Exposogas

NEWSLETTER

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EDITORIAL

We are excited to deliver the 6th and final newsletter of the EXPOSOGAS project. During the last 3 years, the project promoted the training and career development of researchers in the field of occupational and environmental health sciences. Special focus was paid on public health concerns expressed by the general population in communities near oil and gas activities. The concept of the human exposome and its tools were incorporated into the training and capacity building activities of the project. This project comes to an end, but we are still keen to engage with those with similar interests and to continue the interactions with the oil/gas stakeholders for public and environmental health concerns. If you have any questions or comments, please get in touch with us!

Konstantinos C. Makris, PhD
EXPOSOGAS project coordinator

What is EXPOSOGAS about?

EXPOSOGAS is a 3-year Horizon 2020 Twinning project funded by the European Union, which aims to develop the research capacity of the Cyprus International Institute for Environmental and Public Health (CII) in using the human exposome methodological tools.

What is the human exposome?

The exposome concept was first coined by Dr. Christopher Wild in 2005, who defined it as the cumulative set of all non-genetic (i.e. environmental) exposures which an individual experiences from the moment of conception throughout their life.

What is EXPOSOGAS interested in?

EXPOSOGAS is interested in oil/gas operations that often involve exposures to multiple chemicals and the collective impact on health that these multiple exposures have. Important operation stages of hydrocarbons occur throughout the industry lifecycle and include the preparation and installation, production, transport, storage, distribution, use and end of life activities and each of these will affect health differently, thus increased training is necessary in order to be able to establish how health is affected across the stages.

Why focus on the oil and gas industry in Cyprus?

The oil and gas industry in Cyprus is growing fast, especially with the recent discovery of the natural gas reserves in the Cypriot exclusive economic zone (EEZ). In order to increase the autonomy and energy independence of the Southern European region, the EEZ region is of primary importance. However, given the expansion of the oil and gas sector in Cyprus, there is also a need to similarly increase the capacity of the occupational and environmental health sciences in maintaining active surveillance of affected communities.

How will we do this?

Primarily by promoting the training and career development of CII researchers in the field of occupational and environmental health sciences through training that teaches them how to apply the exposome concept and related technologies on workers directly involved with oil/gas activities. EXPOSOGAS is actively trying to engage stakeholders and the general public to express their views as a means of furthering the exposomic framework.

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PROJECT ACTIVITIES

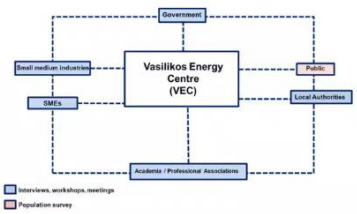
Government and Industry-Oriented Symposium:

"Sustainable Development and Management of Hydrocarbons in the Vasilikos area, Cyprus"

- An online technical symposium on environmental and public health concerns for the Vasilikos energy hub and its surrounding area took place on September 17, 2021, in which all the relevant stakeholders of hydrocarbon management in Cyprus were invited.
- The Director of the Department of Environment, Ministry of Agriculture, Rural Development and Environment, Mr. C. Hadjipanagiotou and the community leader of Kalavasos and Chairman of the Coordinating Committee of the 9 communities of Vasilikos, Mr. L. Fokas, welcomed the event.
- The findings of the recent stakeholder consultation analysis were presented and discussed among the participants. The key stakeholders involved in this exercise over a 2-year period are shown in the figure below.

Discussion points

- Consultations with stakeholders showed that there is a need to create an environment and health observatory for the wider area of Vasilikos and Limassol, where a series of indicators of population health and environmental pollutants will be monitored periodically in time and space.
- The need for stricter government policies for monitoring hydrocarbon activities and communicating risks with all stakeholders before the licensing of a new industrial facility at the Vasilikos energy hub became apparent.
- The benefits of sustaining a transparent and open communication channel among all stakeholders and the public, while exchanging views among health experts related to hydrocarbon activities (e.g. service stations, industrial activities, asphalt, etc.) were emphasized.



Stakeholders

- **Government (GOV)** (n=9)**:** governmental departments and units responsible for hydrocarbons' authorizations, strategic planning and energy provision.
- **Small-medium industries (SMIs)** (n=6): companies which are actively involved in Cyprus with activities of exploration, production, managing and distributing hydrocarbons, onshore and offshore; big multi-national industries of oil and gas are also included in this group.
- **Small-medium enterprises (SMEs)** (n=4): companies related with the hydrocarbons industry of Cyprus, including environmental consultants, laboratories and engineers.
- **Academia / professional associations (APA)** (n=4)**:** academics who are involved in hydrocarbons research.
- **Local residential community authorities (LA)** (n=9)**:** Local authorities of Vasilikos surrounding area and specifically, leaders of the nine communities of the area: Asgata, Pentakomo, Tochni, Kalavasos, Choirokitia, Mari, Maroni, Zygi and Psematismenos.
- **Public/Communities** (n=5000): residents of the nine communities around the Vasilikos (VEC) area.

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International Exposome Conference 2021
29-30th November 2021

The EXPOSOGAS consortium was delighted to organize the 2021 International Exposome Conference (virtual event). The focus of our conference was on the **applications, utility and tools of the human exposome framework on environmental and occupational health practical applications in industrially contaminated sites (ICS)** located in the Mediterranean region, and elsewhere.

Aims:

1. Exchange knowledge and experiences on the application of the exposome concept for the improved understanding of environmental and public health risks associated with ICS activities
2. Create awareness among scientists and ICS stakeholders about the pressing environmental and public health risks for the general public surrounding ICS.
3. Overcome barriers linked with the deployment of prevention and control measures for ICS in the community.

Global reach - Participants connected from Europe, Africa, Middle East and Asia

-Keynote Speakers-

Dr. Tony Fletcher
PFAS and Public Health.
Associate Professor in Environmental Epidemiology, Department of Public Health, Environments and Society, London School of Hygiene & Tropical Medicine

Dr. Marco Martuzzi
Risk management of industrially contaminated sites.
Director, Environment and Health Department, Italian National Institute of Public Health

More than 70 participants attended each day of the 2-day long conference

Particular attention was paid on emerging tools and technologies that could help better assess environmental and public health risks using the human exposome methodological framework and its tools.

Key Points emerging during conference

- More than 600K industrial contaminated sites (ICS) registered in Europe and about 340K require clean up.
- Environmental injustice: socially deprived population groups affected by their living nearby ICS
- Need to monitor environment and health in these ICS to the benefit of the surrounding populations

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Training School

- The Training School was part of the International Exposome Conference 2021 and it was open to the global scientific community.
- A two-day online "live" training in exposure technologies on 25 and 26 November 2021. This followed up naturally the earlier training events that took place primarily for CII students and researchers.
- It consisted of multiple sessions which were presented online “live” by lecturers, with supportive or additional offline materials, where necessary.

The following topics and technologies were covered during the training school:

1. General introductions into exposome research
2. External exposure assessment (e.g., sensors, dermal exposure assessment)
3. Internal exposure assessment (e.g., Biomonitoring, omics)
4. Environmental epidemiology (e.g., epidemiology principles, disease spatial modelling)and
5. Supportive data handling and analysis technologies (e.g., R scripts, omics workflows)

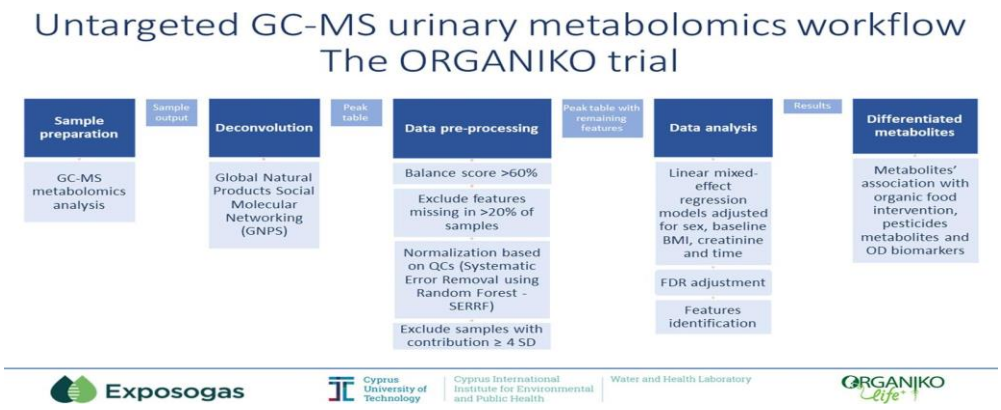
The training was open to:

- ✓ Graduate students and early-stage researchers to augment their curriculum
- ✓ Delegates attending the International Conference, to provide prior technical background information towards comprehending the health risks associated with Industrial Contaminated Sites
- ✓ Those with an interest in learning more about exposome technologies and their applications

More info

Recent Publications (1)

Use of metabolomics in refining the effect of an organic food intervention on biomarkers of exposure to pesticides and biomarkers of oxidative damage in primary school children in Cyprus: A cluster-randomized cross-over trial



Background

Exposure to pesticides has been associated with oxidative stress in animals and humans. Previously, we showed that an organic food intervention reduced pesticide exposure and oxidative damage (OD) biomarkers over time; however associated metabolic changes are not fully understood yet.

Objectives

We assessed perturbations of the urine metabolome in response to an organic food intervention for children and its association with pesticides biomarkers [3-phenoxybenzoic acid (3-PBA) and 6-chloronicotinic acid (6-CN)]. We also evaluated the molecular signatures of metabolites associated with biomarkers of OD (8-*iso*-PGF2a and 8-OHdG) and related biological pathways.

Methods

We used data from the ORGANIKO LIFE + trial (NCT02998203), a cluster-randomized cross-over trial conducted among primary school children in Cyprus. Participants (n = 149) were asked to follow an organic food intervention for 40 days and their usual food habits for another 40 days, providing up to six first morning urine samples (>850 samples in total). Untargeted GC–MS metabolomics analysis was performed. Metabolites with RSD ≤ 20% and D-ratio ≤ 50% were retained for analysis. Associations were examined using mixed-effect regression models and corrected for false-discovery rate of 0.05. Pathway analysis followed.

Results

Following strict quality checks, 156 features remained out of a total of 610. D-glucose was associated with the organic food intervention (β = −0.23, 95% CI: −0.37,−0.10), aminomalonic acid showed a time-dependent increase during the intervention period (β_{int} = 0.012; 95% CI:0.002, 0.022) and was associated with the two OD biomarkers (β = −0.27, 95% CI:−0.34,−0.20 for 8-*iso*-PGF2a and β = 0.19, 95% CI:0.11,0.28 for 8-OHdG) and uric acid with 8-OHdG (β = 0.19, 95% CI:0.11,0.26). Metabolites were involved in pathways such as the starch and sucrose metabolism and pentose and glucuronate interconversions.

Discussion

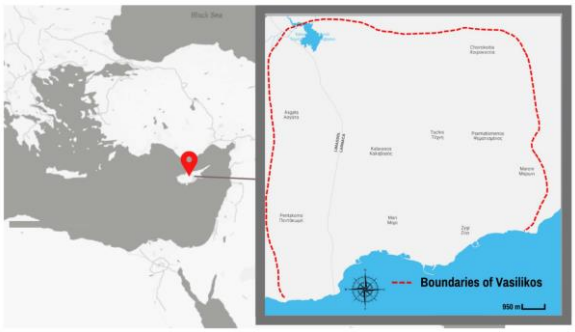
This is the first metabolomics study providing evidence of differential expression of metabolites by an organic food intervention, corroborating the reduction in biomarkers of OD. Further mechanistic evidence is warranted to better understand the biological plausibility of an organic food treatment on children's health outcomes.

- The work was published in the *Environment International* journal
- Funding by the EXPOSOGAS project, H2020 Research and Innovation Programme (Grant #810995)

Recent Publications (2)

Stakeholders' Perceptions of Environmental and Public Health Risks Associated with Hydrocarbon Activities in and around the Vasilikos Energy Center, Cyprus

This publication is the official output of the EXPOSOGAS project's stakeholder engagement activities



Background and aim

The Vasilikos Energy Center (VEC) is a large hydrocarbon industrial hub actively operating in Cyprus. There is strong public interest by the communities surrounding VEC to engage with all stakeholders towards the sustainable development of hydrocarbon in the region. The methodological framework of the exposome concept would allow for the holistic identification of all relevant environmental exposures by engaging the most relevant stakeholders in industrially contaminated sites. The main objectives of this study were to: (i) evaluate the stakeholders' perceptions of the environmental and public health risks and recommended actions associated with the VEC hydrocarbon activities, and (ii) assess the stakeholders' understanding and interest towards exposome-based technologies for use in oil and gas applications.

Methods

Six major groups of stakeholders were identified: local authorities, small-medium industries (SMIs) (including multi-national companies), small-medium enterprises (SMEs), academia/professional associations, government, and the general public residing in the communities surrounding the VEC. During 2019–2021, a suite of stakeholder engagement initiatives was deployed, including semi-structured interviews (n = 32), a community survey for the general public (n = 309), technical meetings, and workshops (n = 4). Results from the semi-structured interviews, technical meetings and workshops were analyzed through thematic analysis and results from the community survey were analyzed using descriptive statistics.

Results

Almost all stakeholders expressed the need for the implementation of a systematic health monitoring system for the VEC broader area and its surrounding residential communities, including frequent measurements of air pollutant emissions. Moreover, stricter policies by the government about licensing and monitoring of hydrocarbon activities and proper communication to the public and the mass media emerged as important needs. The exposome concept was not practiced by the SMEs, but SMIs showed willingness to use it in the future as part of their research and development activities.

Conclusions

The sustainable development of hydrocarbon exploitation and processing prospects for Cyprus involves the VEC. Continuous and active collaboration and mutual feedback among all stakeholders involved with the VEC is essential, as this may allow future environmental and occupational health initiatives to be formalized.

- The work was published in the *International Journal of Environmental Research and Public Health*:
- Funding by the EXPOSOGAS project, H2020 Research and Innovation Programme (Grant #810995)

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Policy Brief

A policy brief was prepared to provide policy makers in Cyprus with the EXPOSOGAS study framework and its major findings. This policy brief was communicated in December 2021 with all stakeholders of hydrocarbons activities in the Cyprus Exclusive Economic Zone (EEZ). This brief placed particular emphasis on:

- **Public and environmental health issues related to the sustainable development of hydrocarbons in the EEZ of Cyprus, and in particular for the Vasilikos Energy Center (VEC) and the surrounding area.**
- **Evaluation of the perceptions of the stakeholders regarding the potential risks for the environment and public health and the proposed actions related to the hydrocarbon activities in the VEC area.**
- **Analysis of stakeholder interest in new exposome technologies for monitoring and evaluating exposure to hydrocarbons and related pollutants for both industry workers and the general population nearby.**

CONTACT US

Thank you all for your interest during these 3 years!

We hope that we continue our interactions and networking activities for hydrocarbons activities in the field of environmental and public health sciences.

The website will remain live for you to access the training recordings and technical materials available in there.

Last, feel free to send us an email, if interested in joining a scientific network on the industrially contaminated sites and the application of the exposome concept and its tools.