underlying conditions, perhaps, is that they are not that keen on World Heritage listing.¹⁷

1.55 Ms Milne responded:

I have not been working on this campaign for a long time, but in November I went up to Karratha and the area and met with Mr Wilfred Hicks, who is an Aboriginal elder in the area. He is supportive of World Heritage listing, but it was fairly clear in what he had to say that a lot of the Aboriginal

15 Ms Judith Hugo, Co-convenor, Friends of Australian Rock Art, *Committee Hansard*, 17 February 2017, p. 42.

16 Ms Christine Milne, Spokesperson, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 42.

17 Ms Judith Hugo, Co-convenor, Friends of Australian Rock Art, *Committee Hansard*, 17 February 2017, p. 44.

people do not yet understand what World Heritage listing would mean or what the nature of the management that might be developed as part of a World Heritage management plan would be.¹⁸

1.56 Coalition Senators note the following comments when asked if the local Aboriginal community does not support World Heritage listing:

Ms Hugo: Not exactly the whole Aboriginal community. There are individuals within the community who are very for it. But, officially, the Murujuga Aboriginal Corporation, or the circle of elders, has been reluctant to commit to World Heritage listing. We feel that there are possibly influences within the organisation which are trying to downplay the importance of World Heritage listing, because it was claimed that they have not been exposed or given workshops on it—but we have specifically been up there to promote World Heritage listing...¹⁹

Ms Milne: If I could just add to that..I think it is a case where some of the elders are in favour of it, and others are unsure because they do not know what it means...²⁰

Dr Mulvaney: I have attended a meeting of the Murujuga board, at which they voted for nomination for World Heritage. That occurred four years ago. The CEO at the time was opposed to World Heritage and did not progress that. I have attended three meetings of what is known as the circle of elders, the senior representatives of the native title groups, at MAC meetings, at which, again, they have specifically stated support for World Heritage. Again, there are certain staff of MAC who come from a different area and are not supportive of World Heritage and, despite agreement for it, have stymied it. There are individuals who have come here as Aboriginals to speak to federal ministers in support of World Heritage requesting action...²¹

1.57 Coalition Senators note with concern the comment made from MAC Board Member Mr Peter Hicks when asked if he had been consulted at all by anyone about heritage listing.

We have not had anybody come in and sit at the board table with us and talk with us about what is going on here. There are a lot of people running around the parliament, and everywhere else, that we hear about but there is nobody coming to sit down and talk with us...²²

18 Ms Christine Milne, Spokesperson, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 45.

19 Ms Judith Hugo, Co-convenor, Friends of Australian Rock Art, *Committee Hansard*, 17 February 2017, p. 46.

20 Ms Christine Milne, Spokesperson, Bob Brown Foundation, *Committee Hansard*, 17 February 2017, p. 46.

21 Dr Ken Mulvaney, *Committee Hansard*, 17 February 2017, pp. 46–47.

22 Mr Peter Hicks, Board Member, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 7.

1.58 Comments echoed by MAC CEO Mr Craig Bonney who, when asked if the elders council had a formal position on World Heritage Listing, stated:

The short answer is no. We have not discussed it at a board level and formed a view. Again, that is related to that lack of information and awareness. We believe in making informed decisions at the board level, and, because we have not got the information, we have not discussed it.²³

1.59 Coalition Senators also note with concern comments made by Mr Bonney regarding past incidents between elders and FARA:

For us, culture is really, really important. We have to abide by certain cultural protocols and parameters. There are things we can and cannot do. Images of the petroglyphs themselves have significant meaning. Some of those are only to be seen by certain people who have been through certain levels of Aboriginal law. I cannot see many of those things as the CEO because I have not been through law. So when we have not only Friends of Australian Rock Art but others who wish to use images, sometimes they go on the internet and find images which in our view should not be on the internet or should not be seen by anyone. Sometimes they will use those images on their website as part of their promotional material or whatever. On a couple of occasions we have asked the Friends of Australian Rock Art to remove those images because you cannot be our friend on one hand and disrespect our culture on the other. We have had those conversations and, to their credit, we have seen those images removed of late, which is great.

Sometimes we have external stakeholders come and speak to our elders. I have been working with Aboriginal people for more than 25 years right across northern Australia and the Pilbara, and what I find is we get a lot of stakeholders who, without meaning to, talk down to Aboriginal people or talk to Aboriginal people as though they are—it is difficult to describe the word—of lesser understanding or capability. What happens is the dominant people who have the intelligence tend to portray their views down to those people. Those people are often not in a position to question or really understand what the message or the conversation is all about. Their views are then seen as the only views—the dominant views—that must be adopted by the mob. I have seen a couple of instances of that where people come along and talk to us from that perspective...²⁴

1.60 We also note that throughout the committee process, the over-zealousness of FARA and the Bob Brown Foundation in attempting to criticise Yara Pilbara and other industry has resulted in claims made to the committee which were based on hearsay, specifically inferring 'strings attached' financial inducements had been offered to traditional owners.

23 Mr Craig Bonney, Chief Executive Officer, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 7.

24 Mr Craig Bonney, Chief Executive Officer, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 6.

1.61 Coalition Senators note the comment made by Ms Hugo when asked if any there is any evidence of inducements, financial or otherwise, that have been offered to the Aboriginal community, to not support World Heritage listing:

Not directly, no. But I do know that Yara Pilbara—from reading their submission—have offered to support the community financially with their living knowledge centre, and the current thinking by the Western Australian government is that the centre would be better placed in the northern Burrup, away from industry. That, we know, is precisely what people like Wilfred Hicks and other Aboriginal custodians do not want to happen. They would prefer it to be at Hearsons Cove, where it has always been planned, right next to Deep Gorge. That is just one piece of information we have had to hand recently.

We feel it is very important to go back again and speak to the custodians, but we are meeting with considerable negative feeling from Murujuga Aboriginal Corporation; put it that way...²⁵

1.62 Coalition Senators note with concern the statement from Mr Bonney when questioned over the validity of FARA's claim that there was an underlying condition that financial support for the living knowledge centre was contingent that the corporation not support World Heritage listing:

I have read that statement. I actually watched it live when it was occurring. I have responded in writing directly to the people who made that statement and pointed out our issues with that. That statement undermines our credibility as an organisation and almost suggests that we are open to taking inducements to form various views. We take no inducement from anybody in how we manage and protect our country and our Murujuga.

We have dealt with them directly. They have responded and very apologetically withdrawn from that position, to their credit. However, it was deeply offensive at the time. We do not and have not ever had a discussion with any industrial partner or stakeholder in forming a view around World Heritage listing. We certainly have not had a conversation where any talk of financial inducement or incentive was ever discussed. I can state that for the record.²⁶

1.63 Coalition Senators note with concern the statement from Mr Hicks when questioned over the validity of FARA's claim that there was an underlying condition that financial support for the living knowledge centre was contingent that the corporation not support World Heritage listing:

25 Ms Judith Hugo, Co-convenor, Friends of Australian Rock Art, *Committee Hansard*, 17 February 2017, p. 45.

26 Mr Craig Bonney, Chief Executive Officer, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 7.

The only financial benefit to the cultural centre is what has been placed into the BMIEA agreement and that would be a part of the building of that cultural centre. There has been no other conversation around that.²⁷

1.64 Coalition Senators also note with concern comments contained in a letter to the Committee Secretary dated 27 February from Dr Mary Edmunds, refuting Ms Hugo's statement to the committee. In particular that:

Whatever Ms Hugo's intention—and she was not present at the 2016 Roeburne meeting—the implication was that Yara's offer of funding was intended to influence MAC improperly...This would be an inaccurate and misleading interpretation of Yara's offer. It would also have the potential to undermine the achievements to date of the National Heritage Listing of the area, of the establishment of the Murujuga National Park, and of other relevant stakeholders in progressing a supportive and inclusive approach to the future preservation of Murujuga, its invaluable rock art, and the continuing culture of Traditional Owners and Custodians.²⁸

Conclusion

1.65 Coalition Senators note that significant factors, including failure to consult with the Murujuga Aboriginal Corporation, have been excluded from both the committee's Terms of Reference and Final Report, in favour of a number of claims about the negative impacts of emissions from one company, Yara Pilbara, on the Burrup Rock Art that are unsubstantiated by scientifically valid evidence. This is to the detriment of a full and proper consideration of the important and relevant issue of the Commonwealth's responsibility under the *Environment Protection and Biodiversity Conservation Act 1999* to protect the globally significant and National Heritage listed Aboriginal rock art of the Burrup Peninsula.

Senator Jonathon Duniam
Deputy Chair
Senator for Tasmania

Senator Dean Smith
Senator for Western Australia

27 Mr Peter Hicks, Board Member, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 7.

28 Dr Mary Edmunds, Correspondence dated 27 February 2017.

Labor Senators' additional comments

1.1 Labor Senators acknowledge that Murujuga, also known as the Burrup Peninsula and Dampier Archipelago, is home to one of the largest and the oldest collections of rock art in the world.

1.2 The petroglyphs document human presence in the area over an estimated 45,000 year timespan—the longest continuous production of rock art in the world.

1.3 It is without doubt that the petroglyphs are of immense and irreplaceable cultural and spiritual significance to Aboriginal people, and are of equally immense national and international archaeological and heritage value.

1.4 Labor Senators sincerely thank the Murujuga Aboriginal Corporation for their participation in this inquiry. The Murujuga Aboriginal Corporation represents the five traditional owner groups: the Ngarluma people, the Mardudhunera people, the Yaburara people, the Yindjibarndi people, and the Wong-Goo-Tt-Oo people. We pay respect to the traditional owners and custodians of Murujuga, their continuing connection to this land, and their right to a place of honour in our constitution and a full and equal share in our nation's future. Community control and direct involvement of Aboriginal and Torres Strait Islander peoples in the planning and delivery of programs and services is vital.

1.5 Labor is committed to building a relationship where Aboriginal and Torres Strait Islander peoples and communities are the architects of their place in Australia and are equal partners with government in the development and implementation of policies that affect their way of life and livelihoods. Land and water are the basis of Aboriginal and Torres Strait Islander spirituality, law, culture, economy and wellbeing. Native Title and land rights are both symbols of social justice and a source of valuable economic opportunity for Aboriginal and Torres Strait Islander Australians.

1.6 Labor believes in the absolute necessity of free, prior and informed consent for Aboriginal and Torres Strait Islander peoples and communities in resource management and conservation decisions. This right is guaranteed under the UN Declaration of the Rights of Indigenous Peoples, which Australia has ratified. Any decisions which pre-suppose an outcome of a community-led process do nothing to protect precious sites and set back Indigenous development. Labor supports the investigation and nomination of areas suitable for future listing in cooperation with traditional owners, state and territory governments and other stakeholders, including industry.

1.7 Labor Senators thank all organisations and individuals that made submissions to this inquiry and gave evidence at hearings, and the Secretariat for their ongoing research and administrative support.

Indigenous-led progress

1.8 Labor Senators note with concern the evidence from the Murujuga Aboriginal Corporation that they have been 'left out a lot regarding the Burrup'.¹ This is with respect to the joint management plan of the Murujuga National Park with the Western Australian Government, including no consultation on World Heritage listing with the current board, no consultation or advice on alleged or potential damage to the petroglyphs from vandalism or pollution, and feeling like a 'subcontractor' in terms of reporting requirements.² Further, unlike other WA national park rangers, the Murujuga rangers are employed by the Murujuga Aboriginal Corporation and hold no enforcement powers.

1.9 Labor Senators consider that as an immediate priority, the Western Australian Government and the Australian Governments must formally consult with the Murujuga Aboriginal Corporation and Murujuga Circle of Elders.

Recommendation 1

1.10 Labor Senators recommend that prior to any future steps in securing protection for Murujuga, or undertaking further decisions relating to resource activities in the region, the Western Australian Government and Australian Government must formally consult with the Murujuga Aboriginal Corporation and Murujuga Circle of Elders, which represent the five traditional owner groups in the region. Such consultation should be conducted on terms set by the Murujuga Aboriginal Corporation and Murujuga Circle of Elders.

Indigenous-led World Heritage Listing

1.11 Labor Senators note with concern the evidence from the Murujuga Aboriginal Corporation that none of the current board and only a small number of elders participated in discussions on World Heritage listing eight to ten years ago. Further, we note concerns from the Murujuga Aboriginal Corporation that World Heritage listing may lead to changes or a reduction in the ability for the Murujuga Aboriginal Corporation to manage the area.

1.12 Labor Senators note that the Australian Heritage Council reported in 2011 that the rock art collection represents a masterpiece of human creative genius and is one of the most exciting and significant collections of rock engravings in the world.

1.13 Labor Senators urge that any consideration of World Heritage listing for Murujuga is led by the traditional owners of Murujuga.

1 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 5.

2 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 5.

Recommendation 2

1.14 Labor Senators recommend that, if agreed by the Murujuga Aboriginal Corporation, it be provided funding to consult on the potential to seek listing of Murujuga on Australia's Tentative World Heritage List. If a listing is agreed, that the Murujuga Aboriginal Corporation be assisted by the Western Australian and Australian Governments to prepare a tentative listing.

Recommendation 3

1.15 If a Tentative listing is agreed by traditional owners, and Murujuga is placed on the Tentative World Heritage list, Labor Senators recommend that the Australian Government and the Western Australian Government work together to resource traditional owners to prepare a nomination of Murujuga for World Heritage listing.

Indigenous ranger support

1.16 Labor Senators note with concern the evidence from the Murujuga Aboriginal Corporation that unlike other WA national park rangers, the Murujuga Indigenous Rangers hold no enforcement powers and must refer matters to the Department of Parks and Wildlife. These Indigenous Rangers 'can tell people what they should and should not do, but they simply have no power to move them on, to make them cease or to issue fines or whatever'.³ The Murujuga Aboriginal Corporation officials continued:

Mr Bonney: We have got traditional owners who are rangers on their own country seeing people do the wrong thing, and they have no power to move them off their own country.⁴

Ms Cooper: Also, it does not protect our rangers if there is any kind of conflict with individuals who may be partying out on the beach or whatnot. It can get quite horrific. Things can happen. It is something that we need to protect them as well as individuals who visit the Burrup.⁵

1.17 Ms Cooper from the Murujuga Aboriginal Corporation stated that 'one of our worst fears is the graffiti'. Ms Cooper continued:

Our rangers are out patrolling all the time and they see a lot more and they report and input into a data system that we have set up. Basically, everything is recorded through Murujuga from Murujuga's point of view. We are not experts in chemicals and whatever but it would be fantastic to

3 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 4.

4 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 4.

5 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 4.

have that information and then see how we can deal with any potential hazards that are affecting our rock art.⁶

1.18 Labor Senators recognise the vital work of the Murujuga Indigenous Rangers in managing and protecting the Murujuga. We urge the Western Australian Government and Australian Government to ensure the Murujuga Indigenous Rangers have the resources and enforcement powers to best manage and protect the Murujuga.

Recommendation 4

1.19 Labor Senators note the vital work that is undertaken by the Murujuga Indigenous Rangers and the importance of ensuring that the area is protected from physical destruction and vandalism. Labor Senators recommend that the Murujuga Indigenous Ranger program be given appropriate funding by both the Australian Government and the Western Australian Government. In particular, the Murujuga Rangers must be granted the power to undertake the same enforcement activities as state-employed rangers and must be engaged by the state and Commonwealth governments on any monitoring and research work.

Tourism

1.20 Labor Senators note the Murujuga Aboriginal Corporation and the Western Australian Government are undertaking a comprehensive feasibility study, which commenced in early 2014, for a proposal to site a multi-purpose Murujuga Living Knowledge Centre in or near the park.⁷

1.21 The Murujuga Aboriginal Corporation expressed an interest in locating the Living Knowledge Centre at Conzinc Bay at the northern end of the Burrup Peninsula.⁸ Conzinc Bay is a preferred site as there is no industrial development near Conzinc Bay, and a section of land identified for future industrial use could house the Centre and be incorporated into the national park. The Murujuga Aboriginal Corporation has requested that additional costs related to relocation to Conzinc Bay be met by the Western Australian Government.

1.22 The Murujuga Aboriginal Corporation acknowledged that this proposal would require road access to Conzinc Bay. It was argued that improved road access is likely to also benefit the environment through improved controls on access:

The core reason for us to relocate to that site is that it gives us a better opportunity to protect the environment and to control the traffic on the road.

6 Ms Raelene Cooper, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 4.

7 Parks WA, <https://parks.dpaw.wa.gov.au/sites/default/files/downloads/parks/20140778%20MurujugaNP%20Bro%20WEB.pdf>.

8 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, pp. 7–8.

All of the visitors that come to the park must come to the cultural centre and be made culturally aware of the environment they are visiting, which we hope will mitigate the damage and prevent the desecration that occurred in the past.⁹

Part of the road design and management will be that there is one road in and one road out, and all of the side tracks will be blocked off. That better protects the country as well. That is part of the plan. We are there fundamentally for the protection of that environment, and that is what this thing will do.¹⁰

1.23 The City of Karratha costed the road upgrade at \$6 million and expressed a willingness to contribute financially to the upgrade.¹¹

Recommendation 5

1.24 Labor Senators commend the Murujuga Aboriginal Corporation, the Western Australian Government and the City of Karratha, for their collaborative efforts to improve tourism and road infrastructure at Murujuga. Labor Senators recommend that the Western Australian Government should make a significant contribution to the Living Knowledge Centre and road upgrade to Conzinc Bay as well as continue to improve support to the Murujuga Aboriginal Corporation for the ongoing development of tourism on the Burrup Peninsula.

Monitoring

1.25 Industry on the Burrup Peninsula is subject to regulation by both state and Commonwealth legislative frameworks. As such, the TANPF was approved with a number of conditions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These conditions include the requirement for an air monitoring program, and a spectral mineralogy program to be implemented.

1.26 The committee received evidence which indicated major flaws in the work undertaken by CSIRO on behalf of the Western Australian Government. This work has been used to establish approval conditions for the TANPF, and by proponents who argue that industry on the Burrup Peninsula has not resulted in damage to the rock art collections.

9 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 8.

10 Mr Craig Bonney, Murujuga Aboriginal Corporation, *Committee Hansard*, 20 April 2017, p. 10.

11 Councillor Long, City of Karratha, *Committee Hansard*, 20 April 2017, p. 11.

1.27 This evidence included that:

- the 2007 fumigation studies conducted by CSIRO suffered poor experiment design through an inadequate selection of rock samples, and inadequate replication;
- the 2008 air pollution study incorrectly used a study by Cinderby et al to conclude that the critical load for the Burrup rocks would be 200 meq/m²/year;
- the analysis of rock art monitoring conducted between 2004–2014 did not include adequate statistical analysis, and further the measurements taken were unreliable due to the equipment used.

1.28 Professor John Black raised these concerns with both CSIRO and the Western Australian Government and proposed improvements which could be made to the work of CSIRO. As a result, in 2016 the Western Australian Government engaged an independent reviewer, Data Analysis Australia (DAA), to review the CSIRO monitoring reports and the work of Professor Black. DAA found that:

- the statistical methods proposed by Professor Black represented a substantial change in the effective monitoring of the rock art sites, and the CSIRO reports demonstrated a number of inadequacies such as a lack of statistical analysis; and
- there were significant problems with cross-calibration between measuring instruments, inconsistent error-prone data management, and clear errors in the CSIRO data. As such, the CSIRO data collected should be archived and DAA concluded that it is not appropriate for regulators to make any decisions based on that data.¹²

1.29 In 2017, DAA was again engaged to review the draft *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016* CSIRO monitoring report. It found that four of the recommendations made in 2016 to improve the monitoring program had not been implemented, one recommendation had been partially implemented and one recommendation had been largely implemented. DAA acknowledged that while the 2017 report demonstrated substantial efforts on the part of CSIRO to improve the reporting of data collection and to present better analysis, more needed to be done. It concluded that the CSIRO report was unable to dispel reasonable concerns about the impact of industry on the rock art.

1.30 As a result of the 2017 DAA review, CSIRO made a number of changes to the *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004-2016* report. CSIRO noted that this final report supersedes all previous results published by CSIRO for the monitoring program and that it implemented all the recommendations of the 2016 and 2017 DAA reviews.

12 Data Analysis Australia, *Review of Statistical Aspects of Burrup Peninsula Rock Art Monitoring*, November 2016, Executive Summary.

1.31 The *Burrup Peninsula Aboriginal Petroglyphs: Colour Change & Spectral Mineralogy 2004–2016* concluded that there has been a small but statistically significant change to the rocks in some dimensions of colour. However, the committee received evidence that this conclusion seeks to diminish the value of these colour changes. It was argued that a colour change of approximately 13 per cent over 13 years is a major change which should be of concern in the preservation of rock art.

1.32 Professor Black recently contacted the committee after examining the Western Australian Government's Commissioning Report for the Yara Pilbara Nitrates Pty Ltd Technical Ammonium Nitrate Production Facility with a colleague, Dr Ilona Box. Professor Black and Dr Box concluded that there have been numerous large emissions of nitrogen dioxide that are a serious risk to human health as well contributing to the formation of nitric acid that will increase the speed the rock art is being destroyed.

1.33 Labor Senators thank Professor John Black and his colleagues for undertaking such comprehensive reviews of the CSIRO reports, and for continuing to raise their concerns with both CSIRO and the Western Australian Government.

1.34 Labor Senators are of the view that the development and implementation of a new monitoring program should be a priority for the Western Australian Government.

1.35 In September 2017, the Western Australian Government released the Draft Burrup Rock Art Strategy which proposes to develop a revised method for the collection and analysis of data that incorporates the recommendations of the DAA review. These proposals should be implemented as soon as possible.

Recommendation 6

1.36 Labor Senators recommend the Western Australian Government prioritise the development and implementation of a new, fully funded independent monitoring program.

Recommendation 7

1.37 Labor Senators recommend that the Western Australian Government implement, as soon as possible, proposals for further monitoring included in the Draft Burrup Rock Art Strategy.

Compliance

1.38 The committee received evidence that Yara Pilbara has had a number of incidents of non-compliance with EPBC Act approval conditions. First, it failed to self-refer the TANPF proposal for assessment under the EPBC Act, and it has subsequently failed to comply with a number of its approval conditions.

1.39 The incidents of non-compliance with approval conditions include late production of annual compliance reports and rock art monitoring reports. The Department of the Environment and Energy (the department) told the committee that

it is working with Yara Pilbara to improve the capacity of Yara Pilbara to comply with its approval conditions.

1.40 In September 2017, the department also issued a directed variation to the approval for the TANPF in response to non-compliance. This variation imposed new reporting requirements, new air quality monitoring and reporting requirements, and established a requirement that the approval holder must ensure that no measurable impacts from air pollution must occur within two kilometres of the site, for the life of the approval.

1.41 Labor Senators consider such incidents of non-compliance as unacceptable, particularly in an environment where the consequences may be catastrophic to the irreplaceable rock art collection. The Department of the Environment and Energy must ensure that Yara Pilbara's compliance is improved.

Recommendation 8

1.42 Labor Senators recommend that the Department of Environment and Energy actively work with Yara Pilbara to ensure its compliance is improved.

1.43 Some submitters raised concerns that a heritage monitor should have been engaged to conduct a comprehensive survey of all rock art sites in a two kilometre radius of the Yara Pilbara site. However, Yara Pilbara only monitors six petroglyph sites in its two kilometre radius and has not conducted a survey to identify all the sites that exist in this area. Submitters argued that this sample of sites is inadequate.

1.44 However, both Yara Pilbara and the Department of the Environment and Energy asserted that the approval conditions only required the monitoring of six sites and that there had been no instance of non-compliance in this regard.

1.45 Labor Senators consider that that such a small sample is inadequate.

1.46 As the approval conditions were set by the Department of the Environment and Energy, the Australian Government should engage a Heritage Monitor to conduct a comprehensive survey to identify all rock art sites in the two kilometre radius which may be affected by emissions.

Recommendation 9

1.47 Labor Senators recommend that the Australian Government engage a Heritage Monitor to conduct a comprehensive survey to identify all rock art sites in a two kilometre radius from the site, which may be affected by emissions.

1.48 The committee also received evidence that Yara Pilbara has failed to comply with air quality monitoring requirements as established by approval conditions granted by the Western Australian Government.

1.49 In particular, submitters argued that Yara Pilbara compliance reports demonstrate non-compliance with the requirement to measure PM₁₀ particles, NH₃, NO_x, and SO_x at five sites, including three rock art sites. There are instances in the report where 'No Data' is recorded, and measurements of negative amounts of PM₁₀ particles which are arguably impossible.

1.50 Yara Pilbara acknowledged that there have been periods of time where its air quality monitoring equipment has been unavailable due to breaking down or maintenance work. Yara Pilbara also acknowledged that it has engaged an air quality monitoring consultant to conduct a review of all its air quality monitoring data and baseline data sets.

1.51 Labor Senators are concerned that Yara Pilbara has failed to comply with the approval conditions set by the Western Australian Government.

Recommendation 10

1.52 Labor Senators recommend that the Western Australian Government promptly review and assess Yara Pilbara's compliance with its approval conditions and against best practice, and take any necessary action to improve compliance.

Land-based emissions

1.53 Some submitters expressed concern that the projected increase in emissions from the TANPF would contribute to the destruction of the rock art of the Burrup Peninsula and argued that Yara Pilbara's proposed outputs of airborne ammonium nitrate particles at PM₁₀ size exceed limits which are known to be toxic to humans.

1.54 However, Yara Pilbara responded to such concerns by noting that its emissions modelling was assessed by the Western Australian Department of Environmental Regulation during the TAN Plant Works Approval application, and its PM₁₀ emissions were determined to be insignificant. Further, its carbon monoxide emissions were assessed twice by the Western Australian Department of Environmental Regulation and the Environmental Protection Authority Western Australia. It was found that the worst-case predicted ground level carbon monoxide concentrations from the operation of the TANPF were less than 0.2 per cent of the National Environmental Protection Measure and Impact Statement for Ambient Air Quality.

1.55 Labor Senators recognise the concern and the contentious evidence provided by both sides of the debate. Labor Senators consider it appropriate for the Western Australian Government to examine ways to work with industry and use environmental approvals to reduce the emission load on the Burrup Peninsula.

Recommendation 11

1.56 Labor Senators recommend that the Western Australian Government investigate and implement measures to ensure that the emission load on the Burrup Peninsula is reduced.

Shipping emissions

1.57 Labor Senators suggest that caution should be exercised in comparing operations of commercial freight and passenger cruise ships.

1.58 Nevertheless, given the risks to the rock art from sulphur dioxide, Labor Senators consider it appropriate to monitor emission loads at the Port of Dampier and, if necessary, investigate reducing sulphur emissions.

Recommendation 12

1.59 Labor Senators recommend the Western Australian Government monitor the Port of Dampier to determine if emissions from ships are impacting the values of the surrounding area. If a problem is identified, Labor Senators recommend that a transition to use of low sulphur content fuel or an approved means of achieving required emissions reductions is investigated.

Responsible development

1.60 Successive Western Australian governments have pursued a long-term vision of transforming the Burrup Peninsula into the largest industrial precinct in the southern hemisphere, attracting foreign investment and royalties. As such, the Burrup Strategic Industrial Area (Burrup SIA) was developed to provide an area for industry in close proximity to gas, port and other key infrastructure.

1.61 Some submitters argued that further development on the Burrup Peninsula will damage the rock art. However, this was refuted by other submitters.

1.62 Labor Senators consider that any further industrial development of the Burrup SIA only be pursued by the Western Australian Government under strict environmental conditions.

Recommendation 13

1.63 Labor Senators recommend that further industrial development be approved in the Burrup Peninsula only under strict environmental conditions.

Cumulative effects

1.64 The committee received evidence that under the EPBC Act, the ability for the Minister or their delegate to consider cumulative effects when undertaking an approval assessment is limited.

1.65 Submitters expressed concern that the cumulative effects of existing industry on the Burrup Peninsula may not have been considered during the EPBC approval process. Further, submitters argued that without the release of the Minister's statement of reasons, it is unclear whether or to what extent the cumulative effects are considered.

1.66 The Department of the Environment and Energy and Yara Pilbara provided evidence that the cumulative effects of existing industry on the Burrup Peninsula were considered during the approval process for the TANPF. The Department of the Environment and Energy also provided evidence that any future approvals for development on the Burrup would also include a consideration of the cumulative effects on matters of national significance.

1.67 Labor Senators consider that the improved monitoring programs outlined at Recommendations 6 and 7 will better inform the Minister for the Environment and Energy of cumulative effects.

Recommendation 14

1.68 Labor Senators recommend that the Minister for the Environment and Energy use new data and information provided by improved monitoring to consider the cumulative effects when approving decisions relating to Murujuga.

**Senator Patrick Dodson
Senator for Western Australia**

**Senator Sue Lines
Senator Western Australia**

**Senator Anne Urquhart
Senator for Tasmania**

**Senator Anthony Chisholm
Senator for Queensland**

**Senator the Hon Kristina Keneally
Senator for New South Wales**

Appendix 1

Submissions, tabled documents, answers to questions on notice, and additional information

Submissions

1	Dr Johan Kuylenstierna
2	The Chamber of Minerals and Energy of Western Australia
3	Law Council of Australia
4	Orica
5	Woodside Energy
6	Rio Tinto Iron Ore
7	Mr Brynn Mathews
8	Department of the Environment and Energy
9	Yara Pilbara
10	Dr Ken Mulvaney
10.1	Supplementary to Submission 10
11	Bob Brown Foundation
12	Ms Lyndy Scott
13	Professor John Black
14	Friends of Australian Rock Art
15	Hon Robin Chapple
16	Australia ICOMOS, the Australian Archaeological Association and the Australian Association of Consulting Archaeologists
17	Confidential

Tabled documents

Opening Statement from Ms Raelene Cooper, Chairperson, Murujuga Aboriginal Corporation (public hearing, Perth, 20 April 2017)

CSIRO Responses to 2016 DAA Recommendations from CSIRO (public hearing, Canberra, 17 November 2017)

Answers to questions on notice

CSIRO – Answers to questions taken on notice, public hearing, Canberra, 17 February 2017 (received 10 March 2017)

Yara Pilbara – Answers to questions taken on notice, public hearing, Canberra, 17 February 2017 (received 13 March 2017)

Department of the Environment and Energy – Answers to questions taken on notice, public hearing, Canberra, 17 February 2017 (received 15 March 2017)

Orica – Answers to questions taken on notice, public hearing, Canberra, 17 February 2017 (received 3 March 2017)

Law Council of Australia – Answers to written questions on notice (received 3 March 2017)

Murujuga Aboriginal Council – Answers to questions taken on notice, public hearing, Perth, 20 April 2017 (received 10 May 2017)

Professor John Black – Answers to written questions on notice (received 1 March 2017)

CSIRO – Answers to questions taken on notice, public hearing, Canberra, 17 November 2017 (received 27 November 2017)

Department of the Environment and Energy – Answers to questions taken on notice, public hearing, Canberra, 17 November 2017 (received 5 December 2017)

Correspondence

From Dr Mary Edmunds, dated 27 February 2017

Additional information

Dr Ilona Box – Worksheet on funding of rock art from Western Australian Government

Professor John Black – Response to CSIRO reports, dated 27 November 2017

Appendix 2

Public hearings

Friday, 17 February 2017 – Canberra

Stockholm Environment Institute – via teleconference

Dr Johan Kuylenstierna, Policy Director

Dr Kenneth Mulvaney – Private capacity

Professor John Black – Private capacity

Commonwealth Scientific and Industrial Research Organisation

Dr Helen Cleugh, Director, CSIRO Climate Science Centre
Dr Erick Ramanaidou, Senior Principal Research Consultant
Dr Melita Keyword, Principal Research Scientist
Deborah Lau, Research Group Leader

Yara Pilbara Fertilisers

Mr Chris Rijkssen, General Manager
Mr Brian Howarth, Health, Environment, Safety and Quality Manager

Orica Ltd

Mr Paul Evans, Vice President

Friends of Australian Rock Art – via teleconference

Ms Judith Hugo, Co-convenor

Bob Brown Foundation

Ms Christine Milne, Spokesperson

Department of the Environment and Energy

Mr Matthew Cahill, First Assistant Secretary, Environment Standards Division
Mrs Monica Collins, Assistant Secretary, Compliance and Enforcement
Mr Chris Johnston, Assistant Secretary, Heritage Branch

The Hon Robin Chapple MLC – Private capacity – via teleconference

Thursday, 20 April 2017 – Perth

Murujuga Aboriginal Corporation

Ms Raelene Cooper, Chairperson
Mr Craig Bonney, Chief Executive Officer
Mr Peter Wayne Hicks, Board Member

City of Karratha

Councillor Peter Long, Mayor

Friday, 17 November – Canberra

Department of the Environment and Energy

Mr James Tregurtha, Acting First Assistant Secretary, Environment Standards
Division
Mr David Williams, Branch Head, Heritage Branch
Ms Monica Collins, Chief Compliance Officer

Commonwealth Scientific and Industrial Research Organisation

Dr John Gerard Steele, Director, Science Impact and Policy
Deborah Lau, Research Group Leader