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Engineering and legal considerations for decommissioning of offshore oil and gas infrastructure in Australia

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ABSTRACT

Offshore oil and gas platforms, pipelines and other ancillary offshore infrastructure are aging in Australia and current regulatory frameworks favour complete removal at the end of life. However, evidence indicates that artificial reefs have formed around some of these structures and their removal could cause more harm than good. Furthermore, other perceived social, environmental and economic benefits of a total removal policy may not be warranted. The Australian regulator (NOPSEMA) is currently exploring the possibility of supporting an in situ decommissioning policy, in which alternatives to full removal such as leaving in situ, partial removal or nearby relocation may be adopted if demonstrated to be the preferable approach. This will necessarily involve changes to law and policy but such amendments must be evidence-based. The evidence needed will largely involve the disciplines of engineering and natural sciences, but also fields such as environmental management, economics, social sciences and law. If Australia were to progress an in situ decommissioning policy shift, research will be needed across all of these areas in the specific national context. This paper commences by outlining emergent engineering knowledge, showing the general conservatism of current methodologies available to assess the integrity of decommissioned offshore facilities. Thereafter, the particular legal environment in Australia is explored. This article contributes to the growing body of literature on in situ decommissioning but in setting a multi-disciplinary research agenda takes a more holistic approach.

1. Introduction

The first infrastructure for the offshore petroleum industry was constructed in the early 1920s. The disposal of these installations did not begin until the 1970s with more complex structures being decommissioned in the 1990s (Athanassopoulos et al., 1999). Today there are thousands of offshore oil and gas installations and platforms across the globe in addition to a range of subsea infrastructure, pipelines and wells. Much offshore infrastructure has been in service for several decades and is due or will soon be due to be decommissioned (Hamzah, 2003). For example, over 550 platforms and subsea production facilities are situated in the North Sea, a mere 7% of all North Sea installations have been decommissioned to date and much is forecast for the coming three decades (Royal Academy of Engineering, 2013), while South East Asia hosts close to 1700 offshore installations, nearly half of which are older than 20 years and are due to be retired (NUS, 2013).

In Australia, the first offshore petroleum infrastructure was constructed in the Bass Strait in the 1960s (DIIS, 2015) with construction accelerating in the 1980s with the development of the North West Shelf (Haggerty and Ripley, 1988). Over the intervening period the sector has grown significantly and today Australia is one the world's major liquefied natural gas (LNG) suppliers. Taking into account the timeframes for exploration, project development and operations, much of the early infrastructure is now towards the end of its life. Assets may function beyond their initial design life through reassessment of the infrastructure condition (so-called 'life extension') if a field continues to produce economically. Additional infrastructure may be installed to optimise production methods that may cause existing infrastructure to be unused. In the context of this paper, "end of life" is taken as when economically viable production is no longer possible using the existing infrastructure or asset configuration, and a decision is made by the Operator to abandon the infrastructure. Decommissioning is always a consideration regardless of the age of the asset, because of its influence as a future liability. However, attention on decommissioning issues is becoming increasingly visible in Australia as end of life is imminent for a number of developments. Over the coming years decisions will increasingly need to be made about the decommissioning approach for more of that infrastructure.

The sections that follow demonstrate the engineering and legal concerns and possible responses. No doubt there is further research to be undertaken and evidence to be gathered but a key issue for the

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Fig. 1. Established marine ecosystems around offshore oil and gas infrastructure (Figures adapted from Leckie et al., 2015, 2016).

future is to ensure that the Australian law and policy framework deals adequately with decommissioning and in doing so provides certainty and the optimal outcome across owners, investors and operators as well as other stakeholders including the broader community.

The end of life options for offshore infrastructure include complete removal (the current position in Australia), in situ decommissioning (leaving the infrastructure in place either completely intact or with the topsides removed and legs toppled), removal and relocation offshore (for example as a dive site or fishery), as well as partial removal (removing some parts of the infrastructure while leaving others in situ) (Ekins et al., 2005). Offshore relocation and in situ decommissioning have received attention in recent years as science has emerged of the artificial reefs that form around infrastructure during their operations, leading to enhancement of the habitat and biota. Recent Australian observations of biota at oil and gas installations include Pradella et al. (2014), Mueller (2015) and Leckie et al. (2016) (Figs. 1, 2).

The potential role of oil and gas infrastructure as habitat for marine biota is a major driving force of the 'rigs-to-reefs' debate and policy changes that provide for partial removal (Claisse et al., 2014; Macreadie et al., 2011). Current rigs-to-reefs options often involve relocating the rig to a new site, thus reducing environmental benefits in terms of preserving an established ecosystem. A further development of decommissioning policy would be a wholly in situ approach with the rig remaining at its original location on the basis of an improved environmental outcome, potentially with societal and economic benefits also resulting. The successful implementation of a 'rigs-to-reefs' program in the US has drawn interest in Australia.

International law and policy has a significant role to play in setting

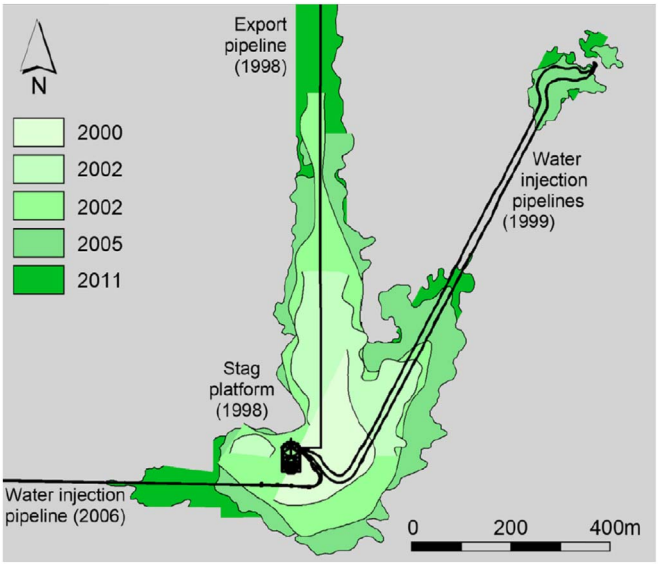

Fig. 2. Growth of seabed pockmarks linked to fish activity around a pipeline system offshore Australia (Mueller 2015).

standards in ocean areas and has provided a framework for decommissioning that influences the approaches in many nations including Australia. Whilst this international framework is critical, it is also clear that different law and policy approaches have been taken in different countries and their analysis is also relevant (Techera and Chandler, 2015).

At the international level both the *United Nations Convention on the Law of the Sea* (UNCLOS) and the *London (Dumping) Convention* are relevant and Australia is a party to both. 'Decommissioning' is not specifically referred to, although reference is made to the need to deal with obsolete offshore platforms, and the term 'abandonment' is used (Hamzah, 2003). The earliest relevant international law is the 1958 Geneva Convention on the Continental Shelf (a predecessor to UNCLOS) which requires entire removal. This Convention remains in force and Australia has implemented this provision. The favouring of complete removal has also influenced the UK and EU policy (Techera and Chandler, 2015).

UNCLOS is now considered to be the dominant instrument in the area of oceans governance, and Article 60(3) provides that abandoned or disused infrastructure shall be removed taking into account 'generally accepted international standards established... by the competent international organisation'. The Maritime Safety Committee of the International Maritime Organisation (IMO) has responded by developing soft law (non-binding) *Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone* (IMO, 1989). Section 2.1 requires a case-by-case evaluation prior to any decision to allow offshore infrastructure to remain on the seabed. Criteria include the safety of navigation, rate of deterioration and risk of structural movement, environmental effects on the marine environment, costs, technical feasibility and risks of injury associated with removal. Finally, reference is made to 'determination of a new use or other reasonable justification' for in situ disposal. The reference to 'new use' is innovative and may include utilisation as an artificial reef. It is this approach that has been taken in some US states through its 'rigs-to-reefs' policy (US Bureau of Safety and Environmental Enforcement, undated). The Standards make provision for complete removal of structures in shallow water and weighing less than 4000 t, and allowing other concrete and steel structures to remain in place provided there is 55 m of clearance (IMO, 1989).

There are relatively few other relevant provisions in UNCLOS and the only other key international law is the *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972* (London Convention) and *Protocol to the London Dumping Convention* 1996 (Protocol). These instruments focus on controlling pollution of the marine environment through regulating the dumping of waste. Under article III of the London Convention, dumping includes the deliberate disposal at sea of waste including 'platforms or other man-made structures' but not 'placement of matter for a purpose other than the mere disposal ... provided that such placement is not contrary to the aims of this Convention'. Again this would permit re-use of obsolete infrastructure as an artificial reef for