

ICSHNet. Environmental health challenges from industrial contamination

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The question of human health in industrially contaminated sites (ICSs) is multi-faceted at the level of problem framing, study design, methodology, analysis, interpretation of results, and derivation of implications for policy and remediation. These dimensions are often separately addressed in real contexts, and this is one of the reasons why a comprehensive approach to the problem is still lacking.

Several aspects contribute to make ICSs a relevant public health issue. Characterizing the overall impacts of industrialized areas is a challenging task, due to several factors often related each other which include:

- heterogeneous hazards and chemical mixtures affecting several environmental matrices (soil, air, water, and food chain)
- multiple agents from multiple sources;
- close contiguity of industrial settings to urban areas, often densely populated and therefore with expected high impacts;
- multiple aetiology of most potentially related diseases;
- difficulty in gathering quantitative exposure estimates.

Another distinctive feature, shared by many ICS, is that they often involve marked health inequalities. These sites, being in general non-attractive residential areas, tend to be inhabited by people of lower socioeconomic level and deprivation gradients are often seen around contaminated sites. Given the concurrence of multiple contaminants, the social disadvantage, and additional burden imposed at the individual level by unhealthy lifestyles, contaminated sites can sometimes be seen as “hotspots” of generally bad environment and health. In addition, society at large obvi-

ously benefits from the output of industrial activities, thus introducing an additional dimension of environmental (in)justice. For these reasons, the issue of human health in industrially contaminated areas is best addressed with a strong sustainability perspective, taking into account, on the one side, the evidence on health effects and impacts, but considering the broader context of environmental and ecosystem health, as well as the social environment – including the occupational opportunities that arise from industrial activities. All these things require an intersectoral approach and has to be seen as part of a social negotiation, where the legitimate needs and aspirations of vulnerable groups, residents, workers, investors, and business are taken into account in a non-discriminatory process.¹

The issue of a European response to the health problems caused by contaminated sites was initially raised in the frame of two technical meetings organized by the European Centre for Environment and Health of the World Health Organization (WHO), whose proceedings were subsequently published.² This implied bringing together for the first time researchers and public health professionals operating in this field across Europe, reviewing existing scientific evidence and methodological options, exploring priorities and identifying topics and goals for collaborative works. One major output of the above-mentioned meetings, taking into account the inherent heterogeneity underlying this complex environmental health matter, was reaching a consensus about a first operational definition of contaminated sites.

Building on the experiences described above, a consequent relevant change in capacity building within environmental

health issues in ICSs is the establishment of the first WHO Collaborating Centre (CC) for Environmental Health in Contaminated Sites in 2013. The WHO CC has been operating in strict collaboration with WHO on:

- expanding and consolidating networks and mechanisms for the collection and dissemination of information on environment and health in contaminated sites, through providing support in organisation of WHO conferences, workshops, training, dissemination activities, and other events;
- contributing to WHO efforts in identifying priorities on how to assess environmental health risks and to support primary prevention interventions to protect and promote public health in contaminated areas and environmental hotspots.

Among the activities coordinated by the WHO CC, the most important was the launch, in 2015, of a specific European Cooperation in Science and Technology (COST) Action on Industrially Contaminated Sites and Health Network (ICSHNet).³

This Action currently involves WHO, European Union, and European Community bodies and public environmental health institution of 33 Countries. Overall, about 150 researchers and experts from about 50 public health institutions, universities, and environmental agencies are involved in the activities carried out by the COST Action.⁴ One of the early goals of the Action was to adopt a definition of industrially contaminated sites, building on the previous one proposed by WHO,² shared by the Action participant. The adopted definition is the following: “areas hosting or having hosted industrial human activities which have produced or might produce, directly or indirectly (waste disposals), chemical contamination of soil, surface or ground-water, air, food-chain, resulting or being able to result in human health impacts”.

Due to the multiplicity of ICSs and heterogeneity of the exposures scenarios and of the environmental, social, and occupational settings, an overall picture of the health impacts remains uncertain. The COST Action was launched to promote collaborative activities between researchers and risk managers to identify common strategies at European level to deal more systematically with these issues. Therefore, the Action aims to consolidate the European network of experts and relevant institutions, and to develop a common framework for research and response.

The networking activities carried out by the ICSHNet Action so far, in close collaboration with WHO, contributed to the inclusion, for the first time, of contaminated sites as an environmental health priority area in the Declaration of the Sixth Ministerial Conference on Envir-

onment and Health (held in Ostrava, Czech Republic, on 15th June 2017). The Ostrava Declaration includes a commitment towards “preventing and eliminating the adverse environmental and health effects, costs, and inequalities related to waste management and contaminated sites, by advancing towards the elimination of uncontrolled and illegal waste disposal and trafficking, and sound management of waste and contaminated sites in the context of transition to a circular economy”.⁵

This **Special Issue** presents review and methodological papers related to environmental health issues in industrially contaminated sites. It is mainly focused on the results of the activities carried out by the working groups of the ICSHNet COST Action aimed at:

- clarifying knowledge gaps and research priorities;
- guiding collection and organisation of relevant data and information;
- stimulating development of harmonised methodology;
- promoting collaborative research initiatives;
- developing guidance on methods and tools for exposure evaluation, health risk, and impact assessment.

This issue is composed by 7 contributions and a commentary.

The first **contribution, from Martin-Olmedo and colleagues**, is focused on the information gap analysis to develop surveillance programmes as a tool to develop or improve the capability of a national or local system of environmental public health tracking in characterizing the health impact of industrially contaminated sites.

The main first effort for the evaluation of the causal nature of the association between environmental and health data should be made in the exposure assessment.

The review from Hoek and colleagues analyses the network of the exposure pathways from the sources of contamination to the target populations, explores the available options for exposure assessment, and identifies the fields for its improvement. The complexity of the exposure assessment in the context of ICSs is analysed in the **manuscript of Sarigiannis and Karakitsios** from the perspective of the exposome paradigm with an example related to neurodevelopment in children living close to a landfill, that can be used for an integrated health risk assessment.

A clear-cut classification of approaches and methods for characterizing the health impact of ICSs is difficult. In current practice, the health impact of an ICS is evaluated using studies and assessments falling in two broad types of strategies: one based on risk assessment, the other on epidemiology.⁶ **The review from Xiong and colleagues** explores the available options for quantitative health risk

assessment and health impact assessment in ICS by identifying, describing, and evaluating methods used in quantification of health risks and impacts, and limits of published studies in the context of an ICS. **The review from De Sario and colleagues** is focused on analysing the epidemiological available literature on the health risk associated with residential exposure to industrially contaminated sites. The contribution highlights some relevant aspects of the available studies in terms of type of design, geographical distribution of study areas, type of industrial contamination, main health outcomes, and population considered.

The last two manuscripts deal with the perspectives of developing methods and strategies to assess health risk and impact from ICSs. **The manuscript from Shaddick and colleagues** proposes a method for assessing the health impact of pollution from an ICS based on big data and explores its application to the case of landfills using available large European datasets, with the possibility to adopt the approach to estimate the environmental health impact of ICSs. The paper from **Iavarone and colleagues** describes cancer risks in children and young adults resid-

ing in National Priority Contaminated Sites in Italy, and provides a suitable framework to develop childhood cancer surveillance in industrially contaminated sites across Europe based on standardized methodologies and accredited information sources.

The last contribution to the Special Issue is a **commentary from Savitz** on when epidemiologic research is a helpful response to address public health questions arising from industrial contamination. He examines strengths and weaknesses of initiating new epidemiological studies to respond to needs of communities living in an ICS, highlighting that the balance between costs and benefits of research may vary across settings and locations, depending in part on the economic resources available to pursue new knowledge versus managing a threat to public health and the nature of available environmental health surveillance data collection systems.

Conflict of interest disclosure: the Authors declare they have no conflict of interest.

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