

**PREVENTION AND COMPENSATION  
OF TRANS-BOUNDARY DAMAGE  
IN RELATION TO CROSS-BORDER  
OIL AND GAS PIPELINES**

**Mehdi PIRI DAMAGH**



intersentia

Cambridge – Antwerp - Portland

Intersentia Publishing Ltd.  
Trinity House | Cambridge Business Park | Cowley Road  
Cambridge | CB4 0WZ | United Kingdom  
Tel.: +44 1223 393 753 | Email: mail@intersentia.co.uk

*Distribution for the UK:*  
NBN International  
Airport Business Centre, 10 Thornbury Road  
Plymouth, PL6 7PP  
United Kingdom  
Tel.: +44 1752 202 301 | Fax: +44 1752 202 331  
Email: orders#nbninternational.com

*Distribution for the USA and Canada:*  
International Specialized Book Services  
920 NE 58th Ave. Suite 300  
Portland, OR 97213  
USA  
Tel.: +1 800 944 6190 (toll free)  
Email: info@isbs.com

*Distribution for Austria:*  
Neuer Wissenschaftlicher Verlag  
Argentinerstraße 42/6  
1040 Wien  
Austria  
Tel.: +43 1 535 61 03 24  
Email: office@nwv.at

*Distribution for other countries:*  
Intersentia Publishing nv  
Groenstraat 31  
2640 Mortsel  
Belgium  
Tel.: +32 3 680 15 50  
Email: mail@intersentia.be

The Energy & Law Series

The Energy & Law Series is published in parallel with the Dutch series Energie & Recht.

Members of the editorial committee are:

Prof.Dr. Martha M. Roggenkamp, University of Groningen and Simmons & Simmons, Rotterdam  
(editor in chief)

Prof.Dr. Kurt Deketelaere, Institute of Environmental and Energy Law, University of Leuven

Prof.Dr. Leigh Hancher, Allen & Overy, Amsterdam and Tilburg University, Tilburg and Council  
Member, WRR

Dr. Tom Vanden Borre, Chief Counsellor, Commission for the Regulation of Electricity and Gas  
(CREG) and University of Leuven

Prevention and Compensation of Trans-boundary Damage in Relation to Cross-Border  
Oil and Gas Pipelines

Mehdi Piri Damagh

© 2015 Intersentia  
Cambridge – Antwerp – Portland  
www.intersentia.com | www.intersentia.co.uk

Cover © bbbimages – Thinkstock

ISBN 978-1-78068-361-4.

D/2015/7849/149

NUR 828

British Library Cataloguing in Publication Data. A catalogue record for this book is available  
from the British Library.

No part of this book may be reproduced in any form, by print, photoprint, microfilm or any  
other means, without written permission from the publisher.

*To my wife and my daughter for their pure love and kindness.*

## ACKNOWLEDGEMENTS

I am very thankful to Allah for his countless blessings and mercy upon me.

This book is based on my PhD thesis. My PhD journey started in 2011 when Prof. Michael Faure quickly replied my email positively and informed me that I am eligible to start my PhD at Maastricht University and now after 4 years I've almost reached the end of this journey. Dear Michael, thanks for that. This journey could have not been completed without generous assistance of numerous individuals and institutions. I would like to thank them all for their support and encouragement. If I look back, my family gave me the courage to endure and carry on my PhD. My dearest Shadi, you have dedicated your life and your career to creating a safe and happy home for my family and enjoying the beautiful and delicious things that life has to offer us. There are no words for how much you are loved and appreciated. I would like to express my deepest gratitude to you. Dear Mom & Dad, thank you for raising me to be a strong, independent and hardworking man and encouraging me throughout my whole life. Without your love, support and care, this research would simply not have been accomplished.

My sweet angel Noora, you are the lightness of my life, definitely your birth within my PhD brought me abundant happiness and made my PhD much easier. You are the most beloved one!

I would like to express my profound gratitude to my supervisor Professor Michael Faure. His advice, encouragement and support have greatly helped me to conduct my PhD research. Michael was always kind and helpful throughout the whole process of my PhD. He is also a close friend of me. We had wonderful moments with him and his family.

My gratitude goes to the members of my assessment committee for reading my manuscript and for making valuable comments: Prof. mr. T. Hartlief (chairman), Prof. dr. L. Bergkamp, Prof. dr. G. Van Calster & Dr. N.J. Philipsen. Dear Niels, your insightful guidance, suggestions and comments always helped me greatly to improve my thesis. I also would like to thank Prof. Marjan Peeters for several inspiring discussions, guidance and feedback, particularly in Ius Commune Workshops. I am very grateful to Prof. Hildegard Schneider as the Dean of the Faculty of Law and Prof René de Groot for their support throughout my doctoral research.

I also would like to thank my colleagues in the Ius Commune Research School for their constructive and crucial comments provided on my research in Ius Commune workshops in Amsterdam, Utrecht, Leuven and Maastricht.

Many other people in and around the Faculty of Law supported me directly or indirectly and to whom I owe my sincere gratitude. I am really thankful for the METRO team: Yleen Simonis, Chantal Kuypers, Elke Hundhausen, Marina Jodogne and Marjo Mullers. Special thanks go to Graham Sedgley for proof reading of my manuscript. Also I am very grateful to Marina Jodogne for making the layout of this book. I also would like to thank Licette Poll who assisted me to deal with all administrative works in the faculty.

Many thanks also go to my colleagues at faculty of law: Chen Xiahong, Willem Loof, Frank Nellen, Kevine Kindji, Emma Dermawati, Catalina Goanta, William Bull, Mark Kawakami, Anna Berlee, Sachin Badkas, Tobias Heldt, Sarah Schoenmaekers, Thomas Biermeyer, Wenqing Liao, Taotao Yue, Huizhen Chen, Yu Xiaowei, Shen Guang and Liu Jing, for the great pleasure they brought me.

It is also a great pleasure for me to have many Iranian friends in and around Maastricht, accompanying me during my PhD. I would like to thank you all for all wonderful moments that we had together. I would especially like to thank: Hossein Rahmani and his wife Shayeste, Reza Rezayatmand and his wife Safoura, and their children, Hosna and Mehdi, Abbas Firoozabadi and his family, Ahmad Naderi and Elham Akbari Iman Rajabzade, Naser Davarzani, Iman Honarvar, Mohammad Khorashadi and his wife, Sohrab and Mitra, Ahmad & Somaye and many others.

Special thanks to Professor Mohamad Shamsaie, my advisor at my Allameh Tabatabai University. I also would like to thank Prof. Seyed Mohammad Mosavi for all his help and support. Finally, I must express my gratitude to my family, my brother Hamid Reza, who always is helpful and full of energy. I also would like to thank my father and my mother in law, my brothers in law, Alireza and Mohsen, and my sister in law Shima and their families for their support and help.

This thesis is the result of my PhD research at Maastricht University, Faculty of Law and is supported by the Iranian Ministry of Science, Research and Technology. I am sincerely grateful to them for giving me the wonderful opportunity to carry out this research.

# CONTENTS

Acknowledgements .....	vii
Abbreviations.....	xix
List of Tables and Maps .....	xxi

## **Chapter 1.**

<b>Introduction</b> .....	1
1. Background.....	1
2. Problem Definition and Research Questions.....	8
3. Terminology .....	12
4. Research Methodologies .....	13
5. Limitations.....	15
6. Structure .....	16

## PART I.

INTRODUCTORY ISSUES: PIPELINES, THE NATURE OF RISKS ASSOCIATED WITH PIPELINES AND THEIR REGULATORY REGIMES Introductory Note.....	23
-----------------------------------------------------------------------------------------------------------------------------------------	----

## **Chapter 2.**

<b>General Features of Cross-border Oil and Gas Pipelines – The Ground Rules</b> .....	25
1. Introduction .....	25
2. Technical Aspects of Natural Gas and Crude Oil Cross-border Pipelines. 27	
2.1. Function and Different Types of Pipelines .....	27
2.2. Substances of Cross-border Pipelines.....	29
2.2.1. Natural Gas.....	29
2.2.2. Crude Oil.....	31
2.3. Some Distinctions between Oil and Gas Pipelines .....	31
2.4. Types of Trans-boundary Pipelines.....	32
2.4.1. Onshore Pipelines .....	34

2.4.2. Offshore Pipelines.....	35
2.5. Development and Economics of Natural Gas and Crude Oil Pipelines .....	37
2.5.1. Global Natural Gas and Crude Oil Trade.....	37
2.6. The Economics of Cross-border Pipelines .....	39
2.7. Pipelines as Economic and Reliable Means for Transporting Natural Gas and Oil.....	41
2.7.1. A Comparison of Current Instruments for Transporting Natural Gas .....	43
2.7.2. A Comparison of Current Instruments for Transporting Oil .....	44
3. Stakeholders of Cross Border Pipelines.....	47
3.1. Operators and Investors.....	49
3.2. Governments.....	52
3.3. Affected Communities .....	54
4. Conclusion.....	56

### Chapter 3.

#### **Risks and Harm Related to Cross-border Pipelines .....**

1. Introduction .....	59
2. Risks Associated with Oil and Gas Pipelines .....	64
2.1. Natural Gas Pipeline Accidents.....	67
2.2. Oil Pipeline Accidents .....	72
3. Harm Related to Pipelines.....	79
3.1. Accidental Damage .....	82
3.1.1. Personal Injuries .....	82
3.1.1.1. The Factual Background .....	82
3.1.1.2. The Definition of Damage.....	84
3.1.1.3. The Geographical Scope of Damage .....	87
3.1.2. Environmental Damage.....	87
3.1.2.1. Air Pollution.....	91
3.1.2.1.1. The Factual Background .....	91
3.1.2.1.2. The Definition of Damage.....	92
3.1.2.1.3. The Geographical Scope of Damage .....	93
3.1.2.2. Marine Pollution .....	95
3.1.2.2.1. The Factual Background .....	95
3.1.2.2.2. The Definition of Damage.....	97
3.1.2.2.3. The Geographical Scope of Damage .....	102
3.1.2.3. Degradation of Land (Soil Pollution).....	103
3.1.2.3.1. The Factual Background .....	103
3.1.2.3.2. The Definition of Damage.....	105
3.1.2.3.3. The Geographical Scope of Damage .....	106

3.1.3. Property Damage and Economic Loss.....	106
3.1.3.1. The Factual Background .....	106
3.1.3.2. The Definition of Damage.....	109
3.1.3.2.1. Property Damage and Consequential Economic Loss .....	110
3.1.3.2.2. Pure Economic Loss .....	110
3.1.3.3. The Geographical Scope of Damage .....	114
3.2. Non-accidental Damage.....	115
3.2.1. Harm Related to the Marine Environment .....	116
3.2.2. Harm Related to the Degradation of Land.....	119
3.2.3. Air Pollution .....	120
4. Conclusion.....	122

#### Chapter 4.

<b>Cross-border Pipelines: The International Legal Regime.....</b>	<b>125</b>
1. Introduction .....	125
2. Cross-border Pipeline Agreements .....	129
2.1. Cross-Border Pipeline Ad hoc Agreements .....	130
2.1.1. The Interconnector Model .....	132
2.1.1.1. The Applicable Law on Safety and Environmental Regulations .....	133
2.1.1.2. The Applicable Law on Trans-boundary Damage ...	133
2.1.2. The Unified Model.....	134
2.1.2.1. The Applicable Law on Safety and Environmental Regulations .....	135
2.1.2.2. The Applicable Law on Trans-boundary Damage ...	138
2.1.3. Transit Pipelines .....	141
2.2. Cross-border Pipeline Framework Agreements .....	142
2.3. Conclusion .....	144
3. Treaty Provisions .....	146
3.1. The United Nations Convention on the Law of the Sea 1982 (UNCLOS).....	147
3.1.1. General .....	147
3.1.2. The Right to Lay Pipelines .....	147
3.1.3. The Applicable Law .....	149
3.1.4. Environmental Regulations.....	152
3.1.5. Trans-boundary Damage and Liability Rules .....	154
3.1.6. Conclusion.....	154
3.2. The Energy Charter Treaty.....	155



3.2.1. Article 19 ECT.....	156
3.2.2. Article 7 ECT.....	157
3.2.3. Model Agreements for Cross-border Pipelines .....	158
3.2.4. Conclusion.....	161
3.3. The Convention on Environmental Impact Assessment in a Trans- boundary Context (Espoo, 1991) .....	162
3.4. The UNECE Conventions .....	164
3.5. The UN Convention on the Law of the Non-navigational Uses of International Watercourses .....	167
3.6. The Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution.....	169
3.7. The Framework Convention for the Protection of the Marine Environment of the Caspian Sea (the Tehran Convention).....	170
3.8. Conclusion .....	172
4. The Work of the International Law Commission .....	173
4.1. The Draft Articles on the Prevention of Trans-boundary Harm from Hazardous Activities .....	174
4.2. The Draft Articles on State responsibility for Internationally Wrongful Acts.....	176
4.3. The ILC Draft Principles on the Allocation of Loss .....	178
5. Conclusion.....	179

PART II.  
PREVENTION OF CROSS-BORDER PIPELINE ACCIDENTS –  
MEANS AND SOURCES

Introductory Note.....	185
------------------------	-----

**Chapter 5.**  
**Technical, Safety and Environmental Regulations .....**

1. Introduction .....	189
2. Types of Standards .....	191
2.1. Technical Codes and Standards .....	194
2.1.1. Description .....	194
2.1.2. Examples and Sources.....	195
2.1.3. Safety Standards and Guidelines .....	200
2.1.3.1. Description.....	200
2.1.3.2. Examples and Sources .....	202
2.2. Environmental Standards and Regulation .....	205

2.2.1. Description .....	205
2.2.2. Examples and Sources.....	207
3. A Theory of Standard Setting.....	212
3.1. Public Regulation.....	213
3.2. Private Regulatory Model.....	216
3.3. Co-Regulation .....	218
3.4. Summary.....	221
4. A Critique and Alternative.....	221
4.1. Criteria Affecting the Optimal Regulatory Model .....	221
4.2. Effectiveness.....	222
4.3. Quality of the Regulation .....	225
4.4. Compliance and Monitoring.....	227
4.5. Legitimacy and Accountability.....	228
4.6. Summary.....	230
5. Concluding Remarks.....	230

**Chapter 6.**

**The Obligations to Prevent Trans-boundary Damage Caused by Cross-border Pipelines..... 233**

1. Introduction .....	233
2. The Obligations of States.....	235
2.1. The Treaty-based Obligations .....	235
2.1.1. The United Nations Convention on the Law of the Sea 1982 (UNCLOS).....	236
2.1.1.1. The Obligation to Prevent Trans-boundary Damage .....	237
2.1.1.2. The Obligation in Relation to Oil and Gas Pipelines.....	240
2.1.1.3. Conclusion .....	242
2.1.2. The Energy Charter Treaty (ECT).....	243
2.1.3. The Convention on Environmental Impact Assessment in a Trans-boundary Context (Espoo, 1991) .....	249
2.1.4. Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes (the UNECE Water Convention) .....	255
2.1.5. The UNECE Convention on the Trans-boundary Effects of Industrial Accidents .....	258
2.1.6. The Convention on the Law of the Non-Navigational Uses of International Watercourses .....	259
2.1.7. The Kuwait Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution .....	261

2.1.8. The Framework Convention for the Protection of the Marine Environment of the Caspian Sea.....	263
2.2. The ILC Draft Articles on Prevention of Trans-boundary Harm from Hazardous Activities .....	264
2.2.1. The Obligation not to Cause Trans-boundary Environmental Damage .....	266
2.2.1.1. The Substantive Implications.....	267
2.2.1.2. The Procedural Implications.....	269
2.2.2. Principle of Co-operation .....	271
2.2.3. Conclusion .....	273
3. The Obligations of the Investors and Operators.....	274
3.1. Investment-agreement Obligations.....	275
3.1.1. Contractual Provisions.....	276
3.1.2. The Domestic Law of the Host State or of Another State .....	277
3.1.3. International Law .....	278
3.2. Non-Investment Agreement Obligations .....	280
3.2.1. Financial Instruments.....	281
3.2.2. Voluntary Code of Conduct and Guidelines (direct standards).....	283
3.2.2.1. The OECD Guidelines.....	284
3.2.2.2. The UN Global Compact .....	285
3.3. Concluding Remark .....	286
4. Conclusion.....	286

## Chapter 7.

<b>An Evaluation of the Safety and Environmental Regulations of Cross-border Pipelines.....</b>	<b>289</b>
1. Introduction .....	289
2. Trans-boundary Damage .....	290
2.1. Trans-boundary Pollution Under the UNCLOS and Espoo Conventions.....	291
2.1.1. The Example of the Blue Stream Gas Pipeline .....	293
2.1.2. Lessons Learned .....	295
2.2. Trans-boundary Pollution Under The UNECE Conventions .....	297
2.3. Trans-boundary Damage Under the Customary and General Principles of International Law .....	298
3. Applicable Standards for Trans-boundary Pipelines.....	299
4. Concluding Remarks.....	306

PART III.	
STATE RESPONSIBILITY FOR TRANS-BOUNDARY DAMAGE CAUSED BY PIPELINES	
Introductory Note.....	313
<b>Chapter 8.</b>	
<b>The Origin of State Responsibility.....</b>	<b>319</b>
1. Introduction .....	319
2. State Responsibility v. State Liability.....	322
3. State Responsibility ( <i>liability ex delicto</i> ).....	323
3.1. Attribution to a State .....	325
3.2. Absolute or Due Diligence Obligations.....	327
3.3. Breach of an International Obligation: the Wrongfulness.....	330
4. State Liability ( <i>liability sine delicto</i> ) .....	332
5. State Residual Liability .....	337
5.1. The Standard of Liability .....	340
5.2. The Duty to Ensure Prompt and Adequate Compensation in National Jurisdiction .....	342
5.3. The Residual Character of the ILC Principles on the Allocation of Loss .....	345
6. Conclusion.....	346
<b>Chapter 9.</b>	
<b>Responsibility of States to Ensure Adequate Compensation for Trans- boundary Damage Caused by Oil and Gas Pipelines Laid under Their Jurisdiction and Control.....</b>	<b>349</b>
1. Introduction .....	349
2. The Characterization of the Lawful Operation of Pipelines.....	352
3. The Rules derived From the Treaty Law .....	353
3.1. The Energy Charter Treaty.....	353
3.2. The UNCLOS Convention .....	354
3.3. The UNECE Conventions (the Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes and the Convention on the Trans-boundary Effects of Industrial Accidents .....	356
3.4. Protocol on Civil Liability and Compensation for Damage Caused by the Trans-boundary Effects of Industrial Accidents on Trans- boundary Waters.....	357

3.5. The Convention on the Law of Non-Navigational Uses of International Watercourses (the Watercourse Convention) .....	363
3.6. The Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution (the Kuwait Convention) .....	364
3.7. The EU Environmental Liability Directive (ELD).....	365
4. The ILC Draft Principles on the Allocation of Loss .....	366
4.1. The Question of Attribution.....	367
4.2. The Standard of Liability .....	370
4.3. The Role of the Source State.....	372
4.4. The Exhaustion of the Local Remedy Rule.....	374
4.5. Conclusion.....	377
5. Concluding Remarks.....	378

## **Chapter 10.**

### **Responsibility of States for Trans-boundary Damage Caused by the Prohibited Operation of Oil and Gas Pipelines..... 381**

1. Introduction .....	381
2. The Unlawful Operation of Pipelines .....	383
3. Treaty Law.....	384
3.1. Responsibility of States under the Energy Charter Treaty (ECT)....	384
3.1.1. An Overview of the Primary Obligations.....	384
3.1.2. The State Responsibility for Non-fulfilment of Its Primary Obligations.....	384
3.2. State Responsibility under the UNCLOS Convention.....	386
3.2.1. An Overview of the Primary Obligations.....	386
3.2.2. The State Responsibility for Non-fulfilment of Its Primary Obligations.....	387
3.3. The Espoo Convention.....	390
3.3.1. An Overview of Primary Obligations .....	390
3.3.2. Non-binding Dispute Settlement Procedure for Non-fulfilment of Primary Obligations.....	390
3.3.3. The State Responsibility for Non-fulfilment of Its Primary Obligations.....	391
3.4. The UNECE Conventions (the Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes and the Convention on the Trans-boundary Effects of Industrial Accidents .....	392
3.4.1. An Overview of Primary Obligations.....	392
3.4.2. The State Responsibility for Non-fulfilment of its Primary Obligations.....	393

3.5. The Convention on the Law of Non-Navigational Uses of International Watercourses (the Watercourse Convention) .....	395
3.5.1. An Overview of the Primary Obligations.....	395
3.5.2. The State Responsibility for Non-fulfilment of Its Primary Obligations.....	396
3.6. Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution (the Kuwait Convention).....	397
3.6.1. An Overview of the Primary Obligations.....	397
3.6.2. The State Responsibility for Non-fulfilment of Its Primary Obligations.....	399
4. Responsibility of States for Damage Caused by the Unlawful Operation of Pipelines under the work of the International Law Commission .....	400
4.1. An Overview of Customary International Law Obligations.....	400
4.2. Attribution to States.....	403
4.3. The Breach of International Obligations .....	407
4.4. The Consequence of Breach of International Obligations .....	415
4.4.1. The Duty to Cease the Wrongful Act if It Is Continuing .....	416
4.4.2. The Duty to Offer Appropriate Assurances and Guarantees of Non-repetition.....	417
4.4.3. The Duty for Reparation .....	419
4.5. Conclusion.....	423
5. Concluding Remarks.....	423
<b>Chapter 11.</b>	
<b>Conclusion and Policy Recommendations.....</b>	<b>425</b>
1. Introduction .....	425
2. Concluding Remarks.....	426
2.1. Risks Associated with Pipelines .....	426
2.2. The Applicable Legal Regime.....	426
2.3. The Means and Sources Used to Prevent Cross-border Pipeline Accidents.....	428
2.4. The Effectiveness of the Current Legal Regime Applicable to Cross-border and Cross-country Pipelines in Preventing Trans-boundary Damage .....	428
2.5. States Responsibility for Trans-boundary Damage Caused by Pipelines .....	430
3. Policy Recommendations .....	432
4. Limits and Further Research .....	434

| Contents

*Summary*..... 437  
*Bibliography*..... 441  
*Valorisation Addendum*..... 475  
*Curriculum Vitae*..... 481

## ABBREVIATIONS

ARSIWA	Draft articles on Responsibility of States for Internationally Wrongful Acts
Bcm	Billion Cubic Meters
Bcm/y	Billion Cubic Meters per year
Bbl/d	Barrels per day
CNG	Compressed Natural Gas
Dwt	Deadweight Metric Tons
ECT	Energy Charter Treaty
GJ	Gigajoules
GtL	Gas to Liquids
GtW	Gas to Wire
ICJ	International Court of Justice
ILC	International Law Commission
LNG	Liquefied Natural Gas
Mb/d (Mbbbl/d)	Million Barrels per day
MBtu	Million British Thermal Units
Mcm/d	Million Cubic Meters per day
Mm <sup>3</sup> /day	Million Cubic Meters per day
MMcf/d	Million cubic feet per day
MNC	Multinational Corporation
MPa	Mega Pascal
Mt/y	Million Metric Tons per year
MW	Megawatts
NGH	Natural Gas to Solid
Psig	Pound/square inch lb/in
Sm <sup>3</sup>	Cubic Meters per second
STP	Standard Temperature
TCF	Trillion Cubic feet
UNECE	United Nation Economic Commission for Europe



## LIST OF TABLES AND MAPS

Table 1. The Yearly Consumption of Natural Gas and Crude Oil from 2000 to 2010 in the World .....	38
Table 2. A Short List of Countries Which Have the Largest Conventional Natural Gas and Crude Oil Proven Reserves in the World Based on the BP Statistical Review of World Energy 2012 .....	38
Table 3. A Short List of Countries Which Have the Largest Production of the Conventional Natural Gas and Crude Oil in the World Based on the BP Statistical Review of World Energy 2012 .....	39
Table 4. Total Export of Natural Gas in 2010 .....	44
Table 5. Examples of Recent Trans-boundary Pipelines (under Construction) .....	46
Table 6. Comparative Data About Oil and Gas Pipeline Accidents in the US, Europe, and a Severe Accidents Category .....	67
Table 7. Recent Examples of Cross-border Gas Pipeline Accidents.....	70
Table 8. Recent Examples of Cross-border Oil Pipeline Accidents.....	75
Table 9. Hazardous Liquid Pipeline Accident Summary by Cause in the US.....	77
Table 10. Summarizing the Key Characteristics of the International Legal Regime Related to Cross-border Pipelines .....	181
Table 11. Typical Maximum Design Factors for Transmission Pipelines .....	196
Table 12. Key Finding with Respect to Effectiveness of Safety and Environmental Regulations of Cross-Border Pipelines in Preventing Trans-boundary Damage.....	299
Table 13. Key Finding with Respect Applicable Safety and Environmental Regulations of Cross-Border Pipelines .....	309
Table 14. Possible Scenarios for the Breach of International Obligations of a State to Prevent Trans-boundary Damage.....	408
Map 1. Pan-European Cross-country and Cross-border Oil and Gas Pipelines .....	33
Map 2. Druzhba Crude Oil Pipeline .....	35
Map 3. North Stream Gas Pipeline .....	36