Analytical Modeling of Solute Transport in Groundwater. Using Models to Understand the Effect of Natural Processes on Contaminant Fate and Transport

Description: Emphasizes use of models to understand the impact of subsurface processes on contaminant transport

Groundwater is a critical resource that is relied upon by hundreds of millions of people globally. Contamination is an important problem that threatens people's access to sources of safe, clean, and plentiful groundwater in both developed and developing countries alike. To address this problem, an understanding of how contaminants in the subsurface behave is crucial, as a result of the physical, chemical, and biological processes that affect their movement. To gain this understanding, mathematical models are applied to simulate the fate and transport of groundwater contaminants. Modeling is an excellent way to gain an understanding of how nature behaves. In particular, analytical models are great teaching tools, allowing students to visualize under greatly simplified conditions how the presence, absence, or change of a natural process may affect behavior.

Analytical Modeling of Solute Transport in Groundwater: Using Models to Understand the Effect of Natural Processes on Contaminant Fate and Transport provides a strong teaching tool, going well beyond previous endeavors by not only presenting the models used to describe groundwater contaminant behavior but also systematically applying the models to clearly demonstrate to the reader how naturally occurring physical, chemical, and biological processes affect the fate and transport of contaminants in the subsurface.

Analytical Modeling of Solute Transport in Groundwater includes:

- A companion website with a downloadable modeling tool that is integrated with the text, allowing the reader to conduct simulations in order to graphically demonstrate the impact of processes on groundwater contaminant behavior
- A compendium of analytical solutions along with examples of how these solutions are derived from the governing model equations
- Example illustrations showing the effect of process parameter values on remediation efficacy, as well as how simple analytical models can be used to interpret the results of field observations

Researchers, students, and professionals in environmental engineering and hydrogeology studying the fate, transport, and remediation of contaminants in the subsurface will find the collected material useful in their studies.

Contents: List of Symbols xi
Preface xv
Acknowledgments xvii
About the Companion Website xix
1 Modeling 1
1.1 Introduction 1
1.2 Definitions 3
1.3 A Simple Model Darcy’s Law and Flow Modeling 3
1.3.1 Darcy’s Law 3
1.3.2 Flow Equation 5
6 Application of Analytical Models to Gain Insight into Transport Behavior 121

6.1 Contaminant Remediation 121

6.2 Borden Field Experiment 124

References 127

A Solution to One-Dimensional ADR Equation with First-Order Degradation Kinetics Using Laplace Transforms 129

Reference 132

B Solution to One-Dimensional ADR Equation with Zeroth-Order Degradation Kinetics Using Laplace Transforms 133

Reference 135

C Solutions to the One-Dimensional ADR in Literature 137

References 140

D User Instructions for AnaModelTool Software 141

E Useful Laplace Transforms 145

E.1 Laplace Transforms from van Genuchten and Alves (1982) 145

Reference 148

F Solution to Three-Dimensional ADR Equation with First-Order Degradation Kinetics for an Instantaneous Point Source Using Laplace and Fourier Transforms 149

References 151

G Solution to Three-Dimensional ADR Equation with Zeroth-Order Degradation Kinetics for an Instantaneous Point Source Using Laplace and Fourier Transforms 153

References 155

H Solutions to the Three-Dimensional ADR in Literature 157

References 160

I Derivation of the Long-Time First-Order Rate Constant to Model Decrease in Concentrations at a Monitoring Well Due to Advection, Dispersion, Equilibrium Sorption, and First-Order Degradation (Three-Dimensional Infinite System with an Instantaneous Point Source) 161

J Application of Aris Method of Moments to Calculate Temporal Moments 163

K Application of Modified Aris Method of Moments to Calculate Spatial Moments Assuming Equilibrium Sorption 165

L Application of Modified Aris Method of Moments to Calculate Spatial Moments Assuming Rate-Limited Sorption 167

L.1 Zeroth Spatial Moment 168

L.2 First Spatial Moment 168

L.3 Second Spatial Moment 168
M Derivation of Laplace Domain Solutions to a Model Describing Radial Advective/Dispersive/Sorptive Transport to an Extraction Well 171

References 173

N AnaModelTool Governing Equations, Initial and Boundary Conditions, and Source Code 175

N.1 Model 101 175
N.2 Model 102 176
N.3 Model 103 178
N.4 Model 104 179
N.5 Model 104M 180
N.6 Model 105 182
N.7 Model 106 184
N.8 Model 107 185
N.9 Model 108 187
N.10 Model 109 189
N.11 Model 201 191
N.12 Model 202 193
N.13 Model 203 195
N.14 Model 204 197
N.15 Model 205 200
N.16 Model 206 201
N.17 Model 207 203
N.18 Model 208 206
N.19 Model 301 207
N.20 Model 302 210
N.21 Model 303 212
N.22 Model 304 215
N.23 Model 305 217
N.24 Model 306 220
N.25 Model 401 222
N.26 Model 402 223
N.27 Model 403 225
N.28 Model 404 227
N.29 Model 405 229
N.30 Model 406 232
Index 235

Ordering:

Order Online - http://www.researchandmarkets.com/reports/2171855/

Order by Fax - using the form below

Order by Post - print the order form below and send to

Research and Markets,
Guinness Centre,
Taylors Lane,
Dublin 8,
Ireland.
Fax Order Form
To place an order via fax simply print this form, fill in the information below and fax the completed form to 646-607-1907 (from USA) or +353-1-481-1716 (from Rest of World). If you have any questions please visit http://www.researchandmarkets.com/contact/

Order Information
Please verify that the product information is correct.

Product Name: Analytical Modeling of Solute Transport in Groundwater. Using Models to Understand the Effect of Natural Processes on Contaminant Fate and Transport
Web Address: http://www.researchandmarkets.com/reports/2171855/
Office Code: SC2GC623

Product Format
Please select the product format and quantity you require:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Hard Copy (Hard Back):</th>
<th>USD 104 + USD 28 Shipping/Handling</th>
</tr>
</thead>
</table>

* Shipping/Handling is only charged once per order.
* The price quoted above is only valid for 30 days. Please submit your order within that time frame to avail of this price as all prices are subject to change.

Contact Information
Please enter all the information below in BLOCK CAPITALS

Title: Mr [ ] Mrs [ ] Dr [ ] Miss [ ] Ms [ ] Prof [ ]
First Name: ______________________________ Last Name: ______________________________
Email Address: * ______________________________
Job Title: ______________________________
Organisation: ______________________________
Address: ______________________________
City: ______________________________
Postal / Zip Code: ______________________________
Country: ______________________________
Phone Number: ______________________________
Fax Number: ______________________________

* Please refrain from using free email accounts when ordering (e.g. Yahoo, Hotmail, AOL)
Payment Information

Please indicate the payment method you would like to use by selecting the appropriate box.

☐ Pay by credit card: You will receive an email with a link to a secure webpage to enter your credit card details.

☐ Pay by check: Please post the check, accompanied by this form, to:

Research and Markets,
Guinness Center,
Taylors Lane,
Dublin 8,
Ireland.

☐ Pay by wire transfer: Please transfer funds to:

Account number 833 130 83
Sort code 98-53-30
Swift code ULSBIE2D
IBAN number IE78ULSB98533083313083
Bank Address Ulster Bank,
27-35 Main Street,
Blackrock,
Co. Dublin,
Ireland.

If you have a Marketing Code please enter it below:

Marketing Code: ____________________________

Please note that by ordering from Research and Markets you are agreeing to our Terms and Conditions at http://www.researchandmarkets.com/info/terms.asp

Please fax this form to:
(646) 607-1907 or (646) 964-6609 - From USA
+353-1-481-1716 or +353-1-653-1571 - From Rest of World