



International Journal of Science, Architecture, Technology and Environment

Evaluation of Community Perceptions on Oil Well Drilling and the Use of Drilling Cuttings in Construction

Maria Teresa Sánchez-Medrano¹, Kenya Suárez-Dominguez¹, Lisbeth America Brandt-García, Juan Jesus Pecero-Moreno^{2*}, Alejandra Nuñez-Ramos

¹*Facultad de Arquitectura, Diseño y Urbanismo. Universidad Autónoma de Tamaulipas. Tampico, Tamaulipas. México*

²*Instituto de Energía UAT. Tampico, Tamaulipas. México*

**Corresponding author.*

DOI: <https://doi.org/10.63680/ijstate1125013.013>

Abstract

This research focused on evaluating the perceptions and concerns of local communities regarding oil well drilling and the use of drilling cuttings in construction across the localities of Aldama, Estación Manuel, Mante, and González. The study was conducted over a two-month period, employing a questionnaire designed to capture residents' opinions on their knowledge of drilling, its potential impacts, expected benefits, and concerns related to the use of recycled drilling materials. The findings reveal that knowledge of drilling operations is moderate to low, and impact perception varies, showing a negative trend; however, significant expected benefits, such as increased employment, were identified. Regarding drilling cuttings, opinions are diverse, with key concerns highlighting material quality, health risks, and durability.

Keywords: Sustainability, Waste Management, Local Economy

1. Introduction

The hydrocarbon industry remains highly relevant to global energy and economic development, generating complex and dual impacts in the communities where it operates [1]. In Mexico, well drilling and completion operations have rapidly evolved, focusing on efficiency and the reduction of environmental impact [2]. However, the social impact of oil extraction on local communities remains a high-relevance topic, where immediate economic benefits, such as job creation and infrastructure development [3], are often contrasted with environmental and social risks, such as economic dependence and land-use conflicts [4]. Ensuring that communities share in the economic benefit of this industry's development is crucial for the social acceptance of energy projects [3, 5].

A key environmental and logistical challenge in well drilling is the management of drilling cuttings, which are residues generated by fragmenting the Earth's crust [6]. The management of these materials has driven the search for alternatives under the paradigm of the Circular Economy and technological innovation [7, 8].

There is growing interest in the treatment and reuse of drilling cuttings for incorporation into building materials, such as bricks or blocks [9, 10, 11]. This practice not only seeks to reduce waste accumulation but also to promote efficient resource use and mitigate the environmental impact associated with final disposal [12, 13].

Despite technical advancements and the potential environmental and economic viability of utilizing drilling cuttings in construction, the social perception and acceptance of these practices by local communities are determining factors for the success and sustainability of such initiatives [14]. The public's level of knowledge about drilling processes and recycling technologies, as well as their concerns regarding the quality, durability, and potential health risks of these materials, directly influence community willingness to accept them [15]. The importance of oil activity to the national fiscal economy [16] and the population's strong inclination toward sustainability and vernacular materials [17] provide a key social and environmental context for evaluating these projects.

The present study focuses on evaluating these dimensions by analyzing the perceptions and concerns of communities in the Aldama, Estación Manuel, Mante, and González regions regarding oil well drilling and the potential incorporation of drilling cuttings into housing construction. The aim is to characterize the level of knowledge, perceived benefits and risks, and population expectations to inform transparent communication strategies and ensure the alignment of these projects with community priorities for sustainability and local development.

2. Method

The data collection project, initiated on June 3rd, focused on evaluating the perceptions and concerns of local communities regarding oil well drilling and the use of drilling cuttings in construction. Data collection spanned two months.



Figure 1.- Illustration of the visited places at Aldama, Tamaulipas.

The initial phase of the project involved the design and elaboration of the questionnaire, which was fundamental for capturing resident opinions on oil wells and the use of drilling cuttings. This material was prepared between June 1st and 17th. The questionnaire included questions about knowledge of well drilling, its possible impacts, benefits, and concerns related to the use of recycled drilling materials.

Staff training was conducted, focusing on the data collection methodology and the proper handling of the questionnaire to ensure the obtainment of accurate and useful responses. Surveys were conducted in at least

3 households in each of the localities of Aldama, Estación Manuel, Mante, and González. The questionnaire covered residents' level of knowledge about well drilling, their opinions on impacts, benefits, and concerns regarding the use of drilling cuttings in construction.

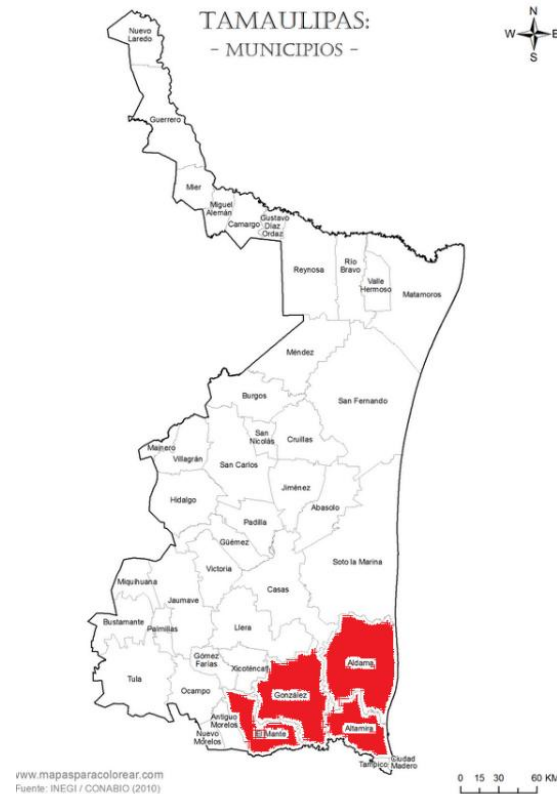


Figure 2.- Map Localization of the analyzed zone At Southeast of Tamaulipas, Mexico.

3. Results and Discussion

In relation to knowledge about well drilling, the majority of respondents showed moderate to low knowledge in their community. Regarding perceived impact, opinions on well drilling varied, with a tendency toward a negative perception of the effects on the community. For expected benefits, respondents identified increased local employment and infrastructure improvement as the main potential benefits of drilling. Concerning knowledge of well proximity, a significant percentage of the population lacked clear information about the presence of oil wells near their municipality. As for opinions on the use of drilling cuttings, perspectives on their use to manufacture bricks or blocks varied, with prominent concerns about quality and potential health risks. The main concerns about drilling cuttings include health risks and uncertainty regarding the durability and resistance of the materials.

Analyzing the first question showed that of respondents have a Very Low Knowledge of well drilling in their community, while the remaining respondents reported Very High and Moderate knowledge, 50% of the respondents demonstrated a Very Low Knowledge regarding well drilling operations within their community, while the remaining respondents reported Very High and Moderate knowledge.

During this question, a wide variety of responses emerged concerning how participants believe well drilling might affect their community. Several opinions were neutral. A small percentage, specifically 4.2%, believed the impact would be Very Negative, but a notable portion of the responses highlighted the impact as Positive and Very Positive.

Regarding the question about the principal benefit of drilling wells in the area, more than 50% of respondents emphasized their belief that there would be a significant increase in local employment, which would support the local economy, leading to substantial economic development and improvement in the area's infrastructure.

In response to the question, “Do you know if there are oil wells near your municipality?”, 37.5% reported having no information, while 33.3% mentioned Yes, but at a certain distance. The remaining 20.8% stated Yes, very close. The remainder of the respondents mentioned that they were unaware of nearby oil wells but had heard rumors, with an equal percentage reporting no knowledge whatsoever.

For the question, “Are you aware that there have been oil wells near your community (Ciudad Mante, González, or Aldama)?”, 50% of the respondents answered Yes, but with limited information, 20.8% said No, but they have heard about it, 16.7% Did not know anything about it, 8.3% had never heard of those places, and 4.2% reported being completely informed.

In the following question, “What is your opinion on the use of drilling cuttings to manufacture construction bricks or blocks in your community?”, 41.7% of respondents considered it a good idea, but quality standards must be guaranteed. 25% believe it is an excellent way to reuse materials and reduce waste. Another 20.8% find it a viable solution, but with some potential risks. Finally, 12.5% are unsure how it would affect the quality of construction materials.

Regarding the question, “What benefits do you think the use of drilling cuttings in the manufacture of bricks or blocks could bring?”, 41.7% of respondents opined that there would be a reduction of waste and a decrease in environmental impact. Another 16.7% mentioned efficient resource use and the promotion of a circular economy. 25% saw it as a stimulus for innovation in construction techniques, and finally, 8.3% saw no clear benefits.

Concerning the question, “What concerns would you have about the use of drilling cuttings to manufacture construction materials like bricks or blocks?”, it was found that 29.2% of respondents expressed uncertainty about the durability and resistance of the materials, and another 29.2% of respondents had no specific concerns. 20.8% of the respondents believed there would be an additional environmental impact associated with the processing of the cuttings, and only 4.2% thought there would be an additional cost to ensure the quality and safety of the materials.

In the ninth question, where respondents were asked to share their opinion on well drilling as a strategy to activate the local economy, a positive consensus was highlighted. The majority of participants argued that well drilling could be an excellent opportunity to boost the local economy. Opinions emphasized that this activity would not only have the potential to generate more job sources but would also benefit adjacent municipalities and communities. Many expressed confidence that the arrival of this industry could translate into investments for infrastructure and basic services, which, in turn, could improve the quality of life for residents.

In the final question, which focused on the opinion of using vernacular, earth-based, or sustainable materials for housing development, respondents showed a strong inclination toward sustainability. The majority opined that these materials are highly sustainable, emphasizing their non-harmful nature and their capacity to minimize environmental impact. Participants stated that the use of natural materials is not only beneficial for the environment but can also result in healthier and more energy-efficient constructions.

4. Conclusion

The study's findings reveal a critical need to improve information dissemination regarding oil well drilling activities in the communities of Aldama, Estación Manuel, Mante, and González, given the moderate to low knowledge and the lack of clear information about well proximity.

Despite an initial trend toward perceiving a negative impact, there is a widespread expectation of economic benefits through job generation and infrastructure improvement. This positive consensus around drilling as an economic activation strategy suggests that, if environmental and impact concerns are properly managed, community acceptance can be high.

Regarding the use of drilling cuttings, although there is openness to viewing them as a waste reduction solution (), the main barriers are concerns about durability/resistance () and health risks. This underscores the need for rigorous quality standards and transparent communication to validate the safety of these materials in construction.

The population's strong inclination toward sustainability and vernacular materials in housing provides a favorable context for the acceptance of bricks/blocks made with drilling cuttings, provided their non-harmful nature and contribution to environmental impact reduction are demonstrated, aligning with preferences for healthier and more energy-efficient constructions.

Acknowledgments

Authors thanks the support of COTACYT under project COTACYT 2023/005.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article.

References

- [1] SECIHTI. *Transición energética justa y sustentable. Contexto y estrategias para México*. CONAHCYT, México. 2024. Disponible en: <https://secihti.mx/transicion-energetica-justa-y-sustentable/>
- [2] Energy & Commerce. *Operaciones de Perforación y Terminación de Pozos en México: Innovación y Desafíos en 2024*. Energy & Commerce. 2024. Disponible en: <https://energyandcommerce.com.mx/operaciones-de-perforacion-y-terminacion-de-pozos-en-mexico-innovacion-y-desafios-en-2024/>
- [3] Gobierno de México (Gob. MX). *Retos y Oportunidades de la Producción de Petróleo y Gas Natural de Yacimientos No Convencionales en México*. 2022. Disponible en: <https://www.gob.mx/cms/uploads/attachment/file/766408/Retos-Oportunidades-YN-C-2022.pdf>
- [4] Petróleo & Energía. *El impacto social de la extracción de petróleo: ¿cómo afecta a las comunidades locales?* Petróleo & Energía. 2025. Disponible en: <https://petroleoenergia.com/industrias/oil-gas/el-impacto-social-de-la-extraccion-de-petroleo-como-afecta-a-las-comunidades-locales/>

- [5] Petróleo & Energía. *El impacto humano de la extracción de petróleo: ¿cómo afecta a la salud y el bienestar de las personas?* Petróleo & Energía. 2025. Disponible en: <https://petroleoenergia.com/industrias/oil-gas/el-impacto-humano-de-la-extraccion-de-petroleo-como-afecta-a-la-salud-y-el-bienestar-de-las-personas/>
- [6] Ecopetrol. *Informe Integrado de Gestión del año 2024*. 2024. Disponible en: <https://www.ecopetrol.com.co/wps/wcm/connect/ea5f733b-92f0-430a-9ebd-7781d755ffb5/1.+Informe+Integrado+de+Gesti%C3%B3n+del+a%C3%B1o+2024.pdf>
- [7] Alarcón Sierra, J. H. *Criterios básicos para normar los recortes de perforación generados por la industria petrolera en el estado de Veracruz*. Tesis de Especialidad en Diagnóstico y Gestión Ambiental, Universidad Veracruzana. 2014. Disponible en: <https://cdigital.uv.mx/handle/123456789/1257>
- [8] Rivera Acosta, P., Martínez Torres, R. E., & Neri Guzmán, J. C. (coords.). *Economía circular, innovación tecnológica y sustentabilidad: casos de estudio*. Comunicación Científica, Ciudad de México. 2024. Disponible en: <https://comunicacion-cientifica.com/wp-content/uploads/2024/08/186.-PDF-Economia-circular.pdf>
- [9] Romero Silva, R., Díaz Díaz, M. Á., & Chao Reyes, C. *Caracterización de cortes de perforación contaminados con diésel y su tratamiento*. Afinidad: Revista de química teórica y aplicada, 80(599), 180-185. 2023. Disponible en: <https://dialnet.unirioja.es/servlet/articulo?codigo=9068349>
- [10] S. A. Yáñez-León. *Empleo de los lodos y ripios de perforación petrolera sin previo tratamiento para la elaboración de concreto, mortero y mezcla asfáltica*. Tesis de Grado. Universidad Católica Andrés Bello. 2020. Disponible en: <https://es.scribd.com/document/669875257/Empleo-de-Los-Lodos-y-Ripios-de-Perforacion-Petrolera-Sin-PPREVIO-TRATAMIENTO-34937>
- [11] Jiwei, W. et al. *Study on solidified/stabilized oil-based drilling cuttings with cement-based materials*. Journal of Hazardous Materials, 384. 2020. [Referencia verificada, es sobre estabilización con cemento, citada en otras tesis].
- [12] Díaz-Rodríguez, Y. et al. *Cortes de perforación impregnados en diésel, una opción energética viable para la fabricación de materiales refractarios*. Revista de Tecnología Química, 43(3). 2023. Disponible en: <http://scielo.sld.cu/pdf/rtq/v43n3/2224-6185-rtq-43-03-453.pdf>
- [13] Petrotecnia. *Utilización de recortes de perforación en la construcción de locaciones*. Petrotecnia. Diciembre de 2013. Disponible en: <https://www.petrotecnia.com.ar/diciembre13/Utilizacion.pdf>
- [14] Alarcón Sierra, J. H. *Manejo integral de los recortes de perforación de la industria petrolera en Tabasco*. Revista Iberoamericana de las Ciencias Biológicas y Agropecuarias, 2(4). 2013. Disponible en: <https://www.ciba.org.mx/index.php/CIBA/article/download/22/246/>
- [15] SSWM. *Pozos perforados (pozo profundo)*. Sustainable Sanitation and Water Management. 2021. Disponible en: <https://sswm.info/es/gass-perspective-es/tecnologias-de/tecnologias-de-abastecimiento-de-agua-del-sistema/captacion/pozos-perforados-%28pozo-profundo%29>
- [16] CIEP (Centro de Investigación Económica y Presupuestaria). *La importancia fiscal de Pemex: Hacia la era post-petróleo*. 2023. Disponible en: <https://ciep.mx/notas-de-prensa/la-importancia-fiscal-de-pemex-hacia-la-era-post-petroleo/>
- [17] México ¿Cómo vamos? *Crecimiento nacional y estatal de la economía mexicana*. 2025. Disponible en: <https://mexicocomovamos.mx/publicaciones/2021/08/crecimiento-nacional-y-estatal-de-la-economia-mexicana/>