Risk and Reliability Assessment for Groundwater and Unconventional Energy Production

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# Abstract

Maud ((**???**)) identified methodological gaps regarding the assessment of risk for groundwater and coal seam gas operations. The aim of this paper is to integrate different risk assessment methods using analogous language to drive the integration.

# Introduction

In the last few years unconventional energy (UE) production has been considered a significant potential economic resource for Australia. Unconventional energy in the Australian context, generally refers to gas held in shale or coal formations, along with what is known as “tight gas” (Taylor 2012, 7).

As noted by Professor Martin in the Committee for Economic Development of Australia (CEDA) report, property rights and water management are key issues for unconventional energy production (Taylor 2012, 5). For water management specifically, Martin recommended that;

* Water allocation and licensing frameworks needed to be enhanced to include water that is produced, and consumed by UE producers
* Due to the potential for irreversible damage to environmental systems, including hydrological systems, UE producers develop a robust risk management framework with strong precautionary principles

In investigating the requirements for such a framework, (**???**) found gaps at three levels. Legislative, calculative, and technical. The aim of this article is to address the calculative gap.

# Risk & Reliability Assessment Methodologies and Language

In the established literature surrounding water and hydrosystems engineering it is common to find risk assessments centered around the concepts of *load* () and *resistance* () (Goodarzi, Ziaei, and Teang Shui 2013, Mays (2010)).[[1]](#footnote-24)

Resistance is defined as the ability of a system component to meet it’s designed purpose without failure when subjected to an external load. Load might be a mechanical or other forcing stress. The hydrosystems discussion is typically within the context of dams, and dam failure.

In this context, reliability () is defined the probability of the resistance exceeding the load. That is, the probability of survival (Mays 2010, 387), defined mathematically as;

Risk () is then defined as the inverse of reliability. That is the probability of the load exceeding the resistance, or the probability of failure [Ibid], defined mathematically as;

Goodarzi, Ehsan, Mina Ziaei, and Lee Teang Shui. 2013. *Introduction to Risk and Uncertainty in Hydrosystem Engineering*. 1. Aufl. Vol. 22. Topics in Safety, Risk, Reliability and Quality. Dordrecht: Springer. <http://ezproxy.library.uq.edu.au/login?url=http://dx.doi.org/10.1007/978-94-007-5851-3>.

Mays, Larry W. 2010. *Water Resources Engineering*. John Wiley & Sons.

Taylor, Nathan. 2012. “Australia’s Unconventional Energy Options.” Committee for Economic Development of Australia. <http://adminpanel.ceda.com.au/FOLDERS/Service/Files/Documents/15347~cedaunconventionalenergyfinal.pdf>.

1. Mays notes that structural engineers might be more familiar with the concepts of *strength* and *stress* respectively. [↑](#footnote-ref-24)