Geological Carbon Storage: The Roles of Government and Industry in Risk Management

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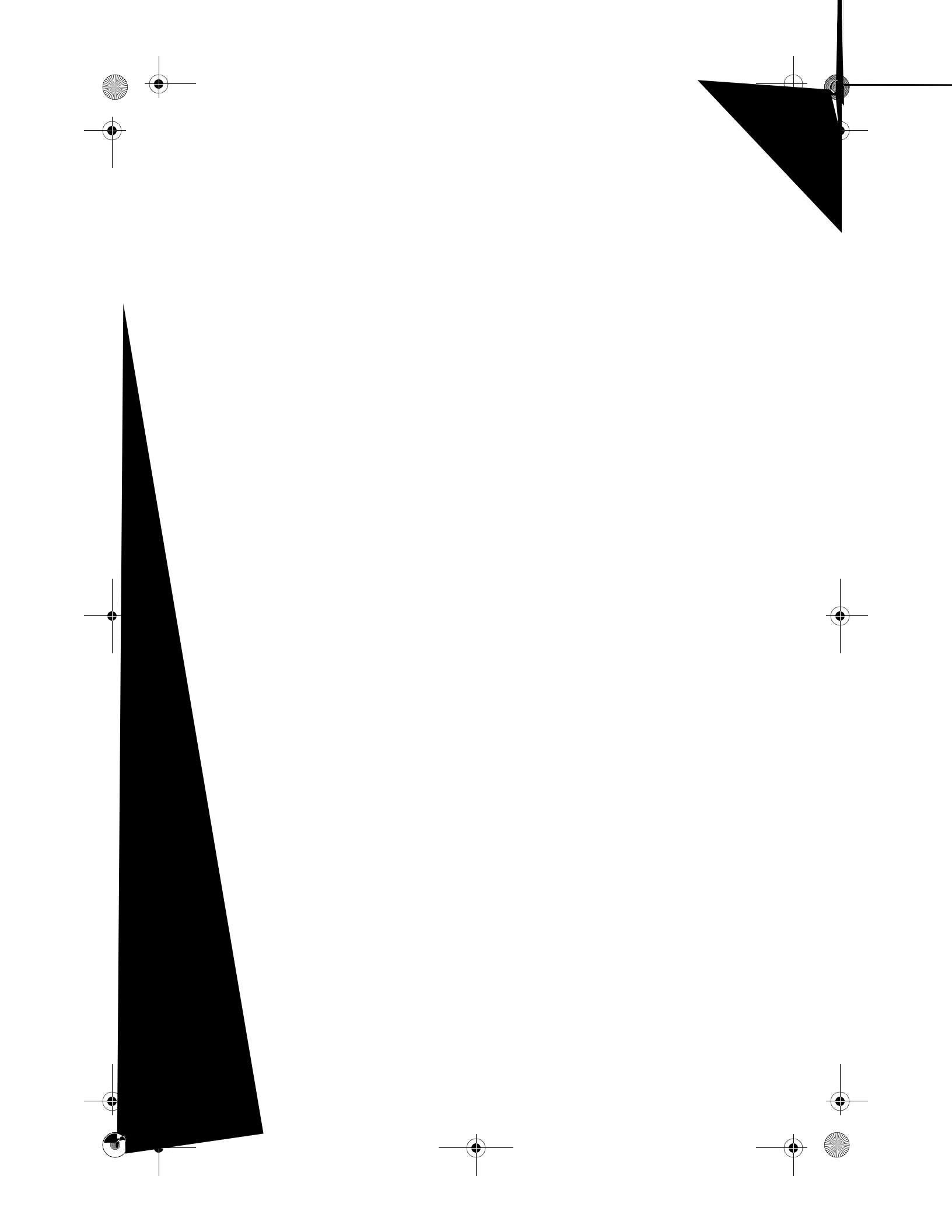

near-zero emissions according to proponents. Three million tonnes of captured CO_2 per year would be available for projects. SaskPower officials pointed out that a price for CO_2 credits in the range of $50/tonne would

pits or depressions. Elevated concentrations of CO_2 are known to cause physiological effects in humans and animals; suffocation is possible at high concentrations. Plants may be damaged or killed. In the second process, CO_2 dissolved in subsurface fluids could have an impact on groundwater chemis-

and potential mitigation options – is particularly poorly understood. The authors of the chapter reviewed studies undertaken in the , Europe, and Japan, but found that direct comparisons are constrained by

contamination of groundwater, the risk of a CO_2 leak, and harm to plants and animals."[21]

stored, emissions reduction and emission permits."[25] Countries wishing to pursue widespread development of will need to develop their legal and regulatory frameworks to fill in the gaps identified. At the same time, they must reduce redundancies and streamline their regulatory processes.[26]

Offshore storage is subject to international legal agreements on the marine environment including the 1972 London Convention, the 1996 London Protocol, and the 1992 convention.[27] Because these treaties do not explic-

including: the ability of the pore spaces in the geological formation to accept injected CO_2, the potential of the site to hold CO_2 over the long-term, the to-

analysis is for the , but may be applied to other countries because of general principles shared by major legal systems. Negligence – "the failure of a person to exercise reasonable care" – is the basis for establishing most accident claims in cases where liability is not specifically addressed by the law.[44] Firms engaged in geological storage would have to exercise "the skill and knowledge normally possessed by members of the profession" in order to avoid being found negligent.[45] The courts have found that the standard of due care under negligence law adequately addresses the risks associated with underground transmission of natural gas.

For "abnormally dangerous activities," de Figueiredo et al. explain that the courts or the legislature may impose "strict liability." Strict liability holds a person liable for the harm caused by his or her actions whether reasonable care was exercised or not. This standard ensures that the entity with the greatest control over the risks of an activity is also responsible for any damage costs. Ultimately, the courts will decide whether geological is dangerous enough to be subject to strict liability. The Comprehensive Environmental Response, Compensation and Liability Act (, also known as Superfund) imposes strict liability with respect to releases of hazardous

viable because the lifetime of a company is too short, and long-lived companies tend to offload outstanding liabilities onto smaller, more short-lived companies.[48] Record keeping in the public sector is believed to be more effective than in the private sector, although it is not clear whether even a system of public liability could assure monitoring and verification, as well as the dissemination of information on storage locations to other users of the subsurface over the long-term.[49] Keith and Wilson view the advantages (reducing CO_2 emissions to the atmosphere at a relatively low cost) and disadvantages (potential for leaks resulting in future emissions, damage to the surface environment) of as fundamentally public in nature.[50]

A mix of private and public liability is also possible; the main way this has been achieved in analogous situations is by limiting the damages for which private companies may be held responsible. To explore this possibility further it is useful to review how indemnity legislation has been applied to the nuclear industry. In the

accidents and terrorism. Liability limits for geological could therefore create associations detrimental to public perception.[54]

Indemnity protection for nuclear operators has faced constitutional challenges in Canada, the , and other jurisdictions. In the early 1990s, the Canadian Nuclear Liability Act was subject to several years of litigation. It was argued by a group of concerned parties including the City of Toronto that the Charter of Rights assures Canadians of their right to compensation if unduly deprived of "life, liberty and security of the person," and that in lim-

Insurance is effectively a mechanism for sharing private liability among a number of firms. If research indicates that the risks of are low enough and predictable enough, private companies may be willing to supply insurance. The European Commission emphasizes the importance of insurability, but explains that "insurance availability for environmental risks, and in particular for natural resource damage, is likely to develop gradually." This is because widely accepted methods for quantifying environmental damage have yet to be developed. The situation "justifies a cautious approach in setting up

11 Wilson et al., "Regulating the Ultimate Sink."
12 , "Summary for Policymakers."
13 M. Stenhouse, M. Wilson, H. Herzog, B. Cassidy, M. Kozak, and W. Zhou, *Regulatory Issues Associated with the Long-Term Storage of CO_2.* (Monitor Scientific LLC, 2004).
14 , "Summary for Policymakers," 12.
15 , "Summary for Policymakers," 14. The uses the term "very likely" to indicate a probability between 90 and 99 per cent; "likely" indicates a probability between 66 and 90 per cent.
16 S. Ansolabehere and multiple co-authors, *The Future of Coal: An Interdisciplinary MIT Study* (Massachusetts Institute of Technology, 2007).
17 Benson et al., "Underground Geological Storage."
18 De Coninck et al., *Acceptability of CO_2 Capture and Storage.*
19 S. Vajjhala, J. Gode, and A. Torvanger, *An International Regulatory Framework for Risk Governance of Carbon Capture and Storage.* (Resources for the Future, 2007), 9.
20 J. Sharp, *Public Attitudes Toward Geological Disposal of Carbon Dioxide in Canada*, Master's Thesis. (School of Resource and Environmental Management, Simon Fraser University, 2005).
21 Sharp, *Public Attitudes*, v.
22 Regional authority over onshore storage is also possible, as in the case of the European Union.
23 / (Organization for Economic Cooperation and Development / International Energy Agency), *Legal Aspects of Storing CO_2.* (Paris, 2005); D.W. Keith, *Towards a Strategy for Implementing CO_2 Capture and Storage in Canada.* (Environment Canada, 2002).
24 Benson et al., "Underground Geological Storage."
25 / , *Legal Aspects of Storing CO_2*, 34.
26 / , *Legal Aspects of Storing CO_2.*
27 The Convention for the Protection of the Marine Environment of the North-East Atlantic is known as the Convention.
28 / , *Legal Aspects of Storing CO_2.*
29 The London Protocol was amended in November 2006 to permit storage of CO_2 in sub-seabed formations.
30 / , *Legal Aspects of Storing CO_2*; Vajjhala et al., *An International Regulatory Framework.*
31 Vajjhala et al., *An International Regulatory Framework* .
32 / , *Legal Aspects of Storing CO_2.*
33 Vajjhala et al., *An International Regulatory Framework* .
34 Benson et al., "Underground Geological Storage."
35 Benson et al., "Underground Geological Storage;" Ansolabehere et al., *The Future of Coal*; / , *Legal Aspects of Storing CO_2.*
36 / , *Legal Aspects of Storing CO_2;* Ansolabehere et al., *The Future of Coal*; Vajjhala et al., *An International Regulatory Framework.*
37 / , *Legal Aspects of Storing CO_2.*

38 Vajjhala et al., *An International Regulatory Framework.*
39 / , *Legal Aspects of Storing CO_2.*
40 Wilson et al., "Regulating the Ultimate Sink," 3476.
41 Wilson et al., "Regulating the Ultimate Sink."