Assessment of the Spatial Variability in Leachate Migration from an Old Landfill Site

Investigations of the pollution of groundwater from old landfills have in most cases focused on delineating the pollution plume and only in very few cases on the landfill as a source to groundwater pollution. Landfills often cover large areas. Spatial variations in leachate composition may have great impact on the location of the main pollution plume in the downstream aquifer. Grindsted landfill in Denmark was investigated by sampling leachate beneath the landfill and in groundwater at the borders of the landfill. A pronounced variability in leachate quality and leakage patterns from the landfill was observed. Also variations in local groundwater flow directions were found. These observations are very important for delineation of the groundwater pollution and for proper choice of remedial action activities, related both to the plume and to the landfill.

Host publication information
Title of host publication: Groundwater Quality: Remediation and Protection (GQ’95) : Proceedings of an international conference held at Prague, Czech Republic, from 15 to 18 May 1995
Place of publication: UK
Publisher: IAHS Press
Editors: Kovar, K., Krásný, J.
ISBN (Print): 978-0947571290

Series: IAHS Series of Proceedings and Reports
Number: 225
Main Research Area: Technical/natural sciences
Conference: Prauge Conference, Prague, Czech Republic, 01/01/1995
Source: orbit
Source-ID: 317680
An Integrated Description of the Organic Pollution Plume from a Landfill (Grindsted, Denmark)

General information
State: Published
Organisations: Department of Environmental Science and Engineering, Water Resources Engineering, Department of Environmental Engineering, Technical University of Denmark
Authors: Rügge, K. (Intern), Bjerg, P. L. (Intern), Würtz, S. (Ekstern), Foverskov, A. (Intern), Skov, B. (Ekstern), Christensen, T. H. (Intern)
Publication date: 1994

Host publication information
Place of publication: Balkema, Rotterdam
Publisher: Balkema Publishers, A.A. / Taylor & Francis The Netherlands
Editors: Dracos, T., Stauffer, F.
ISBN (Print): 905410368X
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 317495

Publication: Research › Article in proceedings – Annual report year: 1994

An Integrated Description of the Organic Pollution Plume from an Old Landfill (Grindsted, Denmark)

General information
State: Published
Organisations: Department of Environmental Science and Engineering, Water Resources Engineering, Department of Environmental Engineering, Technical University of Denmark
Authors: Rügge, K. (Intern), Bjerg, P. L. (Intern), Würtz, S. (Ekstern), Foverskov, A. (Intern), Skov, B. (Ekstern)
Pages: 143-154
Publication date: 1994

Host publication information
Title of host publication: ATV Møde : Vintermøde om grundvandsforurening
Place of publication: Bredsten
Publisher: Akademiet for de Tekniske Videnskaber, ATV
Main Research Area: Technical/natural sciences
Conference: ATV Møde : Vintermøde om grundvandsforurening, Bredsten, Denmark, 08/03/1994 - 08/03/1994
Source: orbit
Source-ID: 317587

Publication: Research › Article in proceedings – Annual report year: 1994

Injektionsforsøg i forureningsfand ved Grindsted Gl. Losseplads

General information
State: Published
Organisations: Department of Environmental Science and Engineering, Water Resources Engineering, Department of Hydrodynamics and Water Resources, Technical University of Denmark
Authors: Rügge, K. (Intern), Bjerg, P. L. (Intern), Pedersen, J. K. (Intern), Christensen, T. H. (Intern), Skov, B. H. (Intern), Foverskov, A. (Intern), Refstrup, M. (Intern), Futtrup, J. (Ekstern), Würtz, S. (Ekstern)
Pages: 18
Publication date: 1994
Main Research Area: Technical/natural sciences

Publication information
Journal: INFO-NYT
Volume: 8
Original language: Danish
Source: orbit
Source-ID: 317358
Variabilitet i biologisk nedbrydning af specifikke organiske stoffer i en aerob akvifer målt ved laboratorie batch eksperimenter

General information
State: Published
Organisations: Department of Environmental Science and Engineering
Authors: Nielsen, P. (Intern), Foverskov, A. (Intern), Christensen, T. H. (Intern)
Pages: 167-178
Publication date: 1994

Host publication information
Title of host publication: ATV Møde: Vintermøde om grundvandsforurening
Place of publication: Bredsten
Publisher: Akademiet for de Tekniske Videnskaber, ATV
Main Research Area: Technical/natural sciences
Conference: ATV Møde: Vintermøde om grundvandsforurening, Bredsten, Denmark, 08/03/1994 - 08/03/1994
Source: orbit
Source-ID: 317629
Publication: Research › Article in proceedings – Annual report year: 1994

Assessing the Variability in Leachate Migration from an Old Municipal Landfill

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering, Water Resources Engineering, Department of Environmental Science and Engineering, Technical University of Denmark
Authors: Kjeldsen, P. (Intern), Bjerg, P. L. (Intern), Winther, P. (Ekstern), Rügge, K. (Intern), Pedersen, J. (Ekstern), Skov, B. (Ekstern), Foverskov, A. (Intern), Würtz, S. (Ekstern), Christensen, T. H. (Intern)
Pages: 1519-1531
Publication date: 1993

Host publication information
Title of host publication: Proceedings of Sardinia 93: Fourth International Landfill Symposium
Place of publication: Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Main Research Area: Technical/natural sciences
Conference: 4th International Landfill Symposium, Cagliari, Italy, 10/10/1993 - 10/10/1993
Source: orbit
Source-ID: 314614
Publication: Research - peer-review › Article in proceedings – Annual report year: 1993

Attenuation of Organic Leachate Pollutants in Groundwater

General information
State: Published
Organisations: Residual Resource Engineering, Department of Environmental Engineering, Water Resources Engineering, Department of Environmental Science and Engineering, Urban Water Engineering, Technical University of Denmark
Authors: Christensen, T. H. (Intern), Bjerg, P. L. (Intern), Rügge, K. (Intern), Albrechtsen, H. (Intern), Heron, G. (Intern), Pedersen, J. (Ekstern), Foverskov, A. (Intern), Skov, B. (Ekstern), Würtz, S. (Ekstern), Refstrup, M. (Intern)
Pages: 1105-1116
Publication date: 1993

Host publication information
Title of host publication: Proceedings of Sardinia 93: Fourth International Landfill Symposium
Place of publication: Italy
Publisher: CISA, Environmental Sanitary Engineering Centre
Main Research Area: Technical/natural sciences
Conference: 4th International Landfill Symposium, Cagliari, Italy, 10/10/1993 - 10/10/1993
Source: orbit
Source-ID: 314616
Publication: Research - peer-review › Article in proceedings – Annual report year: 1993
Degradation of Specific Organic Compounds in Leachate-Polluted Groundwater

General information
State: Published
Organisations: Department of Environmental Science and Engineering, Residual Resource Engineering, Department of Environmental Engineering, University of Waterloo
Authors: Lyngkilde, J. (Intern), Christensen, T. H. (Intern), Gillham, R. (Ekstern), Larsen, T. H. (Intern), Kjeldsen, P. (Intern), Skov, B. H. (Intern), Foverskov, A. (Intern), O'Hannesin, S. (Ekstern)
Pages: 485-495
Publication date: 1992

Host publication information
Title of host publication: Landfilling of Waste: Leachate
Place of publication: London and New York
Publisher: Elsevier Applied Science Publishers
Editors: Christensen, T. H., Cossu, R., Stegmann, R.
Main Research Area: Technical/natural sciences
Source: orbit
Source-ID: 312771
Publication: Research › Book chapter – Annual report year: 1992

The Degradation of Specific Organic Compounds with Landfill Leachate as a Primary Substrate

General information
State: Published
Organisations: Department of Environmental Science and Engineering
Authors: Lyngkilde, J. (Intern), Tjell, J. C. (Intern), Foverskov, A. (Intern)
Pages: 91-100
Publication date: 1988

Host publication information
Title of host publication: Contaminated Soil '88
Publisher: Kluwer Academic Publishers
Editors: Wolf, K., van den Brink, W. J., Colon, F. J.
Main Research Area: Technical/natural sciences
Publication: Research › Book chapter – Annual report year: 1988

Projects:

Field investigations of transport and fate of pesticides in a sandy aquifer
The behaviour of selected pesticides will be studied in the field e.g. migration, sorption, and degradation. A continuous injection experiment has been conducted for ambient flow gradients in an aerobic sandy aquifer. Hydrological and geochemical characteristics of the aquifer are already known. The microbiological and sorption characteristics of the aquifer will be characterized. Selected pesticides and conservative tracer will continuously be injected for a period of 0.5-1 year. Multilevel samplers installed downstream of the injection will be monitored frequently during a period of about two years. The experiment will be evaluated based on: (1) breakthrough curves at sampling points downstream of the injection and (2) reactive solute transport simulation of the pesticide plume using a model developed and evaluated in this project. From the breakthrough data, dilution, sorption, and degradation can be determined and field degradation rates calculated. The spatial distribution of the pesticide plume will be determined by synoptic sampling at all monitoring points (2-3 times). The field investigation will be planned in detail autumn 1997. The project is made in collaboration with GEUS and Department of Hydrodynamics and Water resources (ISVA). The project is funded by The Danish Environmental Research Programme. The project period is 1997-1999.

Department of Environmental Science and Engineering
Department of Hydrodynamics and Water Resources
Department of Environmental Engineering

Period: 01/01/1997 → 31/12/2000
Number of participants: 11
Project participant:
Field investigations of transport and fate of pesticides in a sandy aquifer

The behaviour of selected pesticides will be studied in the field e.g. migration, sorption, and degradation. A continuous injection experiment will be conducted for ambient flow gradients in an aerobic sandy aquifer. Hydrological and geochemical characteristics of the aquifer are already known. The microbiological and sorption characteristics of the aquifer will be characterized. Selected pesticides and conservative tracer will continuously be injected for a period of 0.5-1 year. Multilevel samplers installed downstream of the injection will be monitored frequently during a period of about two years. The experiment will be evaluated based on: (1) breakthrough curves at sampling points downstream of the injection and (2) reactive solute transport simulation of the pesticide plume using a model developed and evaluated in this project. From the breakthrough data, dilution, sorption, and degradation can be determined and field degradation rates calculated. The spatial distribution of the pesticide plume will be determined by synoptic sampling at all monitoring points (2-3 times). The field investigation will be planned in detail autumn 1997. The project is made in collaboration with GEUS and Department of .... (ISVA), and is fundes by The Danish Environmental Research Programme. The project period is 1997-1999.

Department of Environmental Engineering
Period: 01/01/1997 → 31/12/1999
Number of participants: 10
Acronym: 97
Project participant:
Foverskov, Anja (Intern)
Skov, Bent Henning (Intern)
Mosbaek, Hans (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Sørensen, Jens Schaarup (Intern)
Rügge, Kirsten (Intern)
Broholm, Mette Martina (Intern)
Tuxen, Nina (Intern)
Nilsson, Torben (Intern)

Project Manager, organisational:
Bjerg, Poul Legstrup (Intern)

Natural attenuation as remediation of landfill leachate plumes.

Natural attenuation as a remediation technology is being considered for landfill leachate plumes. The demonstration of mass removal of target pollutants by natural remediation and the evaluation of residual risk is somewhat more complicated than the approaches and protocols used in the context of petroleum hydrocarbons and chlorinated aliphatic compounds. The difference relates to the size of the source term and its influence on local hydrogeology, the mixture of pollutants and general organic matter and the often unidentified toxicity of the leachate. Based on the extensive research results described under "landfills" a conceptual model for natural attenuation at landfills is being developed.

Department of Environmental Engineering
Leaching of heavy metals from soils
Quality criteria for soils with respect to heavy metals have traditionally focused on the environmental issues related to the land use (ingestion of soil, skin contact, etc.) and very little attention has been given to protection of the groundwater. The complex form of heavy metals in polluted soils makes prediction of leachability difficult and leaching experiments or leaching test are usually the only way to assess the amount of metal to leach from the soil. Model scenarios are being developed to evaluate heavy metal leaching in the context of groundwater protection and allow for simplified methods to account for groundwater quality criteria, depth and location of polluted soil, reduction in infiltration and leachable amounts determined in leaching test. Experimental studies have been performed at actual sites and leaching experiments are conducted in the laboratory.

Department of Environmental Science and Engineering
National Institute of Aquatic Resources
VKI Water Quality Institute

Leaching of heavy metals from soils.
Quality criteria for soils with respect to heavy metals have traditionally focused on the environmental issues related to the land use (ingestion of soil, skin contact, etc.) and very little attention has been given to protection of the groundwater. The complex form of heavy metals in polluted soils makes prediction of leachability difficult and leaching experiments or leaching test are usually the only way to assess the amount of metal to leach from the soil. Model scenarios are being developed to evaluate heavy metal leaching in the context of groundwater protection and allow for simplified methods to account for groundwater quality criteria, depth and location of polluted soil, reduction in infiltration and leachable amounts determined in leaching test. Experimental studies have been performed at actual sites and leaching experiments are conducted in the laboratory.
complex form of heavy metals in polluted soils makes prediction of leachability difficult and leaching experiments or leaching test are usually the only way to assess the amount of metal to leach from the soil. Model scenarios are being developed to evaluate heavy metal leaching in the context of groundwater protection and allow for simplified methods to account for groundwater quality criteria, depth and location of polluted soil, leaching in infiltration and leachable amounts determined in leaching test. Experimental studies have been performed at actual sites and leaching experiments are conducted in the laboratory.

Department of Environmental Engineering  
Period: 01/01/1996 → 31/12/1998  
Number of participants: 5  
Acronym: 10  
Project participant:  
Foverskov, Anja (Intern)  
Jensen, Dorthe Lærke (Intern)  
Kjeldsen, Peter (Intern)  
Astrup, Thomas Fruergaard (Intern)  
Project Manager, organisational:  
Christensen, Thomas Høj Lund (Intern)  
Project

Anaerobic field injection experiment with organic chemicals in a leachate plume  
Eighteen organic chemicals at trace level were injected for at six month period into the strongly anaerobic part of the leachate plume downgradient from the Grindsted Landfill. The migration and fate of the compounds were monitored for nearly three years. Sorption was insignificant in the coarse sandy aquifer, but many of the organic chemicals degraded: Toluene, o-xylene, several nitrobenzenes and maybe naphthalene. Benzene was recalcitrant. The degradation rates were low and in many cases long adaptation periods were observed making short term laboratory degradation studies unsuited for studying degradation of organic chemicals in leachate plumes. However, long term batch degradation experiments and in situ microcosms installed in the plume gave results generally comparable to the observations in the plume. The plume was dominated by iron reduction, but locally methanogenesis and sulfate reduction also took place.

Department of Environmental Engineering  
Period: 01/08/1994 → 30/08/1997  
Number of participants: 9  
Acronym: 5  
Project participant:  
Foverskov, Anja (Intern)  
Skov, Bent Henning (Intern)  
Mosbaek, Hans (Intern)  
Albrechtsen, Hans-Jørgen (Intern)  
Sørensen, Jens Schaarup (Intern)  
Rügge, Kirsten (Intern)  
Refstrup, Mona (Intern)  
Bjerg, Poul Legstrup (Intern)  
Project Manager, organisational:  
Christensen, Thomas Høj Lund (Intern)  
Project

Anaerobic field injection experiment with organic chemicals in a leachate plume  
Eighteen organic chemicals at trace level were injected for at six month period into the strongly anaerobic part of the leachate plume downgradient from the Grindsted Landfill. The migration and fate of the compounds were monitored for nearly three years.

Department of Environmental Science and Engineering  
Department of Environmental Engineering  
Swiss Federal Institute of Aquatic Science and Technology  
Period: 01/04/1994 → 30/08/1997  
Number of participants: 10  
Project participant:  
Rügge, Kirsten (Intern)  
Bjerg, Poul Legstrup (Intern)
Albrechtsen, Hans-Jørgen (Intern)
Mosbæk, Hans (Intern)
Foverskov, Anja (Intern)
Skov, Bent Henning (Intern)
Sørensen, Jens Schaarup (Intern)
Refstrup, Mona (Intern)
Haderlein, Stefan (Ekstern)
Project Manager, organisational:
Christensen, Thomas Højlund (Intern)

**Financing sources**
Source: Unknown
Name of research programme: **Ukendt**
Amount: 5,000,000.00 Danish Kroner
Source: Unknown
Name of research programme: **Ukendt**
Amount: 0.00 Danish Kroner
Project