



Impact of Corrosion in Australasia

Review of Public Domain Publications
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Impact of Corrosion in Australasia

Summary of Australasian Research

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1 Background

The Australian Corrosion Association (ACA) is a not-for-profit association that disseminates information on corrosion and its prevention or control by providing training, seminars, conferences, publications and other activities. The ACA commissioned Resona to investigate the impact corrosion has on a range of Australia's national infrastructure assets. The ACA's mission is to reduce and mitigate the effects of corrosion in Australasia. By undertaking this report, the ACA is aiming to elevate the discussion around the timely, cost effective prevention of corrosion while highlighting the annual financial impact corrosion has on our national assets. The overall objective is to provide a resource that will help ensure corrosion is managed sustainably and cost effectively to ensure the health and safety of the community and protection of the environment.

The report should be read in association with other published data. Research from NACE International indicates that the effects of corrosion can contribute between 3.5 per cent to 5.2 per cent (average of 4.35%) of global gross domestic product. If these results are extrapolated for Australia's GDP¹, this equates to approximately \$78 billion per annum being spent on remediating assets affected by corrosion. The same study posits that using "available corrosion control practices, it is estimated that savings of between 15 per cent and 35 per cent of the cost of corrosion could be realised; i.e. between US\$375 and \$875 billion annually on a global basis.²

This report recommends that the effects of corrosion be highlighted to our national and state governments and asset owners of our numerous industrial and commercial assets.

¹ GPD in Australia, 2017 – US\$1.323 trillion (A\$1.829 trillion, exchange rate 7 December 2018 – US\$0.7233),

² International Measures of Prevention, Application and Economics of Corrosion Technologies (IMPACT) Study – 2016, NACE International, 15835 Park Ten Place, Houston, TX 77084

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2 Research Design

The objective of the research was to provide details of published papers and associated research that have been conducted into corrosion in Australasia, to provide an overview of that research, and if possible, to identify any economic impacts associated with corrosion in Australasia.

Corrosion affects many parts of our society's infrastructure. Key areas of focus for this study included:

- (1) Oil and Gas Infrastructure
- (2) Water and Waste Infrastructure
- (3) Concrete and Building Infrastructure
- (4) Any other areas that appeared in searches, without being specifically targeted. It is worth noting that Defence Infrastructure may be perceived as being relevant to this study. However, much of the material relevant to defence is unavailable to the public domain.

The research was conducted in stages, as follows:

1. Generic internet search of any websites identified through the keyword search for 'Corrosion', 'Water Corrosion', 'Waste Corrosion', 'Oil Corrosion', 'Gas Corrosion', 'Energy Corrosion', 'Effect of Corrosion', 'Corrosion Australia', and 'Corrosion New Zealand',
2. Specific targeted searches of national library websites (Trove, Australia; and the National Library of New Zealand
3. Other industry-based research centres such as the CSIRO.

The search results provided thousands of results, many of which related to products and services associated with corrosion treatment and management. Where there was no data included, these results have been excluded from this review. In addition, any results that referred to books, or to research completed prior to 2004 have been excluded. As a result, this report provides detail on research and data produced in the last 15 years. Although 'Australia' or 'New Zealand' were included in the searches, where results related to generic data that had no specific reference to Australia or New Zealand, these results have been excluded from this report.

The results of this searches have been tabulated by category. The model preferred by the ACA is for reporting to be based on the following table:

Sector	Data source	Publication	Publication Date	Author/s	Region	Quantitative Data	Qualitative Data	Corrosion management cost
Oil and Gas	Academic			XXXX et al	Australia	Y	N	

The results in this report have been grouped by Sector. That column has therefore been removed from the tables in the report. Where abstracts of relevant articles are available, these have been included in the report.

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3 Oil and Gas

Data source	Publication	Date	Author/s	Region	Quant Data	Qual Data	Corrosion management cost
Corrosion Prevention 2019	Addressing several critical issues on the mechanism CO₂ corrosion and its inhibition	2019	Thompson, P.F.	Australia	N	Y	N
Corrosion Prevention 2019	Flange face corrosion in seawater and hydrocarbon environment related to gasket material selection	2019	n/a	Australia	N	Y	N
Corrosion Prevention 2019	The probing of pipeline localized corrosion using a novel designed ring pair electrical resistance sensor array	2019	n/a	Australia	N	Y	N
Aloe Trade America	Corrosion in Oil and Gas industry: a perspective on corrosion inhibitors	2018	Rahuma, M.N and Kannan, B.	Australia	N	Y	N
Curtin University	Materials and corrosion trends in oil and gas production	2017	Iannuzzi <i>et al.</i>	Australia	N	Y	N
Oil & Gas Australia	Corrosion management in a challenging economy	2016	n/a	Australia	N	Y	Y
The Australian Pipeliner	Engineering pipeline innovation in the West	2016	n/a	Australia	N	Y	N
New Zealand Herald	Corroded Mobil oil pipe blamed for harbour spill	2015	Bateson, S.	New Zealand	N	Y	N
Australian Mining	The remote detection of oil & gas infrastructure corrosion	2015	ACA	Australia	N	Y	N
Australian Mining	The remote detection of oil & gas infrastructure corrosion	2015	ACA	Australia	N	Y	N
The Australian Oil & Gas Review	New scanning services for faster pipeline corrosion results	2015	n/a	Australia	N	Y	N
Atteris.com.au	C for cased pipelines in Shore crossings – challenges in design	2014	Claveria, <i>et al.</i>	Australia	N	Y	Y

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4 Water and Wastewater

Data source	Publication	Date	Author/s	Region	Quant Data	Qual Data	Corrosion management cost
Water New Zealand	Don't tear down this wall – renewal of a U-shaped sewer	2018	Owen <i>et al.</i>	New Zealand	N	Y	Y
Build	Our vulnerable water systems	2018	White, I	New Zealand	N	Y	N
ASSDA	Current and Emerging uses of Stainless Steel in the Water Industries	2018	Sussex, G	Australia	N	Y	N
ACA	Protecting & repairing structures in harsh environments	2018	Sarkady, A	Australia	N	Y	N
Water New Zealand	Optimised long-term condition-based renewals of Hastings District Council trunk sewers	2017	Gandashanga, E	New Zealand	N	Y	Y
New Zealand Water	Managing corrosion risk	2016	Cook, Corrie	New Zealand	Y	Y	Y
New Zealand Water	Crumble manhole pie meets its match	2016	Hill, K and Robbins, W	New Zealand	Y	Y	Y
The Australian Pipeliner	Piping water to Melbourne's West	2016	n/a	Australia	N	Y	Y
CSIRO	Predictive analytics for sewer construction	2016	Shepherd, A	Australia	N	Y	N
New Zealand Water	Improving the long-term management of sewer systems	2015	Cesca <i>et al.</i>	Australasia	N	Y	Y
Water New Zealand	Renwick losing 300,000 litres a day	2015	McPhee, E	New Zealand	Y	Y	N
Trenchless Australasia	Corrosion an \$A892 million cost to Australian water industry	2015	ACA	Australia	N	Y	Y
Water Services Association of Australia	Corrosion of copper pip in Australian drinking waters	2015	Materials Facts Sheet	Australia	N	Y	N
Company (Think PVC)	Corrosion – not age – is the problem with Australia's water pipeline infrastructure: Four reports download * PVC pipe- the right choice for trenchless projects * PVC pipes – clearly the best choices for sewer pipes in Australia * Superior toughness: PVC pips Vs ductile iron * When water quality matters, corrosion is not sustainable	2014	Jones, Nigel	Australia	Y	Y	-

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Water New Zealand	Sewex modelling tool for corrosion and odour management	2013	Dexter <i>et al.</i>	Australia	Y	Y	Y
New Zealand Water	Phased approach to water pipeline condition assessment	2012	Ratliff, GHD	Australia	Y	Y	Y
Sewer Processes	The sewer corrosion and odour research (score) project	2011	Rootsey, R and Yuan, Z	Australia	N	Y	N
Encyclopedia of Australian Science	On the action of the Nepean water on tubes and boiler plates, with some remarks on corrosion generally	1988	Hamlet, W.M	Australia	N	Y	N
Water New Zealand	Odour mitigation to minimise sewer corrosion	Not stated	Tan <i>et al.</i>	Australia	Y	Y	-
Water New Zealand	Acid corrosion of reinforced concrete pipes – the buried facts	Not stated	Husham, I; and Langdon, W	Australasia	Y	Y	Y

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5 Concrete and Buildings

Data source	Publication	Date	Author/s	Region	Quant Data	Qual Data	Corrosion management cost
Corrosion Materials	Addressing sheet pile microbiologically induced fresh-water corrosion on Ohau Diversion Wall	2019	Sarraf <i>et al.</i>	New Zealand	N	Y	Y
Corrosion Prevention 2019	A Two-Stage Corrosion Protection System for Reinforced Concrete Structures	2019	n/a	Australia	N	Y	N
Trove	Managing safety and environmental risks from corrosion on line 9595/92Z	2019	TransGrid	Australia	N	Y	Y
Build Australia	Corrosion impact on bridge infrastructure	2018	n/a	Australasia	N	Y	N
BRANZ	Position, position, position	2018	Zhengwei, L	New Zealand	N	Y	N
Engineers Australia	Corrosion of steel in concrete: causes, investigations and cures	2017	Chirgwin and Farana	Australia	N	Y	N
Build	Concerns with B2 durability	2017	Sarraf, E	New Zealand	N	Y	N
Build	Why timber eats metal	2017	Zhengwei, L	New Zealand	N	Y	N
BRANZ	Materials in geothermal areas	2017	Zhengwei, L	New Zealand	N	Y	N
SESL	Assessing corrosion risks	2017	Leake, S	Australia	N	Y	N
IPWEA	The hidden cost of concrete corrosion	2016	n/a	Australia	N	Y	Y
BRANZ	Managing subfloor moisture, corrosion and insulation performance	2016	McNeil <i>et al.</i>	New Zealand	N	Y	N
Progressive Building	The high cost of corrosion	2016	Cook, C	New Zealand	N	Y	Y
NZTA	Combating corrosion: how to best protect key assets	2016	Cook, C	New Zealand	N	Y	N
Trove	Crevice corrosion joint technical bulletin to industry	2015	Australian Window Association	Australia	N	Y	N
Build Magazine	Keeping corrosion at bay	2015	Fawaz, W	New Zealand	N	Y	N
New Zealand Local Government	Making infrastructure last longer	2015	Cook, C	New Zealand	N	Y	Y
Build Magazine	Coast guard for metal components	2013	Pringle, T	New Zealand	N	Y	N
NZTA	Assessing pre-tensioned reinforcement corrosion within the New Zealand concrete bridge stock	2013	Rogers <i>et al.</i>	New Zealand	N	Y	N
NZTA	Undetected chlorine corrosion in bridges could be problematic	2013	n/a	New Zealand	N	Y	N
Build Magazine	Sharpening corrosion boundaries	2012	Zhengwei, L	New Zealand	N	Y	N
BRANZ	Sharpening Corrosion boundaries	2012	Li, Z	New Zealand	N	Y	Y

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NZTA	Revised approach needed for South Island concrete	2012	Freitag, S	New Zealand	N	Y	N
NZTA	Halting reinforcement corrosion in concrete bridges	2011	Freitag, S	New Zealand	N	Y	N
BRANZ	High cost of building services corrosion	2011	Duncan, J	New Zealand	N	Y	Y
BRANZ	Enhancing metal element durability	2011	Elkink, A	New Zealand	N	Y	N
BRANZ	Durability and exposed steel beams	2011	Pringle, T	New Zealand	N	Y	N
BRANZ	Two-year field test fasteners timber	2010	Li, Z	New Zealand	N	Y	N
Build Magazine	Corrosion of fasteners	2009	Zhengwei, L	New Zealand	N	Y	N
Build Magazine	Galvanic corrosion	2009	Zhengwei, L	New Zealand	N	Y	N
NZTA Research	Corrosion finding sparks wider investigation	2008	NZTA	New Zealand	Y	Y	N
Build	Copper preservatives & corrosion	2005	Bruce, E	New Zealand	N	Y	N
BRANZ	Nail plate corrosion in concrete tiled houses in coastal New Zealand	2002	Jordan, L.R.	New Zealand	N	Y	N

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6 General and Other Sectors

Sector	Data source	Publication	Date	Author/s	Region	Quant Data	Qual Data	Corrosion management cost
General	Curtin University	What is corrosion?	2019	Iannuzzi, M.	Australia	N	Y	N
Energy	Corrosion Prevention 2019	The study of water-line corrosion in static and dynamically flowing electrolytes using multi-electrode sensor in combination with electrical resistance method		n/a	Australia	N	Y	N
Energy	Corrosion Prevention 2019	Corrosion Behaviour of Ni-Cr Alloys in Oxygen at High Temperature		n/a	Australia	N	Y	N
Defence	Researchgate.net	The development of a corrosion prognostic health management system for the Australian Defence Force aircraft	2008	Trueman <i>et al.</i>	Australia	N	Y	N
Marine	Boating New Zealand	Tarting up your tinny	2019	Holtzhausen, N	New Zealand	N	Y	N
Defence	Stories of Australian Science	Silicon solves helicopter corrosion	2011	US Navy	Australia	N	Y	N
Energy	Wares New Zealand	Hype and hysteria: don't believe everything you read	2010	n/a	New Zealand	N	Y	N
Mining	Australian Mining Review	High performance corrosion protection for harsh environments	2013	n/a	Australia	N	Y	N
Defence	Envelop Protective Covers	Envelop covers – long term cost analysis	2019	Company website	USA	N	Y	Y
Defence	Australian Defence Magazine	Envelop corrosion covers	2018	n/a	Australia	N	Y	N
Energy	Trove	Corrosion-resistant alloy solves big challenges	2004	n/a	Australia	N	Y	N

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		caused by tiny defects						
General	Manufacturers' Monthly	Corrosion is eating away at Australian industry	2017	Review	Australia	N	Y	N
Defence	Researchgate.net	Corrosion control on Australian Defence Force aircraft - Future challenges	2008	Hinton <i>et al.</i>	Australia	N	Y	N
Mining	DSI	Corroded mining elements replaced with double corrosion protected DSI rock bolts	2016	Company website	Australia	N	Y	N
Map	BRANZ	BRANZ maps makes it easy	2012	n/a	New Zealand	N	Y	N
Defence	Researchgate.net	Aircraft structural diagnostic and prognostic health monitoring for corrosion prevention and control	2009	Galea <i>et al.</i>	Australia	N	Y	N
Marine	Australian Energy Review	A year of achievements	2016	Review	Australia	N	Y	N
General	Griffith University	A corrosion map of Australia: Principles and implications	2012	Cole, Ivan, Ganther, Wayne D.	Australia	Y	Y	N