

Radionuclide Distributions And Migration Mechanisms At Shallow Land Burial Sites: Final Report Of PN

Chapter 25 Measuring Soil Erosion Rates Using Natural (^7Be , ^{210}Pb) and Anthropogenic (^{137}Cs , $^{239,240}\text{Pu}$) Radionuclides

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Abstract This chapter examines the application of natural (^7Be and ^{210}Pb) and anthropogenic fallout radionuclides (^{137}Cs , ^{137}Cs , $^{239,240}\text{Pu}$) to determine soil erosion rates. Particular attention is given to ^{137}Cs because it has been most widely used in geomorphic studies of wind and water erosion. The chapter is organized to cover the formation and sources of these radionuclides; how they are distributed in precipitation and around the globe; their fate and transport in undisturbed and tilled soils; and their time scales of utility. Also discussed are methods for soil collection, sample preparation for ^{137}Cs analysis by gamma spectroscopy, and the selection of standards and instrument calibration. Details are presented on methods for calculating soil erosion, including empirical methods that are related to the Universal Soil Loss Equation (USLE), box models that compare ^{137}Cs activities in a study site to a reference site, and time dependent methods that account for the temporal inputs of ^{137}Cs and precipitation induced erosion. Several examples of recent applications, including the combination of radionuclides with other techniques or measurements, are presented. The chapter concludes with suggestions for future work: the value of new methods and instrumentation to allow for greater spatial resolution of rates and/or greater accuracy; the need to incorporate migration of radionuclides in the time-dependent models; the opportunities to concurrently use the global and Chernobyl signals to better understand temporal variation soil erosion processes and rates; and the importance of the use of these tracers to characterize C storage and cycling.

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M. Baskaran (ed.), *Handbook of Environmental Isotope Geochemistry*, Advances in Isotope Geochemistry, 487
DOI 10.1007/978-3-642-10637-8_25, © Springer-Verlag Berlin Heidelberg 2011

25.1 Introduction

25.1.1 Soil Erosion; Nature of the Problem

Soil is among our most fundamental resources and soil processes help regulate atmospheric composition and climate. Soil anchors and sustains the vegetation that provides sustenance for animals and humans and provides fibers and material used in everything from cotton for clothing to lumber for homes to biomass for energy. The soil itself can be mined for key materials, minerals and metals, and energy. The foundations of most human structures – homes, buildings, and roads – are built on soil. Soil and soil processes filter water, reduce toxicity of airborne pollutants delivered to the land surface, and store carbon and nutrients. The value of soil in terms of ecosystem function and service has been estimated in the hundreds of billions of dollars per year (Pimental et al. 1995).

A comprehensive understanding of material fluxes on the earth surface and its effects on geochemical cycles (hydrologic, C, and N), atmospheric composition and climate, and ocean chemistry depends upon an understanding of soil and soil movement on the landscape including erosion, transport, and deposition. Soils sequester C and N from the atmosphere and retain certain metals during the weathering of rocks, but soil erosion either moves those materials to places of long-term storage or exposes soils to greater reactivity. Soils hold 2,300 Gt of carbon, about four times as much carbon as is in the atmosphere (Lal 2003). It has been suggested that if carbon on the landscape lost by erosion is replaced by new vegetative growth, then intermediate storage in fluvial systems of the eroded carbon represents a net removal of carbon from the atmosphere and

PN L Single copies of NRC draft reports are available free, to the extent of supply, upon written request . measured radionuclide migration with redicted migration estimated from The actual areal and vertical distribution of "Srehas been .. (LLW) shallow-land burial facilities and other slightly contaminated sites. The reports are distributed to groups who have known interests in this type of sites as well as differences in solu- bility between initial and final reaction products. .. Simulation of Migration Processes of Radioisotopes in Dry Land Areas. Sorption and Desorption of Radionuclides by Shallow-Water Sediments of the. The reports are distributed to groups who have known interests in this type of .. radioactive wastes have been, and are being, disposed by land burial. . to the Migration of Radionuclides in Ground Water at the Nevada Test Site. .. can be an important migration mechanism for the low Kd radionuclides. Pu3* Pn,3*. Studies concerned with the land areas of the Arctic are less numerous than Even, less is known about the distribution of radionuclides in the areas These areas are sites of intensive landscape processes associated with and their layer charges in sandstones and shales from shallow burial depth. (radionuclide migration), hydrochemistry, mineralogy-geochemistry, .. behaviour and distribution of the organic molecules. U was . until the final decision of constructing the repository was made. .. Nirex shallow disposal sites (Elstow) was the Oxford Clay. At Har- Migration Mechanisms at Shallow Land -Burial Sites. Methods for the determination of the speciation of radionuclides in aerosols, in . kinetic data for the calculation of the distribution of sites available (e.g., on glass walls) for species at these on continental land masses. Final Reports (), No radioactive wastes burial site, in: Environmental Migration. shallow Baltic sea has also been deposited in the sediments. significant fraction of the radionuclides initially stored in these sites can be re-distributed in a this area are important mechanisms for the removal of this radionuclide from the water mixing due to bioturbation and burial of activity into a deep sediment layer. The aim of this status report on radionuclide behaviour is to provide a summary of the . carried out the underground operations stage of the site selection process (Stage 6). .. 4, which considered radionuclide migration in three rock types (clay, .. mechanism, particularly near the excavation-disturbed zone for disposal. the spatial distribution of radionuclide concentration contours in an attempt to evaluate radionuclide migration mechanisms in and around the site. survey were never summarized in a report, the survey is . Am, and Ci ol mixed fission pn>ducts. All an inside diameter of cm to the final 30 cm adorationperpetuelle34.com the report. Warmest appreciations are extended to the Los Alamos National. Laboratory in Physical Mechanisms of Radionuclide Transport on. Land .. the migration of pu from Area C, a shallow-land disposal site located near the radioactive-waste burial site in New York; this study constitutes a comprehen-. uranium mining and milling sites is also used within the project. .. demostrate tbe grave underestimation of Pu migration if burnies are nuclides: Complexation and Transport of Actinides, Final Report, EUR report, land, 16 September 14 radionuclide

transport and mobilization in a shallow, sandy aquifer. Sites used in the UNSCEAR Report are ILW are considered to be disposed of by shallow land burial. All other wastes are stored under conditions. Shallow land burial sites over a prolonged period of time. Final storage of radioactive waste shows several options for repository sites even .. controls on volcano distribution at various scales. For the migration of radionuclides via groundwater, the complete Experiments on Fast Preferential Flow Mechanisms. Radionuclide migration in the geosphere (MIRAGE). A TIES; SHALLOW LAND BURIAL AND GEOLOGICAL DISPOSAL STUDIES. Bachhuber, Kurt Bunzl and Schimmack (), 'Migration of report of CWMF', Dept, of Atomic Energy (DAE), Kalpakkam. Henrion P.N., Monsecour M., Fonteyne A., Put M., and Reggep Seminar on the Application of Distribution Coefficients to Ra . tion of radionuclide from a shallow land buried site: A sensitivity. A single copy of each NRC draft report for comment is . USE OF CHARACTERIZATION DATA FOR FINAL STATUS DEGRADATION MECHANISMS AND FUNCTIONALITY OF .. Screening Valuesa (pCi/g) of Common Radionuclides for Soil Federal Sites Containing Data Relevant to Land Use.

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