Soil Chemical Pollution, Risk Assessment, Remediation and Security

Edited by
Lubomir Simeonov
Vardan Sargsyan

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Soil Chemical Pollution, Risk Assessment, Remediation and Security
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Soil Chemical Pollution, Risk Assessment, Remediation and Security

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The book contains the contributions at the NATO Advanced Research Workshop on Soil Chemical Pollution, Risk Assessment, Remediation and Security, which took place in Sofia, Bulgaria, May 23–26, 2007. Scientists representing fields of chemistry, biology, toxicology, physics, risk assessment, ecology, environmental protection, remediation and public health, from Armenia, Azerbaijan, Belarus, Belgium, Bulgaria, Germany, France, Hungary, Italy, Kazakhstan, Moldova, Netherlands, Poland, Romania, Russian Federation, Spain and Ukraine participated in the work of the ARW.

The main objective of the ARW was to contribute to the existing knowledge on soil pollution and remediation. Stress was given to: critical assessment of the used analyses and methods for study effects in combined chemical pollution (organic pollutants and pesticides, metals) on soil biota and fertility; to evaluate specific aspects of the risk assessment; to assess the most advanced technologies for soil remediation used for different purposes; to evaluated the economical involvement; to evaluate national policies for soil security in different NATO and partner countries.

Conclusions are based on the discussion during the ARW and related to the proposed objectives and expected outcomes:

1. Laboratory and field methods for soil pollutants analyses: Laboratory analytical methods and techniques are mostly studied, compared with the sampling and sample preparation techniques; reference materials, standards, quality control procedures. Reference laboratories and accreditation still are not well harmonized among the different countries. A lot of methods are not standardised. The quality control procedures are not completely set-up. In different countries the ISO EN and CEN analytical standards are not available in native language or even not introduced.

2. Strategy of sampling and monitoring of polluted sites: Development in the sampling and analytical physical, chemical and biological methods to characterise the quality of soils is already done, but more efforts should be put on this domain. Sampling and measurement uncertainty data processing contribute to the analytical results improvement. The sampling methods for soil monitoring are properly used.

3. Sources, movement, interaction and transformation of soil pollutants: Information about the sources of soil pollution is available. Soil background data
not enough available, in terms of: compounds, soil types, and regions. Knowledge about pollutants pathways of migration in/from soils is not satisfactory. The monitoring valid data for soil quality control are not enough covering the needs in respect to modeling and remediation. Information about interactions and transformation of the single pollutant in soils are available, but not enough centralized and systematized (books, monographs with theory and exercises). Soil-biological methods will help the elucidation of the combined effects of combined chemical pollution.

4. Risk assessment of combined and complex exposure and effects of soil chemical pollution: The use of risk assessment methods to start a remediation process was emphasized, but they are not commonly used. Risk assessment methods, independent on contaminants and the pathways, are available. Methods for determine the ecological risk for special situations, such as multimedia pollution are needed.

5. Management of soil pollution. Prevention strategies and remediation: A lot of soil remediation methods and technologies are available (physical, chemical and biological) and among them, phytoremediation have been found to be an efficient one and less expensive. Phytoremediation contributes to natural attenuation, and regenerate the soil quality. Bioremediation (microorganisms) is also a promising technique for soil remediation of different contaminants. Most of the remediation methods and techniques are costly, therefore are avoided or improperly used. The validation of using these methods for different soils is insufficient.

Recommendation were formulated as concerning the following fields.

Research needs
Continued research is needed in order to develop new or improved methods for sampling strategies to examine the spatial and temporal variability of the chemical pollutants in contaminated sites. Research priorities should focus on: (i) development and improvement of sampling strategies to examine the spatial and temporal variability of the chemical pollutants in contaminated sites, (ii) the harmonization of the use of bioindicators for soil pollution monitoring especially for unknown and combined chemicals, (iii) development of non-invasive (geophysical) tools to characterize the spatial temporal distribution of the soil physical and chemical properties related to pollution at the laboratory and field scales and the establishment and (iv) validation of new analytical methods for determination of specific soil emerging pollutants.

Research projects for management of chemical pollution to the soil should be multidisciplinary, combining the expertise from the various specialties related to understanding and management of these chemical impacts. A specific need has been identified for research funding to support (i) improvement of the
knowledge of processes involved in pollutants fate with especial focus on bioavailability, (ii) improvement of modeling approaches for prediction of pollutants’ fate and concentrations in the soil, (iii) the improvement of risk assessment methodologies for combined and complex exposure and (iv) effects of soil chemical pollution harmonization of approaches and methods for establishment of soil pollution quality standards on the base of eco toxicity and health data related to different soil use types, (v) development of new ecologically safe methods for effective remediation of polluted soils to restore original multifunctionality of the soils.

Management of chemical polluted soils
The design of field experiments concerning soil remediation should be based on previous laboratory tests. A key requirement for the efficient management of chemical polluted soils is the development of financial mechanisms for optimal control of pollution and pricing of land and soil resources and the availability of information concerning the distribution of chemicals in the environment and the associated health impacts. To facilitate the wide-spread availability of information, databases of environmental monitoring data and human health impacts (i.e., geomedical databases) should be developed and shared.

Environmental and environmental health policies
Coordination of environmental policies among and between nations is essential for the management of chemical polluted soils. Requirements for the control and management of chemical concentration limits of pollutants in soils should be harmonized across nations. In addition, policies should be implemented risk assessment in order to protect the public health and to prevent the transport of pollutants from soils to water and food.

Public communication and education
The general public plays a critical role in the protection of the environment through direct actions and support of public policies for environmental protection. In addition, environmental scientists and researchers have an obligation to facilitate public education and to ensure that the public is provided with accurate information on chemical threats to the environment. International collaboration exchange of experience in the field of soil management should be encouraged by Science and Peace NATO Program.
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