Contents

1 Uranium Boom in Namibia – Hausse or Baisse ................. 1
Helmut Mischo and Rainer Ellmies

2 Rare earth elements in Australian uranium deposits ........... 25
Bernd G. Lottermoser

3 IAEA Initiatives Supporting Good Practice in Uranium
   Mining Worldwide .................................................. 31
Peter Woods, Russel Edge, Martin Fairclough, Zhiwen Fan,
Adrienne Hanly, Ib-rahim Miko Dit Angoula,
Horst Monken-Fernandes, Haridasan Pappinisseri Puthanveedu,
Marcelle Phaneuf, Harikrishnan Tulsidas,
Oleg Voitsekhovych and Tamara Yankovich

4 Challenging Issues in Regulating Uranium Mining
   in Tanzania .......................................................... 41
Firmi P. Banzi, Peter Msaki and Najat Mohammed

5 Uranium leaching from a burning black shale
   deposit – present conditions and future scenarios ........... 47
Mattias Bäckström and Lotta Sartz

6 Is enough information available to derive an overall EQS
   for uranium in French freshwaters, according to European
   Guidance? .............................................................. 55
Karine Beaugelin-Seiller, Olivier Simon, Rodolphe Gilbin,
Jacqueline Garnier-Laplace and Laureline Février
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Radiation exposure and environmental remediation at the Urgeiriça mine site, Portugal</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Fernando P. Carvalho, João M. Oliveira and Margarida Malta</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>The modern hydrochemical state of the Mailuu-Suuriver and radioecological problem of the Fergana Valley</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Bekmamat Djenbaev, Umyt Karmisheva, Azamat Tilenbaev and Altinai Egemberdieva</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Social Licensing in Uranium Mining: Empowering Stakeholders through Information</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>W. Eberhard Falck, Joachim H. Spangenberg and Dominic Wittmer</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Social licensing and Stakeholder Communication in Uranium Exploration and Mining</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>W. Eberhard Falck, Julian Hilton, Henry Schnell and Harikrishnan Tulsidas</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Environmental radiation monitoring around uranium ore deposits and mining sites in India: An overview</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Amir H. Khan</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Optimization of Uranium In-situ Recovery Based on Advanced Geophysical Surveying and Borehole Logging Technologies</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>Horst Märtten, Andrea Marsland Smith, Jonathan Ross, Michael Haschke, Harald Kalka and Jens Schubert</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Fuzzy MCDA for remediation of a Uranium tailing</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Danyl Pérez-Sánchez, Antonio Jiménez, Alfonso Mateos and Alla Dvorzhak</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Uranium in phosphate fertilizers – review and outlook</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td>Ewald Schnug and Nils Haneklaus</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Uranium and Molybdenum transfer within the oxidized zone of uranium deposit</td>
<td>131</td>
</tr>
<tr>
<td></td>
<td>Irina Semenova, Vladislav Petrov, Yana Bychkova, Lyubov Shulik and Jörg Hammer</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Release of uranium from weathered black shale in meso-scale reactor systems – first year of data</td>
<td>139</td>
</tr>
<tr>
<td></td>
<td>Viktor Sjöberg and Stefan Karlsson</td>
<td></td>
</tr>
</tbody>
</table>
17 Environmental Issues and Proposed Assessment of Feasibility of Remediation of the Legacy Sites of Mining and Milling in the Area of Sumsar-Shekaftar in Kyrgyzstan .................................................. 147 Isakbek Torgoev and Alex Jakubick

18 Heavy metals and natural radionuclides in the water of Syr Darya River, Kazakhstan ........................................ 155 Bagdat Satybaldiyev, Hanna Tuovinen, Bolat Uralbekov, Jukka Lehto and Mukhambetkali Burkitbayev

19 Establishment of a database of uranium anomalies and zones in Mongolia .................................................. 161 Boris Vakanjac, Predrag Srna and Vesna Ristic Vakanjac

20 Uranium, Rare Earths and NORM: Mining and current prospects in Australia’s Northern Territory ................ 169 Peter Waggitt

21 Technical Status of Mine Water Control in China and Its Development Strategy ........................................ 177 Hao Wang, Shuning Dong, Rui Chai and Qisheng Liu

22 Revisiting a case study on uranium exposure linked to leukaemia – preliminary results .............................. 185 Frank Winde, Ewald Erasmus, G. Geipel and A.A.A. Osman

23 Virtual Geographical Environments as a tool to map human exposure to mining-related radionuclides ............. 193 Frank Winde and Emile Hoffmann

24 Assessing risks associated with the flooding of mine voids on underground infrastructure and water resources in and around Johannesburg (South Africa) ................................ 201 Frank Winde and Ewald Erasmus

25 Hydrogeological testing for ISL uranium mining: some Australian experience .............................................. 211 Peter Woods and Ben Jeuken

26 Remediation of a uranium geological exploration facility ........ 221 Wei Zhang, Lechang Xu, Xueli Zhang and Jie Gao
27 Does wind energy production cause more radioactive doses than nuclear power plants? Gerhard Schmidt

28 Impact of humic substances on uranium mobility in soil – A case study from the Gessenwiese test field, Germany Stefan Karlsson, Viktor Sjöberg and Bert Allard

29 U-Th-Pb data as a tool for bordering small-scale regions of in-situ monazite mineralization Jan Mestan, Libor Volak and David Sefcik

30 Sorption of U(VI) and As(V) on SiO₂, Al₂O₃, TiO₂ and FeOOH: A column experiment study Sreejesh Nair and Broder J. Merkel

31 Characterization of phosphogypsum deposited in Schistos remediated waste site (Piraeus, Greece) F. Papageorgiou, A. Godelitsas, S. Xanthos, N. Voulgaris, P. Nastos, T.J. Mertzimekis, A. Argyraki and G. Katsantonis

32 Rare earth ore refining in Kuantan/Malaysia – the next legacy ahead? Gerhard Schmidt

33 Uranium sorption onto the granites of Nizhnekansk massif Anna Shiriaeva

34 REE fractionation and distribution of Fe, Ni and U in the soil-water-biomass system along the flow path of Gessenbach, Eastern Thuringia (Germany) Daniela Sporleder, Anja Grawunder and Georg Büchel

35 The externalized costs of uranium mining in the United States Doug Brugge, Aparna Dasaraju, Yi Qi Lu and Brianna Dayer

36 Microbial consortia in radionuclide rich groundwater Katja Burow, Sven Gärtner, Anja Grawunder, Erika Kothe and Georg Büchel
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Flooding of the underground mine workings of the old Witwatersrand</td>
<td>Henk Coetzee, Supi Tlowana and Mosidi Makgae</td>
</tr>
<tr>
<td></td>
<td>gold/uranium mining areas: acid mine drainage generation and long</td>
<td></td>
</tr>
<tr>
<td></td>
<td>term options for water quality management</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Assessment of the success of rehabilitation at waste rock piles of</td>
<td>Klaus Flesch and Andrea Sperrhacke</td>
</tr>
<tr>
<td></td>
<td>the former uranium mining from the supervisory authority’s perspective by the example of Schlema-Alberoda (Germany)</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Microbes affect the speciation of various uranium compounds in</td>
<td>A.J. Francis</td>
</tr>
<tr>
<td></td>
<td>wastes and soils</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Uranium induced stress promotes fungal excretion of uranium/metal</td>
<td>Anna Grandin, Anna Ogar, Viktor Sjöberg and Stefan Karlsson</td>
</tr>
<tr>
<td></td>
<td>stabilizing ligands: Analysis of metal-organic compounds with Size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exclusion Chromatography and Inductively Coupled Plasma-Mass</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Passive treatment of heavily polluted drainage waters in a uranium</td>
<td>Stoyan Groudev, Irena Spasova, Plamen Georgiev and Marina Nicolova</td>
</tr>
<tr>
<td></td>
<td>deposit</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>At the crossroads: Flooding of the underground uranium leach operation at Königstein (Germany) – A 2014 status brief</td>
<td>Ulf Jenk and Micheal Paul</td>
</tr>
<tr>
<td>43</td>
<td>Do macrofungi accumulate uranium?</td>
<td>Jaroslava Kubrová and Jan Borovička</td>
</tr>
<tr>
<td>44</td>
<td>Treatment of Acid Wastewater Containing Uranium by Sulfate Reducing</td>
<td>Jie Gao, Lechang Xu, Yalan Wang and Wei Zhang</td>
</tr>
</tbody>
</table>
Current reclamation of historical uraniferous tailings dams and sand dumps – exacerbating the mess or minimizing the mining footprint? Case studies within the Witwatersrand goldfields
Mariette Liefferink and Simone L. Liefferink

Challenges of water management during tailings remediation – Site and catchment-specific focus
Thomas Metschies, Jan Laubrich, Jürgen Müller and Manja Haupt

Thirteen Years Later: Status of the Moab UMTRA Project
Long-term Remedial Action
Donald Metzler

Overcoming the barriers to implementation of decommissioning and environmental remediation projects - a focus on uranium mining legacy sites.
The CIDER Project
Horst Monken-Fernandes and Patrick O’Sullivan

Phytostabilization of uranium-containing shale residues using Hieracium pilosella
Anna Ogar, Viktor Sjöberg and Stefan Karlsson

Reliable water management as key success factor for the remediation of uranium production sites under humid conditions
Michael Paul

Mine Water Quality Evolution at Abandoned Uranium Mines in the Czech Republic
Nada Rapantova, Monika Licbinska, Pavel Pospisil and Karel Lusk

Glass Bead Filter Packs in Water Wells for Higher Efficiency and Reduced O & M costs
Reinhard Klaus

Soil hydrological monitoring in the framework of the remediation and long-term safeguard of uranium ore mining residues of the Wismut GmbH
Katja Richter, Marcel Roscher, Ulf Barnekow, Gert Neubert and Manfred Seyfarth
54 The New European Radiation Protection Safety Standards as Basis to Assess the Radiological State Achieved at Remediated Uranium Legacy Sites (WISMUT Sites) in Germany .................................................. 469
Peter Schmidt and Jens Regner

55 Geochemical controls on U immobilization in the subsurface. .............................................. 477
Malgorzata Stylo, Daniel Alessi, Shao Paul, John Bargar and Rizlan Bernier-Latmani

56 Impact of Uranium Mill Tailings on Water Resources in Mailuu Suu, Kyrgyzstan .............................................. 487
Frank Wagner, Hagen Jung, Thomas Himmelsbach and Arthur Meleshyn

57 Rhizofiltration of U by plant root surfaces in a tailing wetland ..................................................... 497
Weiquing Q. Wang, Carsten Brackhage, Ernst Bäuker and E. Gert Dudel

58 Temporal and Special Variation of Pore Water and Seepage Quality of an Abandoned Uranium Milling Tailings Impoundment ..................................................... 509
Lechang Xu, Xueli Zhang, Jie Niu and Hui Zhang

59 Neotectonics influence of identified active geological structures on the safety of uranium tailings production Dniprodzerzhynsk industrial agglomeration (Ukraine) .......... 519
Yuliia Yuskiv and Valentin Verkhovtsev

60 Re-Engineering Antibodies for Optimum Performance in Uranium Sensors ..................................................... 529
D.A. Blake, B. Ban, X. Li, R.C. Blake II, G.A. Jairo and Y. Sun

61 Longevity Estimates for a Permeable Reactive Barrier System Remediating a $^{90}$Sr Plume ..................................................... 537
Jutta Hoppe, David Lee, Sung-Wook Jeen and David Blowes

62 Radon diffusion in rocks and minerals ..................................................... 545
Fatima Zahra Boujrhal, Hanane Sabbani and El Mahjoub Chakir
63 Solubility of Radium and Strontium Sulfate across the Temperature Range of 0 to 300°C
Paul L. Brown, Christian Ekberg, Henrik Ramebäck, Hanna Hedström and Artem Matyskin

64 Cost effective screening of mine waters using accessible field test kits – Experience with a high school project in the Wonderfonteinspruit Catchment, South Africa
Lindsay Fyffe, Henk Coetzee and Christian Wolkersdorfer

65 Dispersion Modelling of Natural Radionuclides $^{238}\text{U}$, $^{232}\text{Th}$ and $^{40}\text{K}$ Released from Coal-Fired Power Plants
Maria de Lurdes Dinis, António Fiúza, Joaquim Góis, José Soeiro de Carvalho and Ana Cristina Meira Castro

66 Sequential Extraction of U and Th Isotopes: Study of Their Intrinsic Distribution in Phosphate and Limestone Sedimentary Rock in Comparison with Black Shale
Said Fakhi, Rabie Outayad, Elmehdi Fait, Zineb Faiz, C. Galindo, Abderrahim Bouih, Moncef Benmansour, Azzouz Benkdad, Ignacio Vioque, Marusia Rentaria and Abdelmjid Noureddine

67 Radium in Groundwater
Stephanie Hurst

68 Speciation analysis based design of mine water treatment technologies
Andrea Kassahun, Corinne Lietsch, Nils Hoth and Michael Paul

69 225 years uranium and radioactivity cross-links around the Brocken – Klaproth, Elster and Geitel, Nazi Research, Wismut prospection, and recent anomalies
Friedhart Knolle, Frank Jacobs and Ewald Schnug

70 Contamination of Water Bodies Affected by Post-Mining Activities in the Light of the European Water Framework Directive
Elke Kreyßig and Jana Götze
<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
</tr>
<tr>
<td>72</td>
</tr>
<tr>
<td>73</td>
</tr>
<tr>
<td>74</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>76</td>
</tr>
<tr>
<td>77</td>
</tr>
<tr>
<td>78</td>
</tr>
<tr>
<td>79</td>
</tr>
</tbody>
</table>
80 Reactive transport simulation applied on uranium ISR: effect of the density-driven flow ........................................... 699
E. Bonnaud, V. Lagneau, O. Regnault and N. Fiet

81 Uranium contamination of soil and groundwater by phosphate fertilizer application ........................................ 707
Mandy Hoyer

82 Investigation of Phenomena in Uranium Mine Waters using Hydrogeochemical Modeling – a case study ........ 717
Corinne Lietsch, Nils Hoth and Andrea Kassahun

83 3D Reactive Transport simulations of Uranium In Situ Leaching: Forecast and Process Optimization .................. 725
Olivier Regnault, Vincent Lagneau and Nicolas Fiet

84 Where has all the uranium gone? Or what feeds Dimona – circumstantial evidence for an illicit fate of uranium from rock phosphate processing ..................................... 731
Ewald Schnug

85 Planning of reactive barriers – an integrated, comprehensive but easy to understand modeling approach ..... 739
Markus Zingelmann, Mandy Schipek and Arnold Bittner

86 Uranium in 31 Swedish ashes – differences between boiler type and fuels ......................................................... 745
Naeem Saqib and Mattias Bäckström

87 Characterization of natural phosphates and phosphogypsum ................................................................. 751
Fatima Zahra Boujrhal

88 Radioactivity assessment at the site of historical radium salts factory .......................................................... 759
Fernando P. Carvalho, João M. Oliveira and Margarida Malta

89 Hydrogeochemistry of Uranium in the Groundwaters of Serbia ................................................................. 769
Marina Ćuk, Maja Todorović, Petar Papić, Jovan Kovačević and Zoran Nikić

90 Seed crops: Alternative for non-remediable uranium mine soils ................................................................. 777
Gerhard Gramss and Klaus-Dieter Voigt
91 Using high temperature reactors for energy neutral phosphate fertilizer and phosphogypsum processing .......................... 785
Nils Haneklaus, Harikrishnan Tulsidas, Frederik Reitsma and Ewald Schnug

92 On-Line X-Ray Fluorescence Analysis of Uranium and Thorium Materials in Mining and Processing Industry ........ 793
E. Hasikova, A. Sokolov and V. Titov

93 Nanofiltration of uranium-contaminated water – focus on separation mechanisms .................................................. 805
Michael Hoyer, Roland Haseneder, Robin Steudtner, Vinzenz Brendler and Jens-Uwe Repke

94 Investigations of uranium and trace elements in groundwater of the Tanjero Area, Kurdistan Region, Iraq ................................. 811
Aras Kareem, Broder Merkel and Omed Mustafa

95 Radon measurement along faults in the Upper Rhine Graben with standardized methods ....................................... 821
Georg Kuhn, Rouwen Lehné and Andreas Hoppe

96 Mulde River - A Uranium Mining Archive ............................ 829
Kay Nestler and Broder Merkel

97 Mitigation of radon exposures caused by uranium mining legacies at WISMUT sites .................................................. 839
J. Regner and P. Schmidt

98 Determination of uranium in mineral phosphate fertilizers using a low cost gamma spectroscope ......................... 847
Frank Jacobs, Sascha Riedl, Steven Sesselmann and Ewald Schnug

99 The study of remediation activity of system plant-microorganisms in the model experiments of oil polluted soils .................................................... 855
Yerlan Doszhanov, Aygerym Gabdualiyeva, Galym Umbetkaliev, Yerdos Ongarbaev, Azhar Zhubanova and Zhulkhair Mansurov

100 Laboratory and field test Study on Sandstone Permeability Characteristics ...................................................... 861
Liu Zaibin, Jin Dewu, Dong Shuning and Liu Qisheng
Uranium - Past and Future Challenges
Proceedings of the 7th International Conference on Uranium Mining and Hydrogeology
Merkel, B.J.; Arab, A. (Eds.)
2015, XVII, 870 p. 360 illus., 88 illus. in color., Hardcover
ISBN: 978-3-319-11058-5