

Workshop

“Technical Monitoring and Long-term Governance”

Call, program, abstracts & participants

18. - 19. October 2016

Institut für Technikfolgenabschätzung und Systemanalyse
ITAS at KIT
Karlstraße 11
D-76149 Karlsruhe

Call – “Technical Monitoring and Long-term Governance”

Sophie Kuppler, Peter Hocke

The disposal of high-level radioactive waste in a deep geological repository with the option of retrievability requires monitoring of the waste. In general, monitoring means temporary technical collection of data on the development of the disposal site and the effects on the environment surrounding the disposal site. These monitoring data should give information on whether the repository develops as expected or whether it is necessary to initiate retrieval. This implies that a decision has been made on what measures need to be taken and, then, that a way is found for technical implementation. This is a complex problem in itself because time periods in which data would be collected would be in a high double-digit if not three-digit range. There is no experience with monitoring technologies over such a long period of time as required in nuclear waste management. Furthermore, it can be expected that data collection and interpretation will not be carried out solely by the operator. Protection authorities and supervisory boards as well as scientists and stakeholders will have a strong interest in professional support and advice.

There is another indication of complexity: The basic framework for evaluating the collected data and for ensuring the proper functioning of the monitoring process has to be developed already during the installation phase. After that, the technical options are very limited. This suggests that political and administrative institutions are necessary to maintain the technological infrastructure over long periods of time. In addition to the technical tasks, a stewardship organization must be able to enter into continuous dialogue with civil society and politics. In case of deviation from the expected development of the repository, the institutions have to decide about the interpretation of data: Is there a measurement error, is it necessary to improve the technical features or to retrieve a certain amount of nuclear waste? It can be assumed that after the repository is closed, political and public attention will lessen. It appears necessary to install a system of "checks and balances" which is linked to the monitoring team and which can prepare political and legal decisions of high quality in the near and distant future (from several decades up to three or four centuries). Building these institutions and structures is, besides the technical developments and institutions to maintain the technological know-how, an important aspect of the implementation of a deep geological repository, taking seriously short and mid-term safety issues and integrating the demands in the concept of disposal.

The interdisciplinary workshop "Technical Monitoring and Long-term Governance" aims to examine the problem of "double-complex" monitoring in its many facets – from the perspective of legal sciences as well as engineering, natural and social sciences. This includes the technical aspects of the planning and further development of the monitoring concept as well as an analysis of the experiences in established governance-structures such as the long-term stewardship program implemented by the United States Department of Energy.

PROGRAM	Tuesday, 18. October 2016
10:30 – 11:00	Join in
11:00 – 11:30	Monitoring in the Context of Long-term-Governance. Introduction <i>Dr. Peter Hocke and Sophie Kuppler (ITAS at KIT)</i>
11:30 – 12:30	Organizations Matter: Monitoring and Long-term-Governance <i>Dr. Daniel Metlay (Member of the Senior Professional Staff of the US Nuclear Waste Technical Review NWTRB)</i>
12:30 – 13:30	Lunch break
13:30 – 14:30	Insights from science and technology studies (STS) and social studies of science (SSS) on the long-term governance of nuclear waste: What challenges lie ahead for policy and research <i>Dr. Anne Bergmanns (University Antwerpen)</i>
14:30 – 15:20	Uncertainty and Non-Knowledge in the Context of Ambitious Sociotechnological Solutions <i>PD Dr. Stefan Böschen (ITAS at KIT)</i>
15:20 – 15:50	Coffee break
15:50 – 16:40	MODERN / MODERN2020 – Monitoring im europäischen Kontext <i>Michael Jobmann (DBE Tec) and Anna-Laura Liebenstund (University Antwerpen)</i>
16:40 – 17:30	Robustness vs. Flexibility and Monitorability in Nuclear Waste Disposal <i>Prof. Horst Geckeis (INE at KIT)</i>
17:30 – 17:50	Coffee break
17:50 – 18:40	Monitoring in the Swiss Concept of Deep Geological Repositories <i>Dr. Anne Eckhardt (risicare)</i>
19:30	Conference Dinner <i>Rosa Bianca, Douglasstr. 11-13</i>

PROGRAM		Wednesday, 19. October 2016	
8:30 – 9:00		Join in	
9:00 – 9:45		25 Jahre Monitoring in der Schachtanlage Asse II <i>Dr. Grit Gärtner and Ayk Schindewolf (BfS)</i>	
9:45 – 10:30		Die Bedeutung der Rückhohlbarkeit als Option im Zusammenhang mit dem Wunsch und der Notwendigkeit eines Langzeit-Monitoring <i>Dr.-Ing. Thomas Hassel and Ansgar Köhler (IW at LU Hannover)</i>	
10:30 – 10:45		Coffee break	
10:45 – 11:30		Requirements for Monitoring at the Option of Retrievability <i>Volker Mintzlaff (IGB at TU Braunschweig)</i>	
11:30 – 12:15		Long-term Governance aus rechtswissenschaftlicher Sicht <i>apl. Prof. Dr. Ulrich Smeddinck and Franziska Semper (IRW at TU Braunschweig)</i>	
12:15 – 13:15		Lunch break	
13:15 – 14:00		Technische Projekte, die keine Fehler zulassen <i>Prof. Oliver Sträter (IfA at University Kassel)</i>	
14:00 – 14:45		Ergebnisse und Empfehlungen der Endlager-Kommission zu einem Monitoring-Konzept <i>Prof. Armin Grunwald (ITAS at KIT)</i>	
14:45 – 15:15		Final discussion and further action, publication <i>Dr. Peter Hocke (ITAS at KIT)</i>	

List of Participants

1	Anne Bergmans Univ. Antwerpen	18	Daniel Metlay Washington / USA
2	Elske Bechthold ITAS, KIT	19	Volker Metz INE, KIT
3	Elke Bozau TU Clausthal	20	Volker Mintzlaff IGB-TUBS, Braunschweig
4	Stefan Böschen ITAS, KIT	21	Wolfgang Neumann intac, Hannover
5	Saleem Chaudry IELF, TU Clausthal	22	Ayk Schindewolf BfS, Salzgitter
6	Anne Eckhardt risicare, Zürich	23	Franziska Semper IRW, TU Braunschweig
7	Julian Flesch ITAS, KIT	24	Ulrich Smeddinck IRW, TU Braunschweig
8	Grit Gärtner BfS, Salzgitter	25	Oliver Sträter IfA, Univ. Kassel
9	Horst Geckeis INE, KIT	26	Michael Weigl PTKA
10	Armin Grunwald ITAS, KIT	27	Ralf Wolters IFAD, TU Clausthal
11	Michael Jobmann DBE Technology, Peine	28	Nele Wulf ITAS, KIT
12	Thomas Hassel IW, LU Hannover		
13	Peter Hocke ITAS, KIT		
14	Viola Ibba ITAS, KIT		
15	Ansgar Köhler IW, LU Hannover		
16	Sophie Kuppler ITAS, KIT		
17	Anna-Laura Liebenstund Univ. Antwerpen		

Abstracts

Dr. Peter Hocke and Sophie Kuppler

Monitoring in the Context of Long-term-Governance. Introduction

The long time-frames over which a nuclear waste disposal site needs to be maintained pose a central challenge in nuclear waste governance. In the research project ENTRIA we have identified the need to establish an interdisciplinary dialogue on those questions. The aim of this workshop is to enter into this dialogue by discussing different problem views and identifying central questions. In the introduction a first characterization of the problem from a technology assessment point of view will be given. Establishing an infrastructure, which lasts over centuries, is a task that needs to be taken up early on in the waste governance process. A basic hypothesis is that infrastructures are always “posing a linked series of problems” – problems which are often socio-technical and can escalate to a row of failures (Edwards 2004). Some institution has to be present to uncover and deal with those failures. The difficulty of uncovering and dealing with them increases with time. It will be much more difficult after closure of a repository than before. Further, scientific knowledge as well as societal preferences will change over time. Thus, a central question for a responsible nuclear waste management is to think about how political decision-makers, public administration, science, industry and the interested public can co-design a governance process over such a very long period of time – a process, which promises to be adequate to meet the challenges and react to the current socio-technical problem of final disposal of high-level radioactive waste.

Dr. Daniel Metlay

Organizations Matter: Monitoring and Long-term-Governance

It is striking how little consideration is given to the role that organizations play in the long-term management of high-activity radioactive waste. To be sure, greater attention is now being paid to how government agencies and utility-owned companies interact with interested and affected parties. But, in terms of how they behave as they carry out their responsibilities to develop deep-mined, geologic repositories, the prevailing perspective is that these efforts are self-implementing. That is, if plans, programs, projects, or schedules are advanced, they somehow will be carried out almost frictionlessly, notwithstanding experiences quite to the contrary. With few exceptions, this perspective holds when questions about repository monitoring are discussed and when those activities are evaluated. The objective of this talk is to make the case that the behavior, especially the reliability, of monitoring organizations matters, that it cannot be taken for granted, and that it needs to be understood if surveillance and monitoring are to become more than symbolic acts.

Several recent studies by the OECD’s Nuclear Energy Agency, the U.S. National Academy of Sciences’ Nuclear and Radiation Studies Committee, and the European Commission’s MoDeRn Project either advocate or explicitly accept that the process for developing a repository should be stepwise, phased, and sensitive to new information. Surveillance and monitoring are central and indispensable in such a model. What none of these efforts deeply assess, however, are the organizational requirements for dependable, consistent, and trustworthy decision-making. In particular, it is essential to examine two critical questions: (1) How do organizations evaluate new information, especially if it is ambiguous and opaque? (2) How do organizations alter course?

The talk considers the insights into these two issues that are provided by organization theorists, cognitive psychologists, and researchers who study the interconnection of science, technology, and society. The talk will also discuss lessons that can be learned from monitoring of CI-36 by the Yucca Mountain Project in the United States, from the Swedish exchange over the potential for corrosion in anoxic environments of the elemental copper waste packages that are indispensable components of the KBS-3 disposal concept, and from the experience dealing with the Asse II mine in Lower Saxony.

Dr. Anne Bergmans

Insights from science and technology studies (STS) and social studies of science (SSS) on the long-term governance of nuclear waste: What challenges lie ahead for policy and research

Over the last ten to twenty years the issue of nuclear waste and particularly geological disposal (GD) as a developing technology has attracted the interest of social scientists studying the relationship between society and science and technology development. Earlier social sciences work more explicitly focused on risk perception and later also on participatory methods and supporting a risk dialogue. Of more recent nature is the focus on what the impact is or could be of the confrontation between the proposed disposal technology and society (including the opening up of the technical debate – even if not always explicit – to concerned societal actors, such as citizens in potential host communities). In this presentation I will address the current state of knowledge and potential remaining gaps regarding a number of key notions in today's GD discourse, which have risen (or at least become more present) as a consequence of this confrontation, such as stepwise decision making, voluntary or consent based siting, reversibility and retrievability, monitoring and vigilance.

PD Dr. Stefan Bösch

Uncertainty and Non-Knowledge in the Context of Ambitious Sociotechnological Solutions

Since some decades, the problem of non-knowledge is raising more and more attention. This is why, the precautionary principle was getting a principal framework within the EU regulatory endeavours. Moreover, Agnotology Studies pointed out that ignorance can be used strategically to avoid regulation. The climate change deniers are a case in point. These questions are getting more relevant in situations where ambitious sociotechnological solutions are to be created. These solutions evolve as „posing a linked series of sociotechnical problems“, as Paul Edwards put it to describe their co-evolutionary development, which has to align physical, technical, organizational, legislative and societal factors. Therefore, the complex processes of articulation and solving problems have to be taken into account. The thesis of the presentation is that these processes can be described as the formation of knowledge-regimes, in which the heterogeneity of knowledge-resources and the resulting problems to construct problems as well as to build up evidence to solve them are processed.

Michael Jobmann and Anna-Laura Liebenstund

MODERN / MODERN2020 – Monitoring im europäischen Kontext

Die erfolgreiche Umsetzung eines Endlagerprogramms für radioaktive Abfälle stützt sich sowohl auf technische Aspekte einer fundierten Sicherheitsstrategie und wissenschaftliche und ingenieurtechnische Kompetenz als auch auf soziale Aspekte wie Akzeptanz und Vertrauen von Seiten der Interessengruppen. Monitoring gilt als Schlüssel, wenn es darum geht, beiden Aspekten gerecht zu werden. Aufbauend auf den Ergebnissen des 2013 abgeschlossenen MODERN-Projektes, das eine internationale Rahmenrichtlinie für das Monitoring von Endlagern für hochradioaktive Abfälle bereitstellte, hat MODERN2020, gefördert von der Europäischen Kommission, das Ziel, die Grundlagen zur Entwicklung und Umsetzung eines effizienten Endlagerüberwachungsprogramms bereit zu stellen, das die spezifischen Anforderungen nationaler Programme berücksichtigt. Die Arbeit ermöglicht fortgeschrittenen Entsorgungsprogrammen Überwachungssysteme zu entwerfen, die einsetzbar sind, wenn die Endlager in Betrieb gehen, und unterstützt weniger entwickelte Programme, wenn es darum geht, von Grund auf Überwachungssysteme neu zu konzipieren. Ziel ist es, zu verstehen, was im Rahmen eines Sicherheitsnachweises zu überwachen ist, und eine Methodik zur Verfügung zu stellen, wie Überwachungsergebnisse verwendet werden können, um Prozesse zur Entscheidungsfindung zu unterstützen. Weiterhin soll erarbeitet werden, welche Handlungsoptionen als Reaktion auf Monitoring-Ergebnisse möglich und sinnvoll sind.

Ein Hauptaugenmerk von MODERN2020 liegt auf der Entwicklung von Konzepten zur Überwachung geotechnischer Barrierensysteme (TBS), ohne deren Dichtwirkung zu beeinträchtigen. Außerdem sollen innovative Überwachungstechniken entwickelt und verbessert werden, insbesondere auf dem Gebiet der kabellosen Datenübertragung und alternativer Stromversorgung. Darüber hinaus hat MODERN2020 das spezielle Ziel, lokale Interessengruppen (Stakeholder) effektiv in die FuE-Monitoring-Aktivitäten einzubinden. In diesem Zusammenhang soll, im Dialog mit Stakeholdern, zum einen die generelle Frage geklärt werden, wie eine erfolgreiche Zusammenarbeit aussehen könnte und zum anderen, ab welchem Zeitpunkt eine Einbindung lokaler Interessensgruppen sinnvoll und effektiv ist.

Dr. Grit Gärtner and Ayk Schindewolf

25 Years of Monitoring in the Asse II Mine

The Asse II is a former potash and salt mine near Wolfenbüttel in Lower-Saxony. From 1967 to 1978 low- and intermediate-level radioactive waste was emplaced in the mine. Since 2009, the Asse II mine is operated by the Federal Office for Radiation-protection with the objective to decommission the mine according to Atomic Energy Act after the retrieval of radioactive waste. Not stable dimensioned load bearing elements, a long operational life and a high excavation ratio resulting from the mining led to high deformations of the load bearing elements. To assess the already highly stressed structural elements and the overall support-system until the end of the operational phase a complex geotechnical control and monitoring system has been established over the past 25 years. The safety related geomechanical processes of the system are recorded and their impact on the overburden is assessed. The data is used to derive measures to maintain current operations and to ensure work safety in the mine. This includes the serviceability of the mine workings. In addition, criteria are derived, in which scale and complexity changes and specific measures need to be implemented. Furthermore, local monitoring programs are implemented to assess the serviceability of important infrastructure in highly stressed areas.

Based on the experience of the monitoring in the Asse II mine, challenges for future operations are assessed. The presentation gives an overview on the existing long-term geotechnical control and monitoring program and explains the challenges that arise for an operating phase with a duration of several decades.

Dr.-Ing. Thomas Hassel and Ansgar Köhler

Die Bedeutung der Rückholbarkeit als Option im Zusammenhang mit dem Wunsch und der Notwendigkeit eines Langzeit-Monitoring

Unter Monitoring wird im Allgemeinen eine unmittelbare Überwachung von Prozessen verstanden. Bei der Lagerung von wärmeentwickelnden Abfällen wird in der Regel die Notwendigkeit von Monitoringverfahren beschrieben. Die mangelnde Erfahrung mit der Entwicklung dieser Abfälle, der Behältermaterialien und der Einlagerungsumgebung über lange Zeiträume sowie die Gefährdung, die aus der Freisetzung der eingelagerten Stoffe ausgeht, bilden die Grundlage dieser Forderung. Doch ist die Forderung eines längerfristigen Monitorings auch technisch umsetzbar? Beim Monitoring müssen generell zwei Zeiträume betrachtet werden. Der Zeitraum während des Einlagerungsbetriebs und der Zeitraum nach dem Betrieb. Während im ersten Zeitraum ein Austausch von Sensoren, Versorgungsleitungen oder Peripherie möglich ist, kann nach einem vollständigen Verschluss der Anlage ein solcher Austausch nicht mehr erfolgen. Neben technischen Herausforderungen für einen langen Betrieb der Sensorik, entstehen weitere Herausforderungen z. B. bei der Interpretation und der anschließenden Entscheidungsfindung bei unerwarteten Messergebnissen.

In dem Vortrag werden die Grundlagen und Ursachen einer Rückholung beleuchtet, wobei die Schnittstellen im System Endlager diskutiert werden. Darauf aufbauend wird eine Art Anforderungsprofil an ein Monitoringsystem erarbeitet, welches dann methodisch durchdacht wird. Anschließend werden angewandte Monitoringsysteme aus unterschiedlichen Anwendungsbereichen vorgestellt. Es wird anhand von Beispielen dargestellt, über welche Zeiträume Systeme wartungsfrei betrieben werden und wie die Erwartungen zur Funktionsdauer sind. Ziel des Vortrages ist die Darstellung des heute, nach Stand der Technik, möglichen „Langzeit-Monitorings“ und der daraus für die Endlagerung abzuleitenden Spannungsfelder.

apl. Prof. Dr. Ulrich Smeddinck and Franziska Semper

Long-term Governance aus rechtswissenschaftlicher Sicht

Ausgehend von einer rechtswissenschaftlichen Klärung des Governance-Begriffs werden Rechtsgrundlagen, Organisation und Verfahren / Generationengerechtigkeit auf die Aufgabenstellung einer dauerhaften Verwahrung radioaktiver Reststoffe bezogen. Long-term Governance ist in den vorzufindenden Rechtsgrundlagen ebenso angelegt wie die Pflicht zu ihrer Weiterentwicklung. Long-term Governance muss sich mit den Bedingungen schwindender Staatlichkeit auseinandersetzen. Long-term Governance erfordert die rechtzeitige Autonomisierung einer zuständigen Einheit. Gesellschaftliche und staatliche Entscheidungswege müssen im Sinne von zukünftigen Generationen weiterentwickelt werden. Long-term Governance ist auf partizipative Verfahren mit der Vertretung der zukünftigen Generationen angewiesen.

Prof. Armin Grunwald

Results and Recommendations on Monitoring Given by the Endlagerkommission

The Endlagerkommission of the German Bundestag developed a comprehensive approach to relaunching the process of identifying the best possible disposal site in Germany for HLW. This approach consists of scientific and planning criteria, a procedural concept including several participatory elements, and an institutional structure to operate this process. The general postulate for the reversibility of decisions during the entire process – e.g. in order to ensure the capability to correct errors or to re-adjust the process according to new knowledge or new assessments – accompanied the Commission's work from its very beginning. Monitoring plays a crucial role for designing a process including reversibility at two levels: (1) a permanent process monitoring must provide meta-knowledge about the respective status of the process in order to discover possible necessities or reasons to consider reversing decisions which already had been made, or even which already have been implemented. (2) the identified disposal site must be monitored concerning its development over time, from building the disposal mine over the transport of the waste to later stages in order to get empirical information whether the entire system (host rock, technical facilities, and the waste) behaves as has been expected, in particular with respect to temperature and stability. For the case of unexpected and possibly harmful developments, the Commission postulates that the waste shall be recoverable for 500 years after having closed the mine. Monitoring over such a long time frame and regarding difficult geological conditions, however, needs monitoring technologies which is not available yet.

Participants of the Workshop (CVs)

Anne Bergmans is lecturer and senior researcher at the University of Antwerp's Faculties of Law and of Social Sciences. She holds a PhD in sociology from the University of Antwerp (May 2005). Her research interests are in the fields of science and technology governance, environmental sociology, and sociology of safety and risk, with an empirical focus on questions related to long-term governance of radio-active waste.

Stefan Bösch is senior research scientist at the Institute for Technology Assessment and Systems Analysis (ITAS), Karlsruhe Institute of Technology (KIT) and co-head of the research unit „knowledge politics and knowledge society“. At present, he deputize the professorship “Technology and Gender” at RWTH Aachen University. He studied chemical engineering, philosophy, and sociology at the University of Erlangen-Nürnberg, and holds a diploma in chemical engineering, a doctoral degree in sociology, and Habilitation in sociology (2010). He is head of the commission „risk research and risk communication“ at the Bundesinstitut für Risikobewertung (BfR). His current research focuses on science and technology studies, sociology of modernity, risk sociology, environmental research, with special emphasis to transdisciplinary and problem-oriented research, technology assessment, the analysis of risk politics and risk communication. Recent publication: Bösch, S. (2016): Hybride Wissensregime. Skizze einer soziologischen Feldtheorie. Baden-Baden: Nomos.

Elke Bozau: Dr. Elke Bozau studierte Geologie an der Universität Greifswald, promovierte 1995 an der Universität in Heidelberg und habilitierte 2005 an der Universität in Leipzig. Im Rahmen wissenschaftlicher Projekte und der Sanierung kontaminierter Industriestandorte beschäftigte sie sich mit verschiedenen geochemischen und hydrogeologischen Aufgabenstellungen. Seit 2009 erstellt sie an der TU Clausthal Grundwassermodelle für die Projekte "gebo" und "ENTRIA".

Saleem Chaudry: Studium der Geologie an der Technischen Universität Clausthal; Diplom im April 2010; Mai 2010 bis März 2013 wissenschaftlicher Mitarbeiter am Institut für Endlagerforschung der Technischen Universität Clausthal, Fachgebiet Mineralogie, Geochemie, Salzlagerstätten. Seit April 2013 wissenschaftlicher Mitarbeiter im Forschungsprojekt ENTRIA.

Anne Eckhardt studied biology, majoring in biophysics, and obtained her doctorate in 1990 at the Swiss Federal Institute of Technology (ETH) Zurich. She went on to complete postgraduate courses in Risk and Safety at the ETH Zurich, the Swiss Federal Institute of Technology (EPF) Lausanne and the University of St. Gallen. From 1990 to 2007 she worked for the as an advisor and project manager focusing on the risks of technical systems, natural hazards, opportunities and risks of new technologies, and risk communication. Starting in the late 1990s, she also built up and managed the company's Technology and Society Department. In 2007 Anne Eckhardt founded risicare GmbH, for which she continues to work as CEO and Project Manager. Since founding the company, she has implemented a wide range of projects, mainly on new technologies and the safety of technical systems.

Since 2013 risicare is a participating institution of the German research platform ENTRIA. In addition to

her main professional activities, Anne Eckhardt has participated in various committees and groups of experts. Amongst others she took part in the Expert Group on Disposal Concepts for Radioactive Waste (EKRA), which developed the concept for deep geological storage of radioactive waste in Switzerland. She has been a member of the Board of the Swiss Federal Nuclear Safety Inspectorate since 2008, and has been its Chair since 1 January 2012. Since 2016 she is also Chair of the Federal NBC Protection Commission.

Grit Gärner: Bundesamt für Strahlenschutz / Salzgitter. Studium der Geowissenschaften am Moskauer Geologischen Institut MGRI und TU Braunschweig (1989-1996), 2001 Promotion zum Dr. rer. nat.; 1999 bis 2009 Mitarbeiterin bei GSF (später HMGU) im Bereich der geotechnischen Überwachung, insbes. der Schachtanlage Asse II, seit 2009 Mitarbeiterin BfS-Projekt Asse und seit 2013 Referatsleiterin Asse in Fachfragen.

Horst Geckeis: Leiter des Instituts für Nukleare Entsorgung (INE) am Karlsruher Institut für Technologie (KIT) und Professor für Radiochemie ebenfalls am KIT (seit 2008). Er promovierte am Institut für Anorganische Analytik und Radiochemie der Universität Saarbrücken (bei Prof. Dr. E. Blasius und Prof. Dr. W. Müller). Am INE war er Bereichsleiter: Analytik radioaktiver Stoffe (2003-2007) und Gruppenleiter Radioanalytik und davor wissenschaftlicher Assistent, Universität Saarbrücken (1986-1989). Er ist Vorsitzender der FG Nuklearchemie der GDCh, Mitglied der Nuclear chemistry division der European Chemical Society (EuChemS) und ist Vorsitzender der Deutschen Arbeitsgemeinschaft Endlagerforschung (DAEF): Zudem ist er Mitglied des Endlagerausschusses der ESK (Entsorgungskommission) des BMUB. Seine Forschungsschwerpunkte sind die Radionuklidmigration in der Geosphäre, Actinidenreaktionen an der Fest-Flüssig-Grenzfläche und Analytische Chemie der Radionuklide. In ENTRIA Leiter der INE-Arbeitspakete „Radionuklidquellterme für verschiedene Entsorgungsoptionen“ und „Individuelle Dosimetrie für Beschäftigte in Entsorgungsanlagen“.

Armin Grunwald: Leiter des Instituts für Technikfolgenabschätzung und Systemanalyse (ITAS) am Karlsruher Institut für Technologie (KIT) seit 1999; Studium der Physik, Mathematik und Philosophie. Berufstätigkeiten in der Industrie (Software Engineering, 1987-1991), im Deutschen Zentrum für Luft- und Raumfahrt (1991-1995) und als stellvertretender Direktor der Europäischen Akademie zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen (1996-1999). Neben der Leitung des ITAS seit 2002 Leiter des Büros für Technikfolgen-Abschätzung beim Deutschen Bundestag (TAB, Berlin). Seit 2007 auch Professor für Technikethik und Technikphilosophie am KIT. Mitglied im Präsidium der Deutschen Akademie der Technikwissenschaften (acatech). Mitglied der Endlagerkommission des Deutschen Bundestages. Arbeitsgebiete: Theorie und Methodik der Technikfolgenabschätzung, Technikphilosophie, Technikethik, nachhaltige Entwicklung.

Thomas Hassel: Leiter des Unterwassertechnikum Hannover am Institut für Werkstoffkunde der Leibniz Universität Hannover (seit 2008) und Leiter des dortigen ENTRIA-Teams. Er promovierte mit einem „Beitrag zur Entwicklung bioresorbierbarer Implantatmaterialien auf Magnesium-Basis“ an der Fakultät für Maschinenbau der Leibniz Universität Hannover (2001-2008); Diplom-Ingenieur an der Friedrich Alexander Universität Erlangen-Nürnberg (2001), davor war er Leiter des Fachbereichs Technologie der Werkstoffe am Institut für Werkstoffkunde der Leibniz Universität Hannover (2006-2008) und arbeitete auch als Wissenschaftlicher Mitarbeiter am Institut für Werkstoffwissenschaften FAU Erlangen-

Nürnberg. Seine Forschungsschwerpunkte sind der Rückbau kerntechnischer Anlagen, Schneid-, Schweiß- und Abtragstechnik unter Wasser und an Atmosphäre sowie Korrosion und Wasserstrahlschneidtechnik.

Peter Hocke: Senior fellow at the “Institute for Technology Assessment and Systems Analysis” at the KIT (Karlsruhe). His research is focused on Technology Assessment, social science based research of Nuclear Waste Management and public conflicts about advanced technologies – all done with a strong empirical approach. Currently, he leads the ITAS research team within the national research project ENTRIA; the ITAS topics there are new governance, social conflicts, consensus and dissent between experts and the role of interfaces between formal and informal processes of decision-making in nuclear waste management. In the 1990s he worked as a junior fellow in the unit “Public Sphere and Social Movements” at the Social Science Research Center Berlin (Wissenschaftszentrum Berlin für Sozialforschung). His dissertation is on topics of public policy and communication research. Since 2006 member of the BMUB expert group ESchT (Expert Group “Swiss Deep Underground Repository for Nuclear Waste”). From 2005 to 2013 editor of the journal “Technikfolgenabschätzung – Theorie und Praxis”.

Michael Jobmann: Diplom Geophysiker, Stellvertretender Leiter Forschung & Entwicklung bei DBE TECHNOLOGY GmbH Peine. Nach Abschluss des Studiums an der TU Clausthal als Diplom Geophysiker war er sowohl im Bereich der Exploration geothermischer Energie als auch im Rahmen des Kontinentalen Tiefbohrprogramms (KTB) beim damaligen Landesamt für Bodenforschung in Hannover tätig. In seiner anschließenden Tätigkeit bei der BGR war er u.a. im Felslabor Grimsel der NAGRA tätig zur Untersuchung von Strömungs- und Transportprozessen im geklüfteten Granit. Seit 1994 leitete er zunächst bei der DBE und seit 2001 bei der DBE TECHNOLOGY verschiedene Forschungsprojekte. Der Schwerpunkt seiner momentanen Tätigkeit liegt im Bereich der Entwicklung von Sicherheits- und Nachweiskonzepten für Endlager in verschiedenen Wirtsgesteinen sowie der damit zusammenhängenden Entwicklung von Monitoring-Konzepten.

Ansgar Köhler: Diplom-Ingenieur und wissenschaftlicher Mitarbeiter des ENTRIA-Teams am Institut für Werkstoffkunde der Leibniz Universität Hannover. Seine Forschungsschwerpunkte sind Handhabungssysteme und Rückholtechniken sowie der Rückbau kerntechnischer Anlagen. Im ENTRIA-Projekt arbeitet er zu Interventionstechniken zur sicheren Rückholbarkeit.

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Anna-Laura Liebenstund is a researcher at the Department of Sociology at the University of Antwerp where she is a member of the Society and Environment research group. She graduated in 2015 from Maastricht University in the International Master Programme European Studies on Society, Science and Technology (Master of Arts). She wrote her master's thesis 'Smart City Planning in Vienna: The Concept

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Oliver Sträter: Prof. Oliver Sträter studied engineering psychology and accomplished his Ph.D. and Habilitation at the University of Technology Munich. Since 2008 he is heading the Department of Work and Organizational Psychology at the University of Kassel, in the Faculty of Mechanical Engineering. The analysis of events in terms of human behavior, the effectiveness of organizations and management systems and the robust design of organizations are major research themes of his chair. From 1992 until 2002 he worked for GRS (Gesellschaft für Anlagen- und Reaktorsicherheit), part of the German Nuclear Regulatory Body. At GRS he developed methods for incident investigation and reliability assessment regarding the human impact on the safety of nuclear installations. During this work he conducted his Ph.D. on the evaluation of operational experience regarding human reliability together with the Institute of Ergonomics of the University of Technology Munich. 1999 he moved to the Institute of Ergonomics of the University of Technology Munich and extended the research into the fields of human factors in automobile, aviation and occupational safety. From 2001 he moved to EUROCONTROL, the European Organization for the Safety of Air Navigation in Brussels, where he developed methods and tools for dealing with Human automation issues in European Air Traffic Management and was responsible for the long term safety strategy of Air Traffic Management.

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