



Review

Contaminated land in Colombia: A critical review of current status and future approach for the management of contaminated sites



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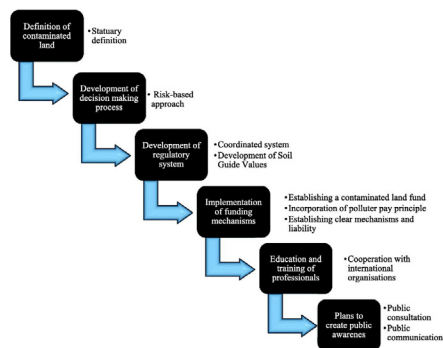
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HIGHLIGHTS

- Describe the principal problems of contamination in Colombia to take decision in future regulation
- Contributes towards the advancement of land contamination management practice
- It can be used as example for Colombia and other countries in the region.
- Provide an integral sustainable solution for restoring the usability and economic value of land

GRAPHICAL ABSTRACT



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ABSTRACT

Environmental contaminants can have negative effects on human health and land, air and water resources. Consequently, there have been significant advances in regulation for protecting the environment in developed countries including the development of remediation frameworks and guidelines. On the other hand, fewer studies have been reported on the risks and health effects of contaminants in developing regions and there is scarce information regarding contaminated land assessment and environmental remediation. Colombia is an important emerging economy and has started to take the first steps towards the development of a framework for the management of contaminated sites and there are opportunities for the country to learn from countries with well-established frameworks such as the United States (US) and the United Kingdom (UK) and for international collaboration with organisations such as CRC for Contamination Assessment and Remediation of the Environment (CARE). We review main pollution issues, current status of contaminated land management in Colombia to identify the gaps in policy and regulation. We also review the UK and US contaminated land policies and regulations to identify the elements of those experiences that could support progress in the country. Finally, we propose recommendations (e.g. risk based approach, soil screening criteria, clean-up funding, liability) for Colombia that could support further development and implementation of a more effective contaminated land management framework.

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1. Introduction

Colombia is situated in the Northwest of the South American continent, with an area of 1'141,748 km², a marine zone that covers 928,660 km² and a population of 46'581,823 (DANE-Departamento Administrativo Nacional de Estadística, 2011), which to put it into perspective, represents the fourth most populated country in the American continent. The vast majority of the population is set in the central (Andean) and north (Caribbean) regions. The country is divided into 32 geographic regions and a capital district, Bogotá, which holds 7,879,000 habitants.

Colombian economy is considered as an emerging economy and belongs to the intercontinental economic group in which members are considered emerging economies with a high development potential, known as CIVETS (Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa) and also member of the continental Community of Latin American and Caribbean States (CELAC). To put into perspective the Colombian economy occupies the fourth place in Latin America, just below Brasil, México and Argentina; sixth place in the American continent and 33rd place in the world (Montoya, 2010). The Colombian economy is mainly based in production of primary materials for export and consumer products for the internal market. The main export activities in Colombia are oil production (fourth place in Latin America and six place in the continent) and mining especially carbon, gold, emeralds, sapphires and diamonds (Ministerio de Ambiente y Desarrollo Sostenible, 2016). The most relevant industrial sectors in the Colombian economy are the textiles, automotive, chemical and petrochemical industries.

As in many other developing countries, industrial growth in Colombia has resulted in contamination of land. In a recent study conducted by the Ministry of Environment and Sustainable Development (MESD) (Ministerio de Ambiente y Desarrollo Sostenible, 2016), 1843 sites were considered to be potentially contaminated across a range of economic sectors. However, Colombia lacks of a formal structure for the assessment and management of contaminated sites. Clean-up efforts in Colombia are

mainly voluntary actions of social responsibility, whose efforts are constrained by financial resources.

There are a number of countries with more developed policies and frameworks for managing pollution and contaminated land. For instance, the United States (US) and the United Kingdom (UK) have well established frameworks for pollution prevention, and the assessment and management/remediation of contaminated sites following a risk-based approach. Several lessons from these can be learnt at a global level, especially in the development of cost effective innovative approaches.

Colombia could benefit from the experiences learnt by these two countries and adapt these to develop a robust local framework and best practices for the management of contaminated land, in particular incorporating risk assessment to determine levels of harm, prioritise issues, and inform policy for contaminated land management.

To this end, this review will first look at the status of the art of contaminated land management in the South American country of Colombia, identify existing gaps, identify well established approaches from overseas (i.e. US and UK) that can be adapted and applied to the country and provide a road map for the management/remediation of contaminated sites in this country.

2. Principal causes of contamination problems in Colombia

There are a range of causes that resulted in pressures on the land that are leading to land contamination in Colombia.

2.1. Gold mining

Colombia is the second largest producer of gold in Latin America, with an annual production of 47,838 kg (López et al., 2012). However, most is produced in an artisanal manner with 200,000 miners officially producing 30 tonnes of gold per annum (Cordy et al., 2011). Some 50% of gold mining activities is thought to be informal mining (PNUMA and

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