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Geological Storage of Carbon Dioxide (CO2) **Developments and Innovation in Carbon Dioxide (CO2) Capture and Storage Technology** *Carbon Dioxide Storage in Geological Media* **Carbon Capture and Storage Carbon Dioxide Capture and Storage** *Policy Readiness for Offshore Carbon Dioxide Storage in the Northeast* **The Industrial Base for Carbon Dioxide Storage** *Numerical Models for Carbon-dioxide Storage in Geological Formations* **Carbon Dioxide Capture for Storage in Deep Geologic Formations - Results from the CO2 Capture Project Carbon Dioxide Storage in Unconventional Underground Reservoirs Carbon Dioxide Capture for Storage in Deep Geologic Formations Geologic Carbon Dioxide Storage on Federal Lands Carbon Dioxide Capture for Storage in Deep Geologic Formations - Results from the CO2 Capture Project National Carbon Dioxide Storage Capacity Assessment Act of 2007, and Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007** Carbon Dioxide Storage in Unconventional Reservoirs Workshop *Near-well Effects in Carbon Dioxide Storage in Saline Aquifers* **A Technical Basis for Carbon Dioxide Storage** Geologic Carbon Dioxide Storage *Carbon Dioxide Capture for Storage in Deep Geologic Formations: Capture and separation of carbon dioxide from combustion sources* **Mathematical Modeling and Multiscale Simulation of Carbon Dioxide Storage in Saline Aquifers** *Carbon-dioxide Storage in the Subsurface* Carbon Dioxide Capture for Storage in Deep Geologic Formations **Bulk liquid carbon dioxide storage at users' premises** *Geological Carbon Storage* **Carbon Capture and Storage** Carbon Dioxide Storage in the UK Southern North Sea *Design of Gas-surfactant Injection for Carbon Dioxide Storage in a North Sea Aquifer Using Streamline-based Simulation* **Bulk Liquid Carbon Dioxide Storage at Users' Premises Earth and Environmental Sciences Earth and Environmental Sciences Bulk Liquid Carbon Dioxide Storage at Users' Premises** Predicted Column Heights for Carbon Dioxide Storage in New Zealand Based on Membrane Seal Capacity National Carbon Dioxide Storage Capacity Assessment Act of 2007, and Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007 **Carbon Dioxide Capture for Storage in Deep Geologic Formations S. Hrg. 110-83 Carbon Dioxide Capture for Storage in Deep Geological Formations: Geologic storage of carbon dioxide with monitoring and verification** *Simulation On Geological Storage Of Carbon Dioxide In The Gulf Of Thailand* Carbon Dioxide Storage in a Devonian Carbonate System, Fort Nelson British Columbia An Approach to Carbon Dioxide Capture and Storage at Ambient Conditions **Feasibility of Geological Carbon Dioxide Storage**

Carbon Dioxide Capture for Storage in Deep Geologic Formations - Results from the CO2 Capture Project Climate change is one of the most concern problems currently because of the increase of the amount of greenhouse gases in the atmosphere. CO2, the most important component of greenhouse gases, comes from industries like power generation. Carbon capture and storage (CCS) is the practical technology to mitigate CO2 especially geological storage. In Thailand, the main potential of geological storage is in the Gulf of Thailand. However, the research on this in Thailand is scarce. Consequently, this work is focusing on the simulation of CO2 geological storage in formations at the Gulf of Thailand. The storage

capacity and the fracture pressure have been estimated. Also, the pressure buildup and plume migration have been simulated with various conditions. CO2 injection is used from 1,000-4,000 tons per day with the depth from 2,160 - 2,510 meters and the results are studied for 1-50 years for monitoring period. The results show that CO2 storage in this area has potential with the formation characteristics. Moreover, pressure buildup and plume migration are illustrated for the period of 50 years. This study can contribute as a fundamental knowledge for CO2 storage in an offshore area in Thailand. Carbon capture and storage (CCS) is the process of capturing carbon dioxide (CO2) prior to its being emitted into the atmosphere, then either using it in a commercial application or storing it in geological formations for hundreds to thousands of years. If policies aimed at large reductions of CO2 emissions from industrial sources and power plants are enacted, more CCS will be needed. RAND researchers explored the ability of the industrial base supporting the transportation and storage of CO2 to expand, assessing the industrial base for transportation and injection for CO2 for both geologic storage and enhanced oil recovery. They also identified and quantified the activities, equipment, and labor required for transporting CO2 to an injection site, using it in oil recovery, and storing it in a geologic formation. RAND developed four scenarios for future CCS development and determined that under most of them, significant expansion of geologic storage capacity is required after 2025, and that based on current activities, it appears that the industrial base supporting the development of geologic storage has the ability to meet increased needs for CO2 storage. In the last few years there has been a surge in interest in the geologic sequestration of carbon dioxide (CO2), a process often referred to as carbon capture and storage, or sequestration (CCS), as a way to mitigate man-made CO2 emissions and thereby help address climate change concerns. The Energy Independence and Security Act contains measures to promote research and development of CCS technology, to assess sequestration capacity, and to clarify the framework for issuance of CO2 pipeline rights-of-way on public land. Other legislative proposals have also sought to encourage the development of CO2 sequestration, capture, and transportation technology. This book discusses the concept and legal issues related to geologic carbon sequestration and mitigation technologies. Among the alternatives CO2 storage in geological media has significant advantages. Experience and sophistication gained in mining and oil industry is a readily available infrastructure of knowledge, techniques and understanding. All the available methods may apply with a reasonable cost since terrestrial storage areas can be used by inland and seaside locations of emissions. However, it must be stated that available methods of geological storage, still, need elaborate researches. Since the global emissions of CO2 is expected to rise, depending on the industrial development and increase of population. Pessimistic approaches project at approximately 150 years for live of coal and the shorter lives for others. Therefore, in addition to researches for the newer and safer energy resources, enhancing the geological storage methods of CO2 need to be paid more effort, since it is the only available method which can be applied to eliminate significant amounts of CO2. We are increasingly faced with environmental problems and required to make important decisions. In many cases an understanding of one or more geologic processes is essential to finding the appropriate solution. Earth and Environmental Sciences are by their very nature a dynamic field in which new issues continue to arise and old ones often evolve. The principal aim of this book is to present the reader with a broad overview of Earth and Environmental Sciences. Hopefully, this recent research will provide the reader with a useful foundation for discussing and evaluating specific environmental issues, as well as for developing ideas for problem solving. The book has been divided into nine sections; Geology, Geochemistry, Seismology, Hydrology, Hydrogeology, Mineralogy, Soil, Remote Sensing and Environmental Sciences. The United States Government Printing Office (GPO) was created in June 1860, and is an agency of the U.S. federal government based in Washington D.C. The office prints documents produced by and for the federal government, including Congress, the Supreme Court, the Executive Office of the President and other executive departments, and independent agencies. A hearing is a meeting of the Senate, House, joint or certain Government committee that is open to the public so that they can listen in on the opinions of the legislation. Hearings can also be held to explore certain topics or a current issue. It

typically takes between two months up to two years to be published. This is one of those hearings. Over the past decade, the prospect of climate change resulting from anthropogenic CO2 has become a matter of growing public concern. Not only is the reduction of CO2 emissions extremely important, but keeping the cost at a manageable level is a prime priority for companies and the public, alike. The CO2 capture project (CCP) came together with a common goal in mind: find a technological process to capture CO2 emissions that is relatively low-cost and able be to be expanded to industrial applications. The Carbon Dioxide Capture and Storage Project outlines the research and findings of all the participating companies and associations involved in the CCP. The final results of thousands of hours of research are outlined in the book, showing a successful achievement of the CCP's goals for lower cost CO2 capture technology and furthering the safe, reliable option of geological storage. The Carbon Dioxide Capture and Storage Project is a valuable reference for any scientists, industrialists, government agencies, and companies interested in a safer, more cost-efficient response to the CO2 crisis. Carbon Capture and Storage, Second Edition, provides a thorough, non-specialist introduction to technologies aimed at reducing greenhouse gas emissions from burning fossil fuels during power generation and other energy-intensive industrial processes, such as steelmaking. Extensively revised and updated, this second edition provides detailed coverage of key carbon dioxide capture methods along with an examination of the most promising techniques for carbon storage. The book opens with an introductory section that provides background regarding the need to reduce greenhouse gas emissions, an overview of carbon capture and storage (CCS) technologies, and a primer in the fundamentals of power generation. The next chapters focus on key carbon capture technologies, including absorption, adsorption, and membrane-based systems, addressing their applications in both the power and non-power sectors. New for the second edition, a dedicated section on geological storage of carbon dioxide follows, with chapters addressing the relevant features, events, and processes (FEP) associated with this scenario. Non-geological storage methods such as ocean storage and storage in terrestrial ecosystems are the subject of the final group of chapters. A chapter on carbon dioxide transportation is also included. This extensively revised and expanded second edition will be a valuable resource for power plant engineers, chemical engineers, geological engineers, environmental engineers, and industrial engineers seeking a concise, yet authoritative one-volume overview of this field. Researchers, consultants, and policy makers entering this discipline also will benefit from this reference. Provides all-inclusive and authoritative coverage of the major technologies under consideration for carbon capture and storage Presents information in an approachable format, for those with a scientific or engineering background, as well as non-specialists Includes a new Part III dedicated to geological storage of carbon dioxide, covering this topic in much more depth (9 chapters compared to 1 in the first edition) Features revisions and updates to all chapters Includes new sections or expanded content on: chemical looping/calcium looping; life-cycle GHG assessment of CCS technologies; non-power industries (e.g. including pulp/paper alongside ones already covered); carbon negative technologies (e.g. BECCS); gas-fired power plants; biomass and waste co-firing; and hydrate-based capture Accompanying CD-ROM contains the results from the CO2 capture projects. We are increasingly faced with environmental problems and required to make important decisions. In many cases an understanding of one or more geologic processes is essential to finding the appropriate solution. Earth and Environmental Sciences are by their very nature a dynamic field in which new issues continue to arise and old ones often evolve. The principal aim of this book is to present the reader with a broad overview of Earth and Environmental Sciences. Hopefully, this recent research will provide the reader with a useful foundation for discussing and evaluating specific environmental issues, as well as for developing ideas for problem solving. The book has been divided into nine sections; Geology, Geochemistry, Seismology, Hydrology, Hydrogeology, Mineralogy, Soil, Remote Sensing and Environmental Sciences. As part of a global effort to assess the storage potential for captured carbon dioxide (CO2), this book estimates and characterizes the storage potential that lies beneath some of the more than 400 million acres of Federal land available for lease. Estimated at between 126 to 375 billion metric tons of CO2, the majority of this storage potential (about 85 percent)

is located west of the Mississippi River, where most of the leasable Federal acreage (92 percent) is found. In assessing the potential for storage beneath Federal lands, the book addresses issues such as Federal control, location of emission sources, and pipeline rights-of-way, as well as laws and regulations relevant to Federal leasing. National Carbon Dioxide Storage Capacity Assessment Act of 2007, and Department of Energy Carbon Capture and Storage Research, Development, and Demonstration Act of 2007: hearing before the Committee on Energy and Natural Resources, United States Senate, One Hundred Tenth Congress, first session, on S. 731 ... S. 962 ... April 16, 2007. Geological storage and sequestration of carbon dioxide, in saline aquifers, depleted oil and gas fields or unminable coal seams, represents one of the most important processes for reducing humankind's emissions of greenhouse gases. Geological storage of carbon dioxide (CO2) reviews the techniques and wider implications of carbon dioxide capture and storage (CCS). Part one provides an overview of the fundamentals of the geological storage of CO2. Chapters discuss anthropogenic climate change and the role of CCS, the modelling of storage capacity, injectivity, migration and trapping of CO2, the monitoring of geological storage of CO2, and the role of pressure in CCS. Chapters in part two move on to explore the environmental, social and regulatory aspects of CCS including CO2 leakage from geological storage facilities, risk assessment of CO2 storage complexes and public engagement in projects, and the legal framework for CCS. Finally, part three focuses on a variety of different projects and includes case studies of offshore CO2 storage at Sleipner natural gas field beneath the North Sea, the CO2CRC Otway Project in Australia, on-shore CO2 storage at the Ketzin pilot site in Germany, and the K12-B CO2 injection project in the Netherlands. Geological storage of carbon dioxide (CO2) is a comprehensive resource for geoscientists and geotechnical engineers and academics and researches interested in the field. Reviews the techniques and wider implications of carbon dioxide capture and storage (CCS) An overview of the fundamentals of the geological storage of CO2 discussing the modelling of storage capacity, injectivity, migration and trapping of CO2 among other subjects Explores the environmental, social and regulatory aspects of CCS including CO2 leakage from geological storage facilities, risk assessment of CO2 storage complexes and the legal framework for CCS Carbon dioxide (CO2) capture and storage (CCS) is the one advanced technology that conventional power generation cannot do without. CCS technology reduces the carbon footprint of power plants by capturing, and storing the CO2 emissions from burning fossil-fuels and biomass. This volume provides a comprehensive reference on the state of the art research, development and demonstration of carbon storage and utilisation, covering all the storage options and their environmental impacts. It critically reviews geological, terrestrial and ocean sequestration, including enhanced oil and gas recovery, as well as other advanced concepts such as industrial utilisation, mineral carbonation, biofixation and photocatalytic reduction. Foreword written by Lord Oxburgh, Climate Science Peer Comprehensively examines the different methods of storage of carbon dioxide (CO2) and the various concepts for utilisation Reviews geological sequestration of CO2, including coverage of reservoir sealing and monitoring and modelling techniques used to verify geological sequestration of CO2 This book is based on laboratory researches that studied the possibility of using sandstone, shale, oil-sand and kaolin reservoirs as candidate carbon dioxide storage. It considered the effects of the Carbon dioxide gas storage on the reservoir porosity and permeability and also the effects of the gas storage on the properties of the formation fluids and drilling fluids being used in adjacent reservoir. Geological Carbon Storage Subsurface Seals and Caprock Integrity Seals and caprocks are an essential component of subsurface hydrogeological systems, guiding the movement and entrapment of hydrocarbon and other fluids. Geological Carbon Storage: Subsurface Seals and Caprock Integrity offers a survey of the wealth of recent scientific work on caprock integrity with a focus on the geological controls of permanent and safe carbon dioxide storage, and the commercial deployment of geological carbon storage. Volume highlights include: Low-permeability rock characterization from the pore scale to the core scale Flow and transport properties of low-permeability rocks Fundamentals of fracture generation, self-healing, and permeability Coupled geochemical, transport and geomechanical processes in caprock Analysis of caprock behavior from natural analogues Geochemical and geophysical

monitoring techniques of caprock failure and integrity Potential environmental impacts of carbon dioxide migration on groundwater resources Carbon dioxide leakage mitigation and remediation techniques Geological Carbon Storage: Subsurface Seals and Caprock Integrity is an invaluable resource for geoscientists from academic and research institutions with interests in energy and environment-related problems, as well as professionals in the field. Book Review: William R. Green, Patrick Taylor, Sven Treitel, and Moritz Fliedner, (2020), "Reviews," The Leading Edge 39: 214–216 Geological Carbon Storage: Subsurface Seals and Caprock Integrity, edited by Stéphanie Vialle, Jonathan Ajo-Franklin, and J. William Carey, ISBN 978-1-119-11864-0, 2018, American Geophysical Union and Wiley, 364 p., US$199.95 (print), US$159.99 (eBook). This volume is a part of the AGU/Wiley Geophysical Monograph Series. The editors assembled an international team of earth scientists who present a comprehensive approach to the major problem of placing unwanted and/or hazardous fluids beneath a cap rock seal to be impounded. The compact and informative preface depicts the nature of cap rocks and the problems that may occur over time or with a change in the formation of the cap rock. I have excerpted a quote from the preface that describes the scope of the volume in a concise and thorough matter. “Caprocks can be defined as a rock that prevents the flow of a given fluid at certain temperature, pressure, and chemical conditions. … A fundamental understanding of these units and of their evolution over time in the context of subsurface carbon storage is still lacking.” This volume describes the scope of current research being conducted on a global scale, with 31 of the 83 authors working outside of the United States. The studies vary but can be generalized as monitoring techniques for cap rock integrity and the consequence of the loss of that integrity. The preface ends by calling out important problems that remain to be answered. These include imaging cap rocks in situ, detecting subsurface leaks before they reach the surface, and remotely examining the state of the cap rock to avert any problems. Chapter 3 describes how newer methods are used to classify shale. These advanced techniques reveal previously unknown microscopic properties that complicate classification. This is an example of the more we know, the more we don't know. A sedimentologic study of the formation of shale (by far the major sedimentary rock and an important rock type) is described in Chapter 4. The authors use diagrammatic examples to illustrate how cap rocks may fail through imperfect seal between the drill and wall rock, capillary action, or a structural defect (fault). Also, the shale pore structures vary in size, and this affects the reservoir. There are descriptions of the pore structure in the Eagle Ford and Marcellus shales and several others. Pore structures are analyzed using state-of-the-art ultra-small-angle X-ray or neutron scattering. They determine that the overall porosity decreases nonlinearly with time. There are examples of cap rock performance under an array of diagnostic laboratory analyses and geologic field examples (e.g., Marcellus Formation). The importance of the sequestration of CO2 and other contaminants highlights the significance of this volume. The previous and following chapters illuminate the life history of the lithologic reservoir seal. I would like to call out Chapter 14 in which the authors illustrate the various mechanisms by which a seal can fail and Chapter 15 in which the authors address the general problems of the effect of CO2 sequestration on the environment. They establish a field test, consisting of a trailer and large tank of fluids with numerous monitoring instruments to replicate the effect of a controlled release of CO2-saturated water into a shallow aquifer. This chapter's extensive list of references will be of interest to petroleum engineers, rock mechanics, and environmentalists. The authors of this volume present a broad view of the underground storage of CO2. Nuclear waste and hydrocarbons are also considered for underground storage. There are laboratory, field, and in situ studies covering nearly all aspects of this problem. I cannot remember a study in which so many different earth science resources were applied to a single problem. The span of subjects varies from traditional geochemical analysis with the standard and latest methods in infrared and X-ray techniques, chemical and petroleum engineering, sedimentary mineralogy, hydrology, and geomechanical studies. This volume is essential to anyone working in this field as it brings several disciplines together to produce a comprehensive study of carbon sequestration. While the volume is well illustrated, there is a lack of color figures. Each chapter should have at least two color figures, or there should be several pages of color

figures bound in the center of the volume. Many of the figures would be more meaningful if they had been rendered in color. Also, the acronyms are defined in the individual chapters, but it would be helpful to have a list of acronyms after the extensive index. I recommend this monograph to all earth scientists but especially petroleum engineers, structural geologists, mineralogists, and environmental scientists. Since these chapters cover a broad range of studies, it would be best if the reader has a broad background. — Patrick Taylor Davidsonville, Maryland Mathematical modeling and multiscale simulation of carbon dioxide storage in saline aquifers. IPCC Report on sources, capture, transport, and storage of CO2, for researchers, policy-makers and engineers.

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