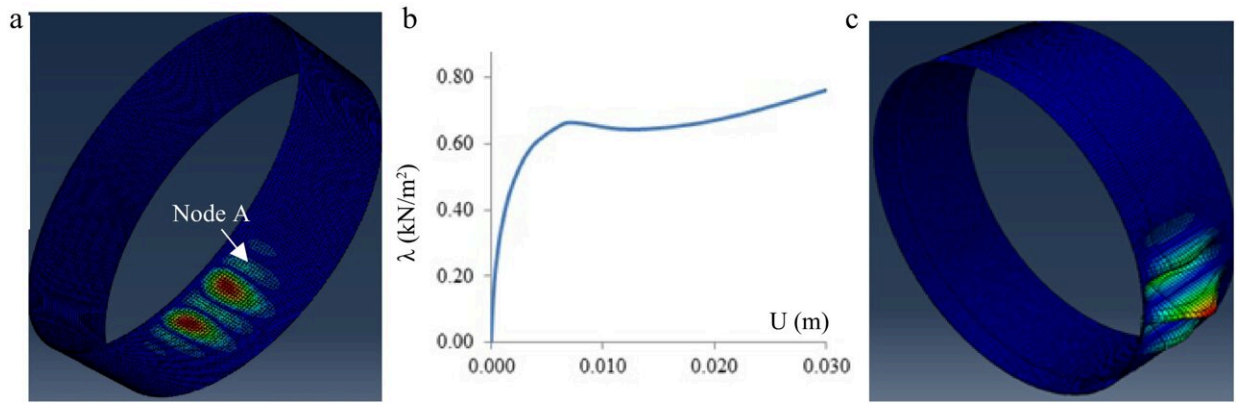
Assessing the wind vulnerability of Patagonia's oil storage tanks

March 25 2024



Damage computed for a tank with D = 45 m and H = 12 m. (a) Deflected shape for damage DS1; (b) Equilibrium path for node A (DS1); (c) Deflected shape for damage DS2 (critical mode). Credit: *Emergency Management Science and Technology* (2023). DOI: 10.48130/EMST-2023-0019

In Latin America, specifically in Argentina, there's a burgeoning petroleum boom, largely thanks to the Vaca Muerta field, known for its substantial shale gas and oil reserves. However, this surge in oil output necessitates extensive fluid storage capacity, primarily in vertical oil storage tanks, which have proven vulnerable to extreme weather events, particularly high-speed winds, leading to potential severe damage.

Existing research highlights the importance of understanding the

structural integrity of these tanks to prevent accidents.

Consequently, a research article titled "Fragility of open-topped oil storage tanks under wind in Patagonia" was published in *Emergency Management Science and Technology*.

The paper focuses on the development of fragility curves for estimating damage states under specific wind pressures in Patagonia's oil-producing regions, aiming to address the issues of shell buckling and loss of integrity in storage tanks to mitigate the risk of accidents and their consequential environmental and economic impacts.

In this research, researchers methodically assessed the susceptibility of open-top oil storage tanks in Argentina's Patagonia to wind-induced damages, utilizing an innovative approach that combined data from government sources, aerial imagery, and the application of API 650 design standards.

The study specifically targeted tanks with floating roofs, establishing a detailed inventory of tank dimensions that informed the creation of a comprehensive artificial database. Finite element analysis conducted within the ABAQUS environment allowed for the simulation of the tanks' responses to wind pressures, highlighting the critical damage states that these structures could endure.

Fragility curves were then constructed to quantitatively describe the probability of the tanks reaching various damage states under specific wind load conditions. These curves revealed a pronounced risk of both structural and operational damages at wind speeds commonly experienced in the Patagonia region, highlighting the need for wind vulnerability assessments in the design and maintenance protocols for such infrastructure.

By delivering a systematic framework for evaluating wind vulnerability, the study makes a significant contribution to the field of structural engineering, offering insights that could guide the enhancement of design standards and retrofitting approaches for oil storage tanks in wind-exposed areas.

Moreover, the findings emphasize the criticality of incorporating wind risk assessments into the planning and design stages to improve the resilience of oil storage facilities, thereby ensuring the continuity of oil production operations and enhancing safety standards in regions susceptible to high wind events like Patagonia.

More information: Rossana C. Jaca et al, Fragility of open-topped oil storage tanks under wind in Patagonia, *Emergency Management Science and Technology* (2023). DOI: 10.48130/EMST-2023-0019

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