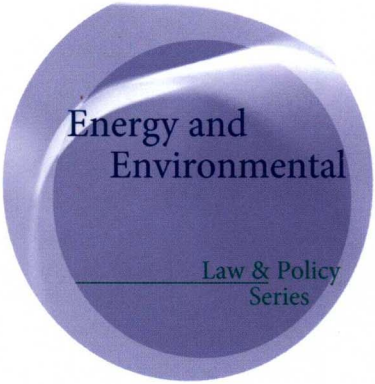


# Environmental Hazards from Offshore Methane Hydrate Operations

## Civil Liability and Regulations for Efficient Governance

Roy Andrew Partain

Wolters Kluwer

# Environmental Hazards from Offshore Methane Hydrate Operations

## Civil Liability and Regulations for Efficient Governance

Roy Andrew Partain

*Published by:*
Kluwer Law International B.V.
PO Box 316
2400 AH Alphen aan den Rijn
The Netherlands
Website: www.wolterskluwerlr.com

*Sold and distributed in North, Central and South America by:*
Wolters Kluwer Legal & Regulatory U.S.
7201 McKinney Circle
Frederick, MD 21704
United States of America
Email: customer.service@wolterskluwer.com

*Sold and distributed in all other countries by:*
Quadrant
Rockwood House
Haywards Heath
West Sussex
RH16 3DH
United Kingdom
Email: international-customerservice@wolterskluwer.com

*Printed on acid-free paper.*

ISBN 978-90-411-8730-7

e-Book: ISBN 978-90-411-8731-4
web-PDF: ISBN 978-90-411-8732-1



Printed in the United Kingdom.

# Environmental Hazards from Offshore Methane Hydrate Operations

## Energy and Environmental Law and Policy Series

VOLUME 32

*Editor*

General Editor: Professor Kurt Deketelaere, Professor of Law, University of Leuven, Belgium; Honorary Professor of Law, University of Dundee, UK; Honorary Chief of Staff, Flemish Government; Secretary-General, League of European Research Universities (LERU), Belgium. Kurt's CV – see www.kurtdeketelaere/en/kurt.

*Introduction*

Environmental protection and energy efficiency/security are important societal challenges. In order to tackle them, policy and legal frameworks are developed at national, regional and global level. Through study and best practices development, the challenges will prove to be solvable.

*Contents/Subjects*

Environment/Nature/Energy/Climate.

*Objective*

The aim of this series is to publish works of excellent quality that focus on the study of energy and environmental policy. Through this series the editors:

- contribute to the improvement of the quality of energy/environmental law and policy in general and environmental quality and energy efficiency in particular; increase the access to environmental and energy information for academics, non-governmental organizations, government institutions, and business; and
- facilitate cooperation between academic and non-academic communities in the field of energy and environmental law and policy throughout the world.

*Readership*

Academics and practitioners in environmental and energy matters.

*The titles published in this series are listed at the end of this volume.*

*To Bokhee and Benjamin, for all the reasons.*

# Preface

This book introduces the legal questions facing policymakers as they begin to address the challenges of offshore methane hydrates, perhaps one of the largest known potential sources of fresh water and energy in the world today. This book develops a theoretical foundation for a model regulatory framework for those challenges and then provides a comparative legal analysis of existing laws and conventions to determine their fitness for offshore methane hydrates related activities. The book includes two executive summaries, one focused on the model framework and the second on the policy recommendations on updating existing laws and conventions to become more robust.

While most readers are familiar with the traditional trio of hydrocarbons, that of coal, crude oil, and natural gas, few are aware of the fourth hydrocarbon, that of methane hydrates. Further, most are surprised to learn that these fiery bits of ice may be more common in nature than oil or gas. It is even more surprising to realize how little has been written about these hydrate resources in environmental law and energy law literatures. This book aims to fill that lacuna, enabling a broader cross-section of legal scholars to engage in this fascinating late-arrival to the natural resource policy arena.

The issues surrounding offshore methane hydrates should be exciting to policymakers. First, they present potential sources of energy and fresh water and may open new pathways to green energy. Furthermore, these resources are abundantly supplied in coastal areas around the globe, altering the geo-politics of energy supplies. However, there are certain novel harms and hazards presented by developing and producing offshore methane hydrates. Both cataclysmic, e.g. anthropogenic tsunami, and non-cataclysmic hazards, e.g. persistent ecological harms, must be integrated into policy planning prior to the onset of this new energy resource. Yet, these rewards and hazards have scarcely been addressed in the legal literature; thus, this book presents the first monograph treatment of the legal issues facing the future of offshore methane hydrates.

The study proceeds in four parts. The first part of the study provides an introduction to the scientific, engineering, and commercial characteristics of offshore

methane hydrate projects. It also provides reviews of both the potential benefits and the potential hazards of offshore methane hydrates.

The second part of the study provides a review of the law and economics theory of accident law as applied to environmental accidents. Rules of civil liability are reviewed to determine when strict liability or negligence might be efficiently employed in risk governance. Further, similar reviews are developed for public and private regulation. A scientific review of the circumstances of offshore methane hydrates finds that the optimal set of rules is a combination of a strict liability paradigm in complementary implementation of public regulations.

The third part examines existing laws and conventions to determine which might be applicable to offshore methane hydrates. The study also reviews if their risk governance strategies are in accordance with the recommendations from the second part of the study. It is found that most of the evaluated laws do follow a similar risk governance strategy of strict liability accompanied by public regulation, but that many of the current laws to address offshore oil and gas hazards would not interface with the particular circumstances of methane hydrates.

In the fourth part of the study, a summary of the three previous parts is presented and recommendations are made as how to update the existing legal frameworks to accommodate the onset of offshore methane hydrate development and production.

There are two executive summaries to be found in the book. Chapter 7 provides an executive summary of the model regulatory framework as supported by theoretical foundations drawn from the Law & Economics approach. The second, more practical, executive summary is contained in Chapter 12. That executive summary provides a road map to amending and revising existing laws and conventions so that policymakers can efficiently move forward to better ensure adequate environmental protections are in place.

It is hoped that this book will find an audience ready to learn about an important natural resource that has stunningly lain undiscovered during the industrial and post-industrial eras, a resource that could both deliver tremendous welfare benefits and bring calamitous harms. Its aims are to ignite policy debates and to bring more parties into the policy discussions that need to be undertaken.

If but one policy recommendation could be drawn out in advance of the book itself, it is that the deliberations to determine policy goals and standard-setting for offshore methane hydrates be undertaken in advance of their first licensing and development projects, and not in retrospect after an accident.

# List of Abbreviations

| | |
|---|---|
| AIST | Japan's National Institute of Advanced Industrial Science and Technology |
| ASEAN | Association of South East Asian Nations |
| B.C.E. | Before common era; Before Christ |
| BHP | Benthic Hazard Planning |
| BP | formerly British Petroleum, now just BP |
| btu | British Thermal Unit |
| C | Celsius degrees, when not in the form Cn |
| Cn | An alkane; *e.gs.* C1is methane and C4 is butane |
| CAA | Clean Air Act |
| CCS | Carbon capture systems/sequestration |
| CDM | Clean Development Mechanism |
| CH4 | Methane |
| CO2 | Carbon dioxide |
| CLC | Civil Liability Convention of 1969 |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CRISTAL | Contract Regarding an Interim Supplement to Tanker Liability for Oil Pollution |
| CWA | Clean Water Act |
| DARPA | The U.S.'s Defense Advanced Research Projects Agency |
| DOE | U.S. Department of Energy |
| EC | European Community |
| ECO2 | A proper name for an EU project to study offshore CCS injection |
| EEZ | Exclusive Economic Zone, from UNCLOS |

| | |
|---|---|
| EHR | Enhanced Hydrocarbon Recovery |
| EIA | Environmental Impact Assessment |
| EIA | The DOE's Energy Information Administration |
| ELD | Environmental Liability Directive of the EU |
| EMSA | European Maritime Safety Agency |
| ENAA | Japan's Engineering Advancement Association of Japan |
| EU | European Union |
| FID | Financial Investment Decision |
| GHDO | Korea's Gas Hydrate Research and Development Organization |
| GHG | Greenhouse gas, as defined under the Kyoto Protocol |
| GTL | Gas-to-Liquids technology |
| GTS | Gas-to-Solids technology |
| GWP | Global warming potential |
| H2O | Water |
| H2SO4 | Hydrogen sulfide |
| HSZ | Hydrate stability zone |
| IRCGH | The Indo-Russian Center for Gas Hydrates |
| ISA | International Seabed Authority |
| JMHEP | Japan Methane Hydrate Exploitation Program |
| JOGMEC | Japan's Oil, Gas and Metals National Corporation |
| KIGAM | Korea Institute of Geosciences and Mineral Resources |
| kJ | kilo-joule |
| KNOC | Korea National Oil Company |
| LNG | Liquefied Natural Gas |
| $m^3$ | cubic meter, a volumetric reference |
| MARPOL | International Convention for the Prevention of Pollution from Ships, from the concept of marine pollution |
| Mcf | Million cubic feet |
| MH21 | Japanese Research Consortium for Methane Hydrate Resources in Japan |
| MHHP | Methane Hydrate Hazard Planning |
| MMBtu | Million British Thermal Units |
| MOCIE | Korea's Ministry of Commerce, Industry, and Energy |
| NEPA | The U.S.'s National Environmental Protection Act |
| NGHP | India's National Gas Hydrate Program |
| NGL | Natural gas liquids, such as propane and butane |
| OCSLA | Outer Continental Shelf Lands Act |
| OPA | The U.S.'s Oil Pollution Act |

| | |
|---|---|
| OPRC | 1990 International Convention on Oil Pollution Preparedness, Response and Co-operation |
| OSPAR | The Convention for the Protection of the marine Environment of the North-East Atlantic (the "OSPAR Convention") |
| psia | Pounds per square inch absolute |
| RCRA | Resource Conservation and Recovery Act |
| SEA | Strategic Environment Assessment |
| sH | The most complex hydrate lattice |
| sI | The simple form of a methane hydrate lattice |
| sII | A methane hydrate lattice that can hold NGLs |
| SLP model | Shavell Landes Posner economic model of Tort Law |
| SUGAR | Submarine Gashydratlagerst_tten: Erkundung, Abbau und Transport |
| Tcf | Trillion cubic feet |
| Tcm | Trillion cubic meters |
| TOVALOP | Tanker Owners Voluntary Agreement Concerning Liability for Oil Pollution |
| UNCED | United Nations Conference on Environment and Development (1992) |
| UNCLOS | United Nations Convention on the Law of the Seas |
| UNFCCC | United Nation's Framework Convention on Climate Change |
| U.K. | The United Kingdom |
| U.S.A. | United States of America |
| USD | United States dollar |
| USGS | United States Geological Service |
| VAT | Value added tax |
| WFD | Water Framework Directive of the EU |

# List of Laws, Conventions, and Regulations

1. United Nations

   (i) 1982 United Nations Convention On The Law Of The Sea
   (ii) 2008 United Nations Convention On The Transboundary Effects Of Industrial Accidents
   (iii) United Nations Framework Convention On Climate Change
   (iv) The Kyoto Protocol To The UNFCCC
   (v) UNECE Convention On Access To Information, Public Participation In Decision-Making And Access To Justice In Environmental Matters
   (vi) UNECE Convention On Environmental Impact Assessment In A Transboundary Context
   (vii) Rio Declaration Of Principles

2. Regional Maritime Conventions

   (i) OSPAR Convention
   (ii) Convention For The Protection Of The Marine Environment And The Coastal Region Of The Mediterranean And Its Protocols. (Barcelona Convention.)
   (iii) Agreement For Cooperation In Dealing With Pollution Of The North Seas By Oil And Other Harmful Substances. (Bonn Agreement.)
   (iv) Convention On The Protection Of The Marine Environment Of The Baltic Sea Area, 1992. (Helsinki Convention).

3. International Oil Spill Conventions

   (i) International Convention For The Establishment Of An International Fund For Compensation For Oil Pollution Damage (Brussels, December 18, 2012)

(ii) International Convention On Civil Liability For Oil Pollution Damage (Brussels, November 29, 1969). (CLC)
(iii) The Tanker Owners' Voluntary Agreement Concerning Liability For Oil Pollution, (TOVALOP)
(iv) The Contract Regarding An Interim Supplement To Tanker Liability For Oil Pollution, (CRISTAL)
(v) International Convention For The Prevention Of Pollution From Ships, (MARPOL)
(vi) 1990 International Convention On Oil Pollution Preparedness, Response And Co-Operation, (OPRC)

4. European Union Directives

(i) Directive 2011/92/EU Of The European Parliament And Of The Council Of 13 December 2011 On The Assessment Of The Effects Of Certain Public And Private Projects On The Environment
(ii) Directive 2001/42/EC Of The European Parliament And Of The Council Of 27 June 2001 On The Assessment Of The Effects Of Certain Plans And Programmes On The Environment
(iii) Directive 2013/30/ EU Of The European Parliament And Of The Council Of 12 June 2013 On Safety Of Offshore Oil And Gas Operations And Amending Directive 2004/35/Ec
(iv) Directive 2009/31/ EC Of The European Parliament And Of The Council Of 23 April 2009 On The Geological Storage Of Carbon Dioxide And Amending Council Directive 85/337/ EEC, European Parliament And Council Directives 2000/60/ EC, 2001/80/ EC, 2004/35/ EC, 2006/12/ EC, 2008/1/ EC And Regulation (EC) No 1013/2006
(v) Directive 2008/56/ EC Of The European Parliament And Of The Council Of 17 June 2008 Establishing A Framework For Community Action In The Field Of Marine Environmental Policy (Marine Strategy Framework Directive)
(vi) Directive 2006/11/ EC Of The European Parliament And Of The Council Of 15 February 2006 On Pollution Caused By Certain Dangerous Substances Discharged Into The Aquatic Environment Of The Community
(vii) Directive 2000/60/ EC Of The European Parliament And Of The Council Of 23 October 2000 Establishing A Framework For Community Action In The Field Of Water Policy. (Water Framework Directive.)
(viii) Directive 2004/35/Ce Of The European Parliament And Of The Council Of 21 April 2004 On Environmental Liability With Regard To The Prevention And Remedying Of Environmental Damage. (ELD)
(ix) Directive 2009/147/ EC Of The European Parliament And Of The Council On The Conservation Of Wild Birds. (Birds Directive)

(x) Council Directive 92/43/EEC Of 21 May 1992 On The Conservation Of Natural Habitats And Of Wild Fauna And Flora (Habitats Directive)
(xi) Directive 2012/18/ EU Of The European Parliament And Of The Council Of 4 July 2012 On The Control Of Major-Accident Hazards Involving Dangerous Substances, Amending And Subsequently Repealing Council Directive 96/82/ EC Text With EEA Relevance (Seveso Iii)
(xii) Directive 2000/60/ EC Of The European Parliament And Of The Council Establishing A Framework For Community Action In The Field Of Water Policy

5. European Union Decisions

(i) 94/69/Ec: Council Decision Of 15 December 1993 Concerning The Conclusion Of The United Nations Framework Convention On Climate Change
(ii) 2002/358/EC: Council Decision Of 25 April 2002 Concerning The Approval, On Behalf Of The European Community, Of The Kyoto Protocol To The United Nations Framework Convention On Climate Change And The Joint Fulfilment Of Commitments Thereunder

6. United States

(i) National Environmental Protection Act (NEPA)
(ii) Oil Pollution Act (OPA)
(iii) National Oil And Hazardous Substances Pollution Contingency Plan
(iv) Clean Air Act (CAA)
(v) Clean Water Act (CWA)
(vi) Outer Continental Shelf Lands Act (OCSLA)
(vii) Methane Hydrate Research And Development Act (MHRDA)
(viii) International Convention Relating To Intervention On The High Seas In Cases Of Oil Pollution Casualties

# Table of Contents