

Valuation of soil-groundwater pollution damage at site scale based on risk and economic theories: Framework, method and case study

XINYI CAO¹, YUANZHENG ZHAI¹, YANGUO TENG²,
WEIFENG YUE¹ AND JIE YANG¹

¹College of Water Sciences, Beijing Normal University, Beijing 100875

²Engineering Research Center of Groundwater Pollution Control and Remediation, Ministry of Education, Beijing 100875

Presenting Author: diszyz@163.com

Environmental damage and pollution bring great harm and loss to human society. Although the “polluter pays” principle is deeply rooted in efforts to manage the remediation of polluted sites, particularly in the soil-groundwater environment. Unfortunately, there is no pollution damage compensation mechanism generally accepted by all stakeholders. The greatest constraint in developing such a mechanism is the difficulty in economically quantifying the pollution damage. In this study, we establish an assessment framework and a valuation method for soil-groundwater damage at polluted sites based on a “pollution source → target (soil-groundwater) → receptor (humans, animals, and plants) → damages → stakeholders (human society and ecosystem)” model that is usually applied in groundwater risk assessment research. Five economic loss are included in the valuation method: (1) human health loss, (2) emergency disposal cost, (3) direct economic loss, (4) ecological restoration cost, and (5) ecosystem services loss. We apply the framework to a case study in northwest China and calculate the total economic loss from soil-groundwater pollution in the case study at 12.6 million yuan. The largest proportion of the total loss was the ecological restoration cost (85.6%), followed by the emergency disposal cost (11.2%), and finally ecosystem services (3.2%). Valuation of damage from environmental pollution is essentially a socioeconomic issue because it depends on the local socioeconomic factors and the strategic game played among stakeholders. This study supplies a new framework and method for valuing environmental damage and pollution, and offers suggestions for environmental management to reduce the damage caused by soil-groundwater pollution to health and ecosystems.