

PhD Thesis proposal

General Information		
PhD Thesis Title	<i>Impact of the Naameh landfill on the Physiochemical Characteristics of Water Resources in the Surrounding Area: An Environmental Approach</i>	
School	<i>Agricultural and Food Sciences</i>	
Research Unit	NA	
Laboratory	NA	
Axis	Biogeochemistry and transfer of pollutants at the water-soil interface	
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Co-supervisor (if applicable)	Name & Title: Desiree El Azzi, Assistant Professor Email: desireeelazzi@usek.edu.lb	University Address: Holy Spirit University of Kaslik- USEK
Location (s)	Location 1: USEK	Work shift calendar /per year (%):
	Location 2: (if applicable)	Work shift calendar /per year (%):
Funding and scholarship	-	

Applicant Profile and/or Special Requirements	Agricultural Engineer / Master's in environmental sciences / Master's in bio-chemical or chemical sciences / Experience in water analysis and environmental monitoring is a plus
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Subject's national or worldwide Context, Objectives & Research lines
<p>Municipal solid waste (MSW) makes up about 90% of the total solid waste stream generated in Lebanon. Organic wastes are the largest component of the waste stream (55%) followed by recyclable material (29%) and other wastes (16%) (http://www.moe.gov.lb). Apart from MSW management in the extended Greater Beirut Area, and to a lesser extent in Greater Tripoli, MSW continues to be managed unsustainably.</p> <p>Two sorting plants are available in Lebanon, sorting waste into green wastes, recyclables and waste rejects. Only 17% of the waste is composted, the rest is wrapped, baled and sent to Naameh landfill (NL) for subsequent disposal in an environmentally controlled manner. NL was initiated in 1997 in the Shouf caza in an old quarry site, between two seasonal rivers, Nahr el Hamam and Nahr el Wadi. It is the only landfill in Lebanon considered as a sanitary engineered waste disposal site with specific pollution control technologies designed to minimize potential environmental impacts (bottom liners and leachate collection, treatment and off-site disposal). Although landfills are indispensable, they present long-term environmental and human health concerns. In fact, precipitation coupled with disposed liquid waste result in the formation of leachate, extracting water-soluble compounds and particulate matter off the waste. This leachate can then migrate, eventually reaching groundwater through direct infiltration and/or</p>

runoff (Eggen *et al.*, 2010; Murtaza *et al.*, 2017). Leachate from MSW landfills typically has high values of solids and chemical oxygen demand, a slightly low to moderately low pH and different levels of hazardous constituents, such as volatile organic compounds and heavy metals (Singh *et al.*, 2016; Qi *et al.*, 2018).

The objective of the proposed thesis is to assess the risk of groundwater contamination surrounding the NL by sampling and analyzing water from off-site wells of neighboring regions. The results will be analyzed and assessed on parameter basis to identify and present solutions in case of any shortfall.

Outcomes (OCs): What do we wish to achieve?	
OC1:	Establish a comprehensive state of the art on water resources around Naameh Landfill area, thus assessing water quality and its impact on human life
OC2:	Assess seasonal variability in water quality, and correlating this variability with human activity and recent capping of Naameh landfill
OC3:	Assess and compare the physiochemical properties of groundwater via digging for possible contamination related to leachate infiltration which is directly correlated to improper management of wastes especially at the point of disposal
OC4:	Evaluate the capability of new techniques and tools in water resources management, thus proposing an adequate system for water treatment

References (R) (5 most recent peer-reviewed publications)	
R1:	Qi, C., Huang, J., Wang, B., Deng, S., Wang, Y., & Yu, G. (2018). Contaminants of emerging concern in landfill leachate in China: A review. <i>Emerging Contaminants</i> , 4(1), 1–10. https://doi.org/10.1016/j.emcon.2018.06.001
R2:	Murtaza, G., Habib, R., Shan, A., Sardar, K., Rasool, F., & Javeed, T. (2017). Municipal solid waste and its relation with groundwater contamination in Multan, Pakistan. <i>IJAR</i> , 3(4), 434–441.
R3:	Singh, S., Raju, N. J., Gossel, W., & Wycisk, P. (2016). Assessment of pollution potential of leachate from the municipal solid waste disposal site and its impact on groundwater quality, Varanasi environs, India. <i>Arabian Journal of Geosciences</i> , 9(2), 131.
R4:	Clarke, B. O., Anumol, T., Barlaz, M., & Snyder, S. A. (2015). Investigating landfill leachate as a source of trace organic pollutants. <i>Chemosphere</i> , 127, 269–275. https://doi.org/10.1016/j.chemosphere.2015.02.030
R5:	Eggen, T., Moeder, M., & Arukwe, A. (2010). Municipal landfill leachates: A significant source for new and emerging pollutants. <i>Science of The Total Environment</i> , 408(21), 5147–5157. https://doi.org/10.1016/j.scitotenv.2010.07.049