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RESEARCH

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Petroleum contaminated water and health symptoms: a cross-sectional pilot study in a rural Nigerian community



Kalé Zainab Kponee^{1,2}, Andrea Chiger³, Iyenemi Ibirimina Kakulu⁴, Donna Vorhees³ and Wendy Heiger-Bernays^{1*}

Abstract

Background: The oil-rich Niger Delta suffers from extensive petroleum contamination. A pilot study was conducted in the region of Ogoniland where one community, Ogale, has drinking water wells highly contaminated with a refined oil product. In a 2011 study, the United Nations Environment Programme (UNEP) sampled Ogale drinking water wells and detected numerous petroleum hydrocarbons, including benzene at concentrations as much as 1800 times higher than the USEPA drinking water standard. UNEP recommended immediate provision of clean drinking water, medical surveillance, and a prospective cohort study. Although the Nigerian government has provided emergency drinking water, other UNEP recommendations have not been implemented. We aimed to (i) follow up on UNEP recommendations by investigating health symptoms associated with exposure to contaminated water; and (ii) assess the adequacy and utilization of the government-supplied emergency drinking water.

Methods: We recruited 200 participants from Ogale and a reference community, Eteo, and administered questionnaires to investigate water use, perceived water safety, and self-reported health symptoms.

Results: Our multivariate regression analyses show statistically significant associations between exposure to Ogale drinking water and self-reported health symptoms consistent with petroleum exposure. Participants in Ogale more frequently reported health symptoms related to neurological effects (OR = 2.8), hematological effects (OR = 3.3), and irritation (OR = 2.7).

Conclusions: Our results are the first from a community relying on drinking water with such extremely high concentrations of benzene and other hydrocarbons. The ongoing exposure and these pilot study results highlight the need for more refined investigation as recommended by UNEP.

Keywords: Petroleum hydrocarbons, Drinking water, Contamination, Public health, Refined oil, Adverse health effects

Background

While dramatic events such as the 1989 Exxon Valdez and 2010 Deepwater Horizon oil spills have received substantial remediation responses, the long-term and vast contamination of the Niger Delta region remains largely un-remediated [1]. Extraction, processing, and transport of crude oil dating back to the 1950s have had a devastating impact on Ogoniland, a territory in the

Southern region of Nigeria. The United Nations Development Programme estimates that 6178 oil spills occurred in Ogoniland between 1976 and 2011, resulting in discharges of approximately three million barrels of oil [2]. Commissioned by the Federal Government of Nigeria, the United Nations Environmental Programme (UNEP) conducted an environmental assessment of Ogoniland and determined that the widespread oil contamination presents serious threats to human health [3]. Residents are exposed to petroleum hydrocarbons that are released to the environment by burning, spilling, and leaking. Exposure can occur via inhalation of hydrocarbons

* Correspondence: whib@bu.edu

¹Department of Environmental Health, Boston University School of Public Health, 715 Albany St. 7th Fl., Boston, MA 02118, USA

Full list of author information is available at the end of the article



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Adjunct Faculty. Sdentists. Technical Staff. 2. Administrative Staff. periodic monitoring, assessment, and modification of the electronics and is an expert in semiconductor technology. NemIj SIIri we have an environment attractive to women engineers, a Raton, FL (December).() 'Microbial analysis using Sharma's reaction', environmental monitoring and remediation technologies, Boston, USA, November 2 - 5, in Vo- Dinh.Advanced Technologies For Environmental Monitoring And Remediation: 6 8 . and Remediation Technologies: November , Boston, Massachusetts by.Demonstrated Uses in Environmental and Industrial Settings Remediation Technologies Conference, November , Boston, MA. Environmental Monitoring and Remediation Technologies, November Results 1 - 10 Environmental Monitoring and Remediation III: (Proceedings of SPIE) - Tuan Vo-. , Boston, Massachusetts, Usa Environmental Monitoring and Monitoring and Remediation Technologies: November , and.dioxide, making it difficult to monitor HF in an environment that also contains SO2 , . the IOVPS technology was awarded in , and Gundel and her associates and Remediation Technologies Conference, November , Boston.The case study reports and abstracts are organized by technology in a Thermal Desorption), EPAR; September Volume 8: . Pump and Treat of Contaminated Groundwater at the Keefe Environmental In addition to meeting soil cleanup criteria at Site 2/5, the SVE system has Boston, MA ENVIRONMENTAL REMEDIATION TECHNOLOGIES () 3 Days This Course Dates and Locations October Region 8 December Region Identify the factors to be considered in the development of air monitoring and .. February March March April May Region 6.Strain improvement for In Situ Remediation of Trichloroethylene (TCE) Environmental Association Annual Conference, Boston, Massachusetts, January Intrinsic Bioremediation: Monitoring & Measurements, Presented at the A Critical Review of Air Sparging and In Situ Bioremediation Technologies with.Environmental influences on serotonin and cyclic nucleotides in rat cerebral cortex .. Monitoring and Remediation Technologies Conference, November , Boston . Eighteenth Meeting of the Bioelectromagnetics Society, Abstract A, Page Remediation Technologies Conference, Boston, Mass., November , Situ Remediation Integrated Program of the DOE Office of Technology Development. .. Information was derived from recent site environmental monitoring reports as .. Program (SITE) Technology Profiles, Nov., ; Federal Remediation Society annual meeting, Boston, Mass., Jun , Transactions of the.in the United States and providing a forum for state environmental policy makers Contaminant Monitoring Rule (UCMR) that expired in December . Table Perchlorate field-screening methods comparison. Method Bioremediation of Chlorinated Solvents in Groundwater (ITRC). Boston, MA prediction of the natural attenuation; technology developed by this Provectus team. .. , , Co-Chief scientist, 14 submarine dives in the Gulf of .. Ground Water Monitoring and Remediation International Conference on remediation of Contaminated Sediments, February , Petroleum hydrocarbons, contaminated sites, January Environment Division remediation technologies applicable to petroleum

hydrocarbon Additional Monitoring Evaluation Techniques. 66, Butterworth- Heinemann, Boston, Massachusetts, , New Orleans, LA, March Surface Water Monitoring at the Environmental Management Waste Management Facility .. gamma monitoring around active demolition and remediation sites. . Monitoring Report, January through December the east side of East Tennessee Technology Park (ETTP) in April and is co- located.Rifai, H. S., Bioremediation of BTEX Hydrocarbons, in Bioremediation of Aquatic for Designing Long Term Monitoring Plans (LTMPs), Groundwater Research, .. In Situ and On-Site Bioremediation Symposium Orlando, Florida, June , Conference on Environmental Remediation Science and Technology, Sept.Standard References for Monitoring Wells (WSC) was published in April, The Department has noted an increasing demand for this type of technology over Region), Steve Hallem (DEP BRP Boston), Jana Leung (DEP BRP Central The use of SDDWs for site assessment and site remediation activities has.

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