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Towards More Effective Environmental Risk Regulation

An Analysis of Complementary Effects between Administrative Environmental Law and Tort Law in the Regulation of Environmental Risks, with a Specific Focus on Chemical Mining Activities in the Deep Subsoil

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Abstract

The precautionary and prevention principles require that environmental risks should timely and adequately be regulated before potentially harmful activities are undertaken. The system of administrative environmental law provides ample

instruments for such regulation. However, scientific uncertainties about environmental risks could complicate the formulation and implementation of effective environmental risk management strategies. This could lead to systemic imperfections and regulatory gaps which, in turn, undermine the system's effectiveness and increase the need for regulatory 'back-ups'. The system of private law is often seen as a potential back-up. In analyzing the complementary effects between both systems and using environmental risks of chemical mining activities in the (deep) subsoil as an example, this article concludes that the actual regulatory effect of tort law should not be overestimated. The complementary role of tort law in regulating environmental risks is mostly limited to the specification and on some occasions enforcement of environmental responsibilities.

Keywords

environmental risk regulation – effectiveness – administrative environmental law – tort law – chemical mining activities

1 Introduction

Industrial activities are often associated with environmental risks. For instance, chemical mining activities in the deep subsoil can lead to ground water and soil contamination and ultimately cause environmental degradation.[1] Apart from potential adverse effects on nature and human health, this can lead to problems regarding the availability of clean and safe drinking water sources for current and future generations.[2] The common opinion based

1 Under 'chemical mining activities', in this article, we understand conventional and unconventional activities in the (deep) subsoil in which chemical substances are used for the extraction of fossil fuels and potentially other mining products. Such activities fall primarily within the scope of mining regulations. Under '(deep) subsoil' we understand those layers of the soil that contain or consist of fossilized organic or mineral substances that can only be extracted by mining activities. Under 'ground water', this article understands water that is present below the surface in a saturated zone and that is in direct contact with the soil or subsoil.

2 A.H. Faber, et al. 'Chemical and bioassay assessment of waters related to hydraulic fracturing at a tight gas production site', *Science of The Total Environment* 690 (2019), p. 636–646; A.H. Faber et al. 'How to Adapt Chemical Risk Assessment for Unconventional Hydrocarbon Extraction Related to the Water System', in: P. de Voogt (ed.), *Reviews of Environmental Contamination and Toxicology*, New York: Springer 2019; Butkovskyi et al. 'Organic Pollutants in Shale Gas Flowback and Produced Waters: Identification, Potential Ecological Impact, and Implications for Treatment Strategies', *Environmental Science and Technology* 2017, 51/9, p. 4740–4754.

on the precautionary and prevention principles is that environmental risks should timely and adequately be regulated *before* even allowing potentially harmful activities to take place.[3] The system of administrative environmental law provides a multitude of instruments for such regulation through the implementation of different risk management strategies.[4] However, scientific uncertainties about environmental effects and risks and the rapid development of chemical mining techniques could complicate the formulation and implementation of effective environmental risk management strategies.[5] This could lead to systemic imperfections and regulatory gaps which, in turn, undermine the system's effectiveness and increase the need for and the dependence on 'back-ups' or 'safety nets'.

The system of private law is often mentioned and embraced as a potential back-up, particularly after the famous Dutch *Urgenda*-case.[6] Yet, it is unclear for which types of system deficiencies tort law could function as such and how it could contribute to the overall effectiveness of environmental risk regulation. Therefore, this article analyzes the interactions and potential synergies between the systems of administrative environmental law and tort law in the regulation of environmental risks of chemical mining activities. This examination is carried out through a structured analysis of the functions and characteristics, as well as the strengths and weaknesses of both systems of law.[7]

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3 This follows from EU law in general and EU environmental law, see J.H. Jans & H.H.B. Vedder, *European Environmental Law after Lisbon*, Groningen: Europa Law Publishing 2012; G. van Calster & L. Reins, *EU Environmental Law*, Cheltenham: Edgar Elgar Publishing 2017; and for a focus on (drinking) water protection: H.F.M.W. van Rijswick & H.J.M. Havekes, *European and Dutch water law*, Amsterdam: Europa Law Publishing 2012; and for a focus on shale gas: L. Reins, *Regulating shale gas: the challenge of coherent environmental and energy regulation*, Cheltenham: Edgar Elgar Publishing 2017; A. Vos, *Shale gas extraction: In line with the general (environmental) principles of Union and Dutch law?*, Utrecht: Utrecht University 2014.

4 J.H. Jans & H.H.B. Vedder, *European Environmental Law after Lisbon*, Groningen: Europa Law Publishing 2012; G. van Calster & L. Reins, *EU Environmental Law*, Cheltenham: Edgar Elgar Publishing 2017.

5 See in general about these issues *Late Lessons From Early Warnings* (EEA Report No 1/2013, ISSN 1725-9177), Copenhagen: EEA 2013.

6 Squintani, 'Addressing the (Lack of) Effectiveness of Environmental Law and the Gap between Law in the Books and Law in Action', *Journal For European Environmental & Planning Law*, 17/2, p. 133–135. See also: Van Rijswick, Key note EELF Conference 2018: 'Shi(f)t happens, but failure is no option: Changes in the legal approach toward sustainability', Conference presentation Environmental loss & damage: attribution, liability, compensation and restoration Como (12-09-2018).

7 H.A.C. Runhaar et al., 'Prepared for climate change? A method for the ex-ante assessment of formal responsibilities for climate adaptation in specific sectors.' *Regional Environmental Change*, 2016, Issue 5, p. 1389–1400; H.K. Gilissen et al., 'The Climate Resilience of Critical

The results of this analysis can be helpful to law and policymakers in drafting strategic policies and decisions about managing and regulating environmental risks. In this paper we use environmental risks of chemical mining activities in the (deep) subsoil, such as shale gas extraction, as an example. The results of this analysis, however, can also be useful in the context of regulating other potentially risky activities in the (deep) subsoil, such as carbon storage, geothermal energy production, salt extraction, and storage of (radioactive) waste, and even for regulating environmental risks more in general.

In section 2, an overview and characterization is given of potential environmental risks, and the level of scientific knowledge about these risks, that might be present during the different phases of chemical mining activities. In section 3 distinct environmental risk management strategies that can be at the basis of systems of environmental risk regulation are briefly discussed. Focusing on environmental risk regulation, sections 4 and 5 examine the strengths and weaknesses of the systems of administrative environmental law (section 4) and tort law (section 5) in adequately and effectively implementing distinct risk management strategies. In the concluding section 6, the results of this analysis are slid together and discussed in order to identify potential synergies and deficiencies in the regulation of environmental risks of chemical mining activities.

2 Environmental Risks of Chemical Mining Activities

In chemical mining activities, the exploration phase and exploitation phase can be distinguished. Several stages can be discerned during these phases.[8] At first, a well is drilled, a process in which drilling fluids are used. When fracking activities are included to stimulate the wells when the oil or gas occurs in a very dense layer, horizontal drills are made with fracks extending from these drills. In order to do this, fracking fluids are mixed and used during the horizontal fracking, under high pressure and temperature conditions.[9] Then,

Infrastructural Network Sectors – An interdisciplinary method for assessing formal responsibilities for climate adaptation in critical infrastructural network sectors.', in: S. Maljean-Dubois (Eds.), *The Effectiveness of Environmental Law*, Antwerp: Intersentia 2017, p. 15–36.

8 M. Annevelink, J.A.J. Meesters & J. Hendriks, 'Environmental contamination due to shale gas development', *SCI TOTAL ENVIRON* 2016, Issue 550, p. 431–438.

9 J.J. Marrugo-Hernandez et al., 'Downhole chemical degradation of corrosion inhibitors commonly used in shale gas fracturing and stimulation', *J. Na Gas Sci. Eng.* 2019; A.J. Sumner & D.L. Plata, 'Exploring the hydraulic fracturing parameter space: A novel high-pressure,

flowback and produced water are collected aboveground. Oil and gas are separated from the produced water, and the remaining wastewater can be treated or used as ingredient during new fracks.[10] Finally, after the production phase the well is abandoned according to local requirements.

During all these phases, environmental risks may occur, such as contamination of surrounding groundwater, surface water or air. Proper wastewater management is considered crucial to diminish these risks.[11] Moreover, as far as possible, ensuring that accidental spills do not occur is essential to control risk. These spills may occur in the subsoil via leaks because of structure integrity problems such as insufficient cementing of the wells, but they can also be a result of human errors. Very incidentally blowouts can occur. In these rare cases the spill volumes are immense and effects can be seen for decades.[12] Lastly, abandoned wells can incidentally leak, which could be overlooked if no subsurface measurements are performed.[13]

Chemicals being used in the drilling fluid include anti-corrosives, biocides, gels and crosslinkers, friction reducers, breakers, pH adjusters, acids, iron controllers, clay stabilizers and surfactants.[14] Faber et al. (2019) made an inventory of all chemicals as mentioned in literature and fracking-related databases, summing up to nearly 1400 different chemicals. Many of these are not monitored, nor routinely, neither in shale-specific studies. Of these chemicals, the authors found that only 44% is regulated under the EU REACH legislation.[15] For the REACH registered chemicals, basic and general

high-throughput reactor system for investigating subsurface chemical transformations', *ENVIRON SCI-PROC IMP* 2018, Issue 2, p. 318–331.

10 Butkovskyi et al., 'Removal of organic compounds from shale gas flowback water', *Water Res* 2018, p. 47–55.

11 A.H. Faber et al., 'How to Adapt Chemical Risk Assessment for Unconventional Hydrocarbon Extraction Related to the Water System', in: P. de Voogt (ed.), *Reviews of Environmental Contamination and Toxicology*, New York: Springer 2019; Butkovskyi et al. 'Removal of organic compounds from shale gas flowback water', *Water Res* 2018, p. 47–55.

12 Schout et al., 'Impact of an historic underground gas well blowout on the current methane chemistry in a shallow groundwater system', *PNAS USA* 2017, Issue 2, p. 296–301.

13 Schout et al., 'Occurrence and fate of methane leakage from cut and buried abandoned gas wells in the Netherlands', *SCI TOTAL ENVIRON* 2019, p. 773–782.

14 M. Annevelink, J.A.J. Meesters & J. Hendriks. 'Environmental contamination due to shale gas development', *SCI TOTAL ENVIRON* 2016, Issue 550, p. 431–438; Butkovskyi et al., 'Organic Pollutants in Shale Gas Flowback and Produced Waters: Identification, Potential Ecological Impact, and Implications for Treatment Strategies', *Environmental Science and Technology* 2017, 51/9.

15 A.H. Faber et al., 'How to Adapt Chemical Risk Assessment for Unconventional Hydrocarbon Extraction Related to the Water System', in: P. de Voogt (ed.), *Reviews of Environmental Contamination and Toxicology*, New York: Springer 2019.

information on toxicity and environmental fate is available in the mandatory dossiers. However, despite the fact that REACH is a regulation, so there is no need for transposition in national law, there is insufficient knowledge available at authorities responsible for regulating and enforcing chemical mining activities about REACH and the regulated and unregulated chemicals The level of detail in the dossiers depends on EU production and used volumes, and the risk assessment is not specified towards scenarios that include chemical mining activities. For the non-registered chemicals, toxicological information might be available in databases but often this will not be the case. Then assessment of the hazardous properties of the chemicals will be based on more generic conservative assumptions, such as the concept of Toxicological Threshold of Concern (TTC).[16]

3 Environmental Risk Management Strategies

In literature *risks* are commonly addressed as the *probability* that adverse *consequences* will materialize.[17] Also, a distinction is made between several risk management strategies;[18] risks can be managed/reduced by avoiding a risk as such (i.e. by not using hazardous chemicals or by avoiding exposure), by reducing the probability that a risk occurs, and/or by mitigating its adverse effects.[19] Such avoiding, preventive or mitigative strategies are commonly characterized as *proactive* in a sense that measures are implemented in anticipation of a risk to occur with the explicit aim to reduce that risk. These are to be distinguished from *reactive* approaches, aiming at restoration or compensation of any damage that results from the occurrence of a risk.[20]

16 Kroes. R., Kleiner. J. & Renwick. A.G., 'The Threshold of Toxicological Concern Concept in Risk Assessment', *ToxSci* 2005, Issue 2, p. 226–230.

17 C.J. van Leeuwen & T.G. Vermeire (eds.), *Risk Assessment of Chemicals: An Introduction*, Dordrecht: Springer 2007; G.W. Suter, *Ecological Risk Assessment*, Boca Raton: CRC Press 2006.

18 P.P.J. Driessen et al., 'Toward more resilient flood risk governance', *Ecology and Society* 2016, Issue 4; H.K. Gilissen et al., 'A framework for evaluating the effectiveness of flood emergency management systems in Europe', *Ecol. and Soc.* 2016, Issue 4.

19 C.J. van Leeuwen & T.G. Vermeire (eds.), *Risk Assessment of Chemicals: An Introduction*, Dordrecht: Springer 2007; G.W. Suter, *Ecological Risk Assessment*, Boca Raton: CRC Press 2006.

20 H.A.C. Runhaar et al., 'Prepared for climate change? A method for the ex-ante assessment of formal responsibilities for climate adaptation in specific sectors.', *Regional Environmental Change*, 2016, Issue 5, p. 1389–1400; H.K. Gilissen et al. 'The Climate Resilience of Critical Infrastructural Network Sectors – An interdisciplinary method for assessing formal

Key questions in the process of determining the required risk management, relate to the determination of environmental objectives and subsequently whether and how to regulate risky activities in order to pursue these goals. Article 191 of the Treaty on the Functioning of the European Union (TFEU) provides the relevant framework for policymakers in this respect. On the basis thereof EU environmental policy shall contribute to the preservation, protection and improvement of the quality of the environment, the protection of human health and the prudent and rational utilization of natural resources (Section 1). Environmental policies moreover shall aim at a high level of protection, while based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay (Section 2).[21] And indeed, these objectives and principles are found at the basis of many relevant Directives, Regulations – including REACH – and EU policy documents, and in turn of many Member States' provisions implementing those.[22]

Nonetheless, at the EU and Member States' domestic levels many risky activities still, be it intentionally or unintentionally, remain unregulated. There can be sound reasons for not or not exhaustively regulating specific activities, but it can also be the result of delays or obstructions in regulatory processes (such as registration under REACH), lacking risk awareness, or uncertainty or a lack of knowledge about the involved risks. Regardless of any underlying reasons, the absence of tailored risk management regulation, more in particular the legal implementation of specified proactive risk management strategies, can result into a passive and merely *re*active attitude ('wait and see') towards environmental risks. This is particularly troubling when environmental damage can be irreversible and unrecoverable, which leaves financial or in kind compensation as a potentially unsatisfactory last resort.

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responsibilities for climate adaptation in critical infrastructural network sectors.', in: S. Maljean-Dubois (Eds.), *The Effectiveness of Environmental Law*, Antwerp: Intersentia 2017, p. 15–36.

21 J.H. Jans & H.H.B. Vedder, *European Environmental Law after Lisbon*, Groningen: Europa Law Publishing 2012; A. Vos, *Shale gas extraction: In line with the general* (*environmental*) *principles of Union and Dutch law?*, Utrecht: Utrecht University 2014.

22 See for example the Water Framework Directive (EC) 2000/60, the Groundwater Directive (EC) 2006/118 and Regulation (EC) 1907/2006 (REACH). REACH requires higher assessment factors in case of uncertainty, which reflects the precautionary principle. The polluter pays principle is reflected in the requirement that the applicant is responsible for the dossier.

4 Environmental Risk Regulation: Administrative Environmental Law

4.1 *Introduction*

Environmental risk management strategies can first and foremost be implemented in the system of administrative (EU and national) environmental law.[23] Although underexposed in the literature in this field, there is broad consensus that a key function of environmental law is the regulation of environmental risks through influencing the conduct of and determining the relations between relevant actors, thus creating a legal framework for environmental risk management.[24] It does so within a *substantive,* an *institutional*, an *instrumental* and a *safeguarding* dimension (section 4.2).[25] This distinction serves analytical purposes and is particularly helpful for identifying and categorizing indicators for legal effectiveness and legitimacy of environmental law (section 4.3).[26] On the basis thereof, specific strengths and weaknesses of subsystems of environmental law can be identified (section 4.4), which in turn provides useful information for the further analysis of the additional role of liability law (and/or other systems of law) in regulating specific environmental risks, such as those potentially resulting from chemical mining activities.

4.2 *Functions of Administrative Environmental Law: Four Dimensions*

The *institutional* and *substantive* dimensions cover the designation of responsible actors and the creation, division and demarcation of legal responsibilities for the pursuit of predetermined environmental objectives. In other words: *who* is *to what extent* responsible for *what* in relation to *whom*? Environmental objectives are mostly formulated in more or less abstract wordings and occasionally concretized in quantified environmental quality standards or emission limit values.[27] Responsibilities lay down the required behavior of relevant actors in order to achieve these environmental objectives.

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23 M.V.C. Aalders & R. Uylenburg (eds.), *Het milieurecht als proeftuin; 20 jaar Centrum voor Milieurecht*. Amsterdam: Europa law Publishing 2007. For this paper the following legislation is particular relevant: the REACH Regulation, the EIA Directive, the Water Framework Directive, the Mining Waste Directive, the Hydrocarbons Directive, the Seveso III Directive, the Habitats and Birds Directive and the Environmental Liability Directive.

24 M. Peeters & R. Uylenburg (eds.), *EU Environmental Legislation. Legal Perspectives on Regulatory Strategies*, Northampton: EE Publishing 2014.

25 This distinction should not be taken too strictly and mainly serves academic purposes, as in fact these dimensions overlap, cohere and interrelate.

26 S. Maljean-Dubois, 'The effectiveness of environmental law: a key topic', in: *The effectiveness of Environmental Law*, Antwerp: Intersentia, 2017.

27 See for example J.H. Jans & H.H.B. Vedder, *European Environmental Law after Lisbon*, Groningen: Europa Law Publishing 2012; G. van Calster & L. Reins, *EU Environmental*

The *instrumental* dimension covers the creation, division and demarcation of competences and instruments that can be used in meeting environmental objectives: *how*, by what means, can or should the one responsible fulfil his responsibilities? There is an obvious and inseparable connection between competences and responsibilities, as responsibilities could hardly be fulfilled without suited and effective competences and (legal) instruments. Regarding the richness of types of responsibilities, a multitude of (policy) instruments could be listed, such as programming and planning instruments, generally applicable rules of conduct, guidelines, instructions, licenses, concessions, market-based instruments, labeling and certification, assessment and monitoring obligations, and supervisory and enforcement instruments (e.g. penalties, administrative coercion, withdrawal of permits, fines).[28]

The – probably most complex and ambiguous – *safeguarding* dimension determines the role of (external) interests and values in the pursuit of environmental objectives: *how*, by what means, can it be ensured that specific public or individual interests or values are properly taken into account and are not unnecessarily harmed? This dimension closely relates to (legal) notions, such as fairness, equality, legality, legitimacy, public participation/consultation, access to justice and independent and impartial judicial review.[29] For the purpose of this article, we mainly focus on the substantive, institutional and instrumental dimensions The dimensions and their key functions are presented in Table 5.1.

4.3 *Indicators for Legal Effectiveness*

The question is how the abovementioned substantive, institutional and instrumental dimensions and the accompanying functions can be achieved through legal mechanisms. The answer to this question is key in understanding the extent to which a specific environmental risk is effectively regulated. Indicators for (expected) effectiveness can be derived from the dimensions of

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Law, Cheltenham: Edgar Elgar Publishing 2017; H.F.M.W. van Rijswick & H.J.M. Havekes, *European and Dutch water law*, Amsterdam: Europa Law Publishing 2012; L. Reins, *Regulating shale gas: the challenge of coherent environmental and energy regulation*, Cheltenham: Edgar Elgar Publishing 2017.

28 See J.H. Jans & H.H.B. Vedder, *European Environmental Law after Lisbon*, Groningen: Europa Law Publishing 2012; G. van Calster & L. Reins, *EU Environmental Law*, Cheltenham: Edgar Elgar Publishing 2017; H.F.M.W. van Rijswick & H.J.M. Havekes, *European and Dutch water law*, Amsterdam: Europa Law Publishing 2012; L. Reins, *Regulating shale gas: the challenge of coherent environmental and energy regulation*, Cheltenham: Edgar Elgar Publishing 2017.

29 M. Ambrus, H.K. Gilissen & J.J.H. van Kempen, 'Public Values in Water Law: A Case of Substantive Fragmentation?', *Utrecht Law Review* 2014, Issue 2, p. 8–30.

TABLE 5.1 Dimensions and functions of administrative environmental law

Dimension	Function
Substantive (what?)	Creation and demarcation of legal responsibilities for the pursuit of predetermined environmental objectives and other goals
Institutional (who?)	Designation of responsible actors and division of legal environmental responsibilities
Instrumental (how?)	Creation and division of instruments and competences, suited to fulfil legal environmental responsibilities
Safeguarding (how?)	Development of preconditions and instruments to ensure that specific public or individual interests or values are properly taken into account and are not unnecessarily harmed

environmental law as presented above, whereby 'effectiveness' is to be understood as the extent to which a given system of environmental law (as a cohesive set of legal provisions) is likely to contribute to the factual reduction of environmental risks to acceptable levels.[30] Revisiting the questions posed above can be helpful in this respect: who is to what extent responsible for what in relation to whom, and how, by what means, can or should the one responsible (strive to) fulfil his responsibilities? This question has three facets, namely the objectives/responsibilities as such (what?), the division thereof (who?), and the fulfilment thereof (how?).[31] Any unclarities or deficiencies at these points could be detrimental to the effectiveness of a subsystem of environmental law in optimally reducing specified environmental risks. So – roughly – the more a responsibility is unclear, the more it is unclear who is responsible, or the more

30 H.A.C. Runhaar et. al., 'Prepared for climate change? A method for the ex-ante assessment of formal responsibilities for climate adaptation in specific sectors.', *Regional Environmental Change*, 2016, Issue 5, p. 1389–1400; H.K. Gilissen et al., 'The Climate Resilience of Critical Infrastructural Network Sectors – An interdisciplinary method for assessing formal responsibilities for climate adaptation in critical infrastructural network sectors.', in: S. Maljean-Dubois (Eds.), *The Effectiveness of Environmental Law*, Antwerp: Intersentia 2017, p. 15–36; S. Wuijts, P.P.J. Driessen & H.F.M.W. van Rijswick. 'Towards More Effective Water Quality Governance – A Review of Social-Economic, Legal and Ecological Perspectives and Their Interactions', *Sustainability* 2018, issue 4; S. Maljean-Dubois, 'The effectiveness of environmental law: a key topic', in: *The effectiveness of Environmental Law*, Antwerp: Intersentia, 2017.

31 As mentioned before, the safeguarding dimension in this article is excluded from further analysis.

the one responsible lacks proper instruments or resources to fulfil his responsibility, the less it is likely that environmental risks will be reduced to acceptable levels. Marking potential weaknesses of subsystems of environmental law, this is where other legal systems such as tort law can play an additional or reparative role.[32] The role of tort law will be further discussed in section 5. Below, per dimension a number of relevant (strongly interrelated) indicators for legal effectiveness is discussed in further detail. In order to operationalize these indicators, a benchmark system is presented in Tables 5.2, 5.3 and 5.4.

4.3.1 Substantive Dimension: What?

Objectives and responsibilities should be *clear*, *comprehensive*, *feasible* and *enforceable.*

They should make *clear* what is and can be expected from the ones on which these have been imposed, and they should cover all relevant aspects and characteristics of the environmental risk for the reduction of which they have been created. First, this means that responsibilities as well as their underlying environmental objectives, should substantively be formulated as *unambiguously* and *explicitly* as possible.[33] This seems obvious, but is often not the case. Moreover, the *legal character* of the responsibility should be clear: is it an obligation of result or of best effort, and what does this imply?[34] Unclear objectives, standards and responsibilities will leave room for interpretation, which can lead to discussion about their scope and purpose and to poor compliance.[35]

Comprehensiveness relates to the extent to which all relevant aspects and characteristics of an environmental risk are covered. This means that all

32 H.K. Gilissen, *Adaptatie aan klimaatverandering in het Nederlandse waterbeheer – Verantwoordelijkheden en aansprakelijkheid* (diss. Utrecht), Deventer: Wolters Kluwer 2013.

33 H.K. Gilissen et al., 'The Climate Resilience of Critical Infrastructural Network Sectors – An interdisciplinary method for assessing formal responsibilities for climate adaptation in critical infrastructural network sectors.', in: S. Maljean-Dubois (Eds.), *The Effectiveness of Environmental Law*, Antwerp: Intersentia 2017, p. 15–36.

34 J. van Kempen, 'Obligations of the Water Framework Directive: Dealing With Problems of Interpretation', in: M. Peeters & R. Uylenburg (Eds.), *EU Environmental Legislation: Legal Perspectives on Regulatory Strategies*, London: Edward Elgar Publishing 2014, p. 146–172.

35 H.A.C. Runhaar et. al., 'Prepared for climate change? A method for the ex-ante assessment of formal responsibilities for climate adaptation in specific sectors.', *Regional Environmental Change*, 2016, Issue 5, p. 1389–1400; H.K. Gilissen et al., 'The Climate Resilience of Critical Infrastructural Network Sectors – An interdisciplinary method for assessing formal responsibilities for climate adaptation in critical infrastructural network sectors.', in: S. Maljean-Dubois (Eds.), *The Effectiveness of Environmental Law*, Antwerp: Intersentia 2017, p. 15–36.

TABLE 5.2 Indicators and benchmarks for assessing expected effectiveness (substantive dimension)

Indicator	Benchmarks
Clear	Unambiguously formulated goals and responsibilities (high) – Much room for interpretation (low)
Comprehensive	All aspects of risk are covered (high) – Overlap, contradiction and/or gaps (low)
Feasible	Realistic goals (high) – Too ambitious goals (low)
Enforceable	Objectively determinable whether/when goals have been met (high) – Uncertainty whether goals have been or can be met (low)

TABLE 5.3 Indicators and benchmarks for assessing expected effectiveness (institutional dimension)

Indicator	Benchmarks
Subsidiarity	Suited and competent actor at an appropriate institutional level (context-specific) (high) – Incompetent actor, lacking influence, decisiveness or power to achieve environmental goals (low)
Interconnectedness	Effective communication, coordination and/or cooperation mechanisms (high) – No communication, coordination and/or cooperation structures (low)

TABLE 5.4 Indicator and benchmarks for assessing expected effectiveness (instrumental dimension)

Indicator	Benchmarks
Practicability	Actor has relevant knowledge, and sufficient powers, competences, instruments and resources (high) – Actor lacks knowledge, powers, competences, instruments and/or resources (low)

relevant aspects of risk reduction are captured in (transparent) objectives and responsibilities, which do not unnecessarily and obstructively overlap, contradict or leave gaps.[36] If only part of the potentially risky activities that are deployed in a production or extraction process or part of the potentially harmful substances used in such a process are regulated, the expected effectiveness of the system of risk reduction can be considered limited. Nonetheless, if an environmental risk is not explicitly or only partly regulated, than only could be fallen back on more generally applicable environmental regulations such as a general duty of care and principles, which inherently leave more room for interpretation.

Lastly, environmental objectives and responsibilities should be *feasible and enforceable*. Unfeasible objectives would easily lead to non-compliance. Enforceability creates an extra dimension in environmental risk management, as competent authorities/institutions have to be appointed and assigned with supervisory and enforcement responsibilities and competences and have to be equipped with suited means and instruments and have capacity thereto.[37] Enforcement deficits are uneasy to fully avoid as even with enough capacity not all cases of non-compliance will come to light. Apart from the creation of an optimal system of active supervision and enforcement, monitoring and reporting duties can help to stimulate compliance.[38]

4.3.2 Institutional Dimension: Who?

Next, factors relating to the division of responsibilities are relevant in drawing expectations about the legal effectiveness of subsystems of environmental law in reducing environmental risks. First, risk reduction will expectedly be most effective when responsibilities are allocated at an appropriate level and are imposed on the most suited authority or actor.[39] What the appropriate level for a responsibility is to be allocated at, depends on the nature and aim

36 H.K. Gilissen et al., 'Bridges over troubled waters: an interdisciplinary framework for evaluating the interconnectedness within fragmented domestic flood risk management systems', *J. Water Law* 2016, Issue 1, p. 12–26.

37 O.F. Essens, *Operationalising effective public enforcement of environmental law in the European Union, with a focus on England, Germany and the Netherlands* (diss. Utrecht) 2019.

38 Ibid.

39 H.K. Gilissen et al., 'The Climate Resilience of Critical Infrastructural Network Sectors – An interdisciplinary method for assessing formal responsibilities for climate adaptation in critical infrastructural network sectors.', in: S. Maljean-Dubois (Eds.), *The Effectiveness of Environmental Law*, Antwerp: Intersentia 2017, p. 15–36; Buijze, 'Shared Regulatory Regimes through the Lens of Subsidiarity – Towards a Substantive Approach.', *Utrecht Law Review* 2014, Issue 5, p. 67–79.

of the responsibility, as well as on the present governance setting, which is context-specific and thus can differ per region or even per (policy) sector.

Another relevant factor is the degree of fragmentation of responsibilities and the degree to and way in which the negative effects thereof have been dealt with. Many different (types of) actors have specific (types of) responsibilities and competences with the aim of contributing to the reduction of a specific environmental risk. Fragmentation is generally seen as potentially detrimental to the achievement of environmental objectives and the effectiveness of environmental risk reduction.[40] Integration of responsibilities is a means to successfully overcome fragmentation, but this is not always feasible.[41] Instead, increasing the degree of 'interconnectedness' between actors is considered essential to remedy the adverse effects of fragmentation and increase effectiveness of risk regulation.[42] This can be done through imposing general or tailored duties upon relevant actors to share relevant information, to substantively and procedurally coordinate the implementation of policies, and to cooperate.[43]

4.3.3 Instrumental Dimension: How?

A last factor relates to the availability of legal and policy instruments in order to make the environmental responsibilities *practicable*. Apart from relevant knowledge and sufficient resources, responsible actors should have proper powers and instruments suited to fulfill their environmental responsibilities. There can be discussion about which competences and instruments are the most appropriate for the pursuit of specific environmental responsibilities. In defining what is 'appropriate', different criteria and (legal) requirements can play a role, such as effectiveness, proportionality, legitimacy and legality. Acknowledging the relevance of all these criteria, the criterion of effectiveness is key: are the instruments and competences that are assigned to the responsible actors actually suited for the purpose for which they have been assigned to them and are they likely to have the desired effects?

40 M. Ambrus, H.K. Gilissen & J.J.H. van Kempen, 'Public Values in Water Law: A Case of Substantive Fragmentation?', *Utrecht Law Review* 2014, Issue 2, p. 8–30.

41 S. Wuijts, P.P.J. Driessen & H.F.M.W van Rijswick, 'Governance conditions for improving quality drinking water resources – the need for enhancing connectivity.', *Water Resources Management* 2018, Issue 4, p. 1245–1260.

42 H.K. Gilissen et al., 'Bridges over troubled waters: an interdisciplinary framework for evaluating the interconnectedness within fragmented domestic flood risk management systems', *J. Water Law* 2016, Issue 1, p. 12–26.

43 Ibid.

4.4 *Limitations of Environmental Law: the Need for a Complementary System*

The system of environmental legislation is first and foremost the appropriate system for the *ex-ante* regulation of environmental risks. Covering and connecting multiple institutional levels, it offers a suitable framework for the implementation of various environmental risk management strategies and, more in particular, the creation of comprehensive and structured networks of both regionally and substantively tailored responsibilities and competences. However, there are also inherent limitations to the potential of environmental law in effectively reducing environmental risks.

First, environmental risk regulation is the result of a process of political decision making and therefore is always exposed to the effects of political positioning, negotiations and lobbying activities, regardless of the institutional level on which it takes place. Second, although proactive as to its desired effects, actual risk regulation is largely a reactive and incremental process; it is often a reaction to harmful events and/or scientific, societal or other developments or innovations, and therefore often inevitably lags a step behind. Moreover, conceptions about the acceptability of exposure levels, the reasonability of objectives and standards, and the appropriateness of strategies can differ and change over time. Third, because of a high degree of complexity regulators face certain knowledge gaps, as the risks are not yet fully understood or perceived as risks, are still unknown, or even are unknowable. Lastly, increasement of the degree of environmental risk regulation also increases the pressure on supervision and enforcement, whilst the level of compliance with specific regulations depends to a large extent on the incentives for relevant actors to comply.[44]

Through the lens of the indicators for effectiveness, discussed above, the systemic deficiencies of environmental law can manifest in different ways. Apart from the complete absence of any tailored regulation of a specific environmental risk, systems of risk regulation can be incomplete in a sense that specific risky activities or potentially harmful substances have not been regulated, or essential responsibilities (e.g. research, monitoring or reporting duties) are lacking. Moreover, environmental objectives, standards or responsibilities can substantively be unclear or ambiguous, or can be outdated (i.e. not/no longer in line with the state of the art). Responsibilities can also be unclearly directed or fragmentedly imposed, resulting into unclarity about who is responsible and accountable for what in the pursuit of a specific

44 O.F. Essens, *Operationalising effective public enforcement of environmental law in the European Union, with a focus on England, Germany and the Netherlands* (diss. Utrecht) 2019.

environmental objective. Furthermore, available competences, instruments and means can prove unsuited or inadequate to fulfill a specific responsibility. And lastly, poor supervision and enforcement deficits can result into poor compliance with environmental responsibilities. A next question therefore is whether other systems, like tort law, could function as effective complementary risk regulating systems, and thus contribute to the factual reduction of environmental risks to acceptable levels.

5 Environmental Risk Regulation: Tort Law

5.1 *Introduction; Functions of Tort Law*

Tort law is primarily understood as the area of law that offers a victim the possibility to hold his wrongdoer legally accountable for the consequences of an alleged wrongdoing.[45] Under this conception, in tort proceedings a civil judge allocates the responsibilities in relation to the risks that are present in the relationship between the *litigating parties*. He determines the extent to which the the defendant (or the claimant) in a specific case was responsible for the management of the risks involved, whether the defendant failed to meet the legally required standard of risk management, as laid down in written and unwritten laws, and whether he consequently has to compensate the victim for the costs of the negative consequences of the risk materialized.

Although tort law indeed is primarily focused on risk and harm distribution between two parties,[46] it can play a complementary role in regulating risks. From the filing of a law suit, the collection of evidence and the final verdict, all kinds of risk regulation effects may occur that transcend the legal and non-legal interest of the litigating parties.

Central to this idea of tort as a risk regulatory mechanism is first that tort adjudication, either intended or united, can lead to the development of obligations that provide several actors guidance on the required risk management. Norm amplification in a single case can, depending on the content and the scope of a particular decision, provide the relevant sector with guidance on the required safety measures to be taken in relation to a specific risk. Courts decisions could either signal that the behaviour and/or risk management

45 See e.g. P. Cane, 'Using Tort Law to Enforce Environmental Regulation?' *Washburn LJ* 2002, Issue 3, p. 427–468; E. Weinrib, *The Idea of Private Law*, Oxford: Oxford University press 2012, p. 3.

46 E.g. T. Honoré, *Responsibility and Fault*, Oxford-Portland: Hart Publishing 1999, p. 79.

policies of those who engage in chemical mining activities are (not) in accordance with the responsibilities enshrined in the substantive norms of tort law.[47] Court rulings could signal that the administrative law system is underdeveloped or shows regulatory gaps, for instance because it does not address particular risks or the provided safety level is too low. Such rulings can provide the relevant sector with the needed legal guidance on how to deal with the respective risks. The case law in many Western countries on liability for asbestos related risks is telling in this respect. Asbestos litigation has been a major driver in developments in the tort law as it led to the acceptance of new or stretching of existing legal concepts such as the duty of care, limitation periods and causation requirements. This case law has set a precedent in for instance the Netherlands, also across the case law of other risks in the jurisprudence of the Supreme Court, such as the risk associated with the use of lead paint.[48]

Next to this, tort adjudication can lead to the generation of evidence about risks and risk management policies of several actors, that had not been generally available before. Such new evidence can in turn be helpful in further developing the administrative environmental law system. Besides, tort cases can increase public awareness about a specific risk, which might be helpful if a specific issue is not prominent on the agenda of industry, regulators or politicians. Tort cases may stimulate actors in civil society to start a case as well, insurers or industries may feel the need to adapt guidelines and governments may introduce new or additional policies or legislation.

And last, but not least, tort adjudication can cause changes in risk management policies because actors want to avoid being exposed to further political, public or legal actions, e.g. for reasons of public exposure and publicity. Such effects can be brought about through direct (legal) impact mechanisms and indirect impact mechanisms.[49] In the case of direct effects, actors adjust their behavior or policy *because of that specific court ruling*. In the case of indirect effects, the reaction of various actors, e.g. NGOs in society to (the outcome of) litigation is the reason to adjust their behavior or policy. In this situation, actors adjust their behavior *because of the reaction of third parties,* such as the media, NGOs, politicians and other potential risk subjects, to a court ruling, which for

47 In section 5.2 under fault and strict liability these norms will be discussed.

48 See Giesen, E.R. de Jong and M.A. Overheul, 'Risks: how Dutch tort law responds to risks and how the law can shape risks' in: M. Dyson (ed.), *Regulating Risk through Private Law,* Cambridge: Intersentia 2018, p. 165–193.

49 This distinction is based on J. Peel & H. M. Osofsky, *Climate Change Litigation; Regulatory Pathways to Cleaner Energy*, Cambridge: Cambridge University Press 2017, p. 29; N. Rosenberg, *The Hollow Hope. Can Courts Bring About Social Change?*, Chicago: University of Chicago Press 2nd ed. 2008.

instance becomes apparent through public action or publicity. Unfortunately, in general there is only thin empirical evidence available about the behavioral effects of tort law in relation to environmental risks.[50] There is however empirical research available that shows that water authorities are not influenced by possible liability claims.[51]

5.2 *Tort Law's Potential in Regulating Environmental Risks*

Bearing in mind the previous section, the question arises when, why and how tort law can play a risk regulating role and hence can be an (additional) instrument for implementing the environmental risk strategies that have been discussed in section 3. Unfortunately, except for anecdotal empirical material and case studies in the common law world,[52] there is a lack of comprehensive empirical understanding of the circumstances that influence the occurrence, nature and scale of regulatory effects, both through direct and indirect impact mechanisms.[53] We therefore examine tort's regulatory potential by analysing tort law's strengths and weakness in relation to the effectiveness factors that have been identified in section 3.[54]

5.2.1 Fault Liability versus Strict Liability

Before analysing tort's regulatory strengths and weaknesses, the distinction between fault liability and strict liability has to be addressed. Central to fault

50 See W.J. Cardi, R.D. Penfield & A.H. Yoon, 'Does Tort Law Deter Individuals?', *J. Empir. Leg. Stud.* 2013, Issue 3, p. 567–603.

51 See for the Dutch situation in relation to climate change: H.K. Gilissen, *Adaptatie aan klimaatverandering in het Nederlandse waterbeheer – Verantwoordelijkheden en aansprakelijkheid* (diss. Utrecht), Deventer: Wolters Kluwer 2013.

52 See for an exception and interesting study on the possibility of courts to bring about social change: N. Rosenberg, *The Hollow Hope. Can Courts Bring About Social Change?*, Chicago: University of Chicago Press 2nd ed. 2008; J. Peel & H. M. Osofsky, *Climate Change Litigation; Regulatory Pathways to Cleaner Energy*, Cambridge: Cambridge University Press 2017, p. 29. See for the Dutch situation in relation to climate change H.K. Gilissen, *Adaptatie aan klimaatverandering in het Nederlandse waterbeheer – Verantwoordelijkheden en aansprakelijkheid* (diss. Utrecht), Deventer: Wolters Kluwer 2013.

53 P. Cane, 'Consequences in Judicial Reasoning', in: J. Horder (ed.), *Oxford Essays in Jurisprudence*, Oxford: Oxford University Press 2000; Smulovitz, 'Law and Courts' Impact on Development and Democratization', in: P. Cane & H.M. Kritzer (eds.), *The Oxford Handbook of Empirical Legal Research*, Oxford: Oxford University Press 2010. See for anecdotal examples in the U.S.A: W. Wagner, 'When All Else Fails: Regulating Risky Products Through Tort Litigation', *The Georgetown Law Review*, Vol. 95:693, 2007; P. Luff, 'Regulating Tobacco through Litigation', *Arizona State Law Journal,* 47:0125, 2015.

54 This analysis only provides a theoretical answer to the question how tort adjudication can play a complementary role in safeguarding these effectiveness parameters.

liability is that one must examine whether the defendant acted in accordance with the appropriate level of care. Fault liability, and hence the responsibility questions that has to be addressed under fault liability, focuses on the conduct of the actors and addresses the question whether the specific risk management measures an actor took are legally sufficient under the given circumstances.

Strict liability can be established without establishing wrongful conduct at the side of the defendant. Pure forms of strict liability are independent from actual behaviour and are linked to the qualities of an actor and its link with the object or subject that carries or creates the risk. Strict liabilities also serve the purpose of effective risks management. In theory, the threat of liability makes it possible to prevent the externalisation of costs and could provide actors with a financial incentive to take the necessary precautions.[55]

In the following discussion on the relationship between tort law and the several benchmarks for effective risks regulation, the distinction between fault and strict liability will have great importance.

5.2.2 Clear Risk Regulatory Responsibilities

Essentially, strict liabilities impose very clear responsibilities: in order to diminish liability risks, actors have to prevent the occurrence of the outcome for which he is strictly liable.[56] In this way, strict liability can be a useful instrument to adapt obligations that are not addressed in the public law framework.

In relation to fault liability and tort's potential to adapt clear responsibilities, two issues arise. First, the question is to what extent it is clear what the responsibilities under fault liability actually are. In order to establish liability, courts often use a list of non-exhaustive viewpoints, which seems to be inspired by the Learned Hand Formula.[57] These viewpoints help to determine whether the defendant owed a duty of care towards the plaintiff, and thus not *towards society in general*, and whether he breached that duty of care.[58] The list of relevant circumstances is non-exhaustive and varies according to *inter alia* the characteristics of the specific case. Consequently, the reasoning of courts based on these viewpoints is often tailored to the facts at hand, thereby leaving the broader meaning and scope of court rulings somewhat in the clouds.

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55 M.G. Faure, L. Visscher, F. Weber, 'Liability for Unknown Risks – A Law and Economics Perspective', *Journal of European Tort Law*, Vol. 7, No. 2, 2016.

56 As will be discussed below, this characteristic of strict liability also has its strength in relation to the requirement of the feasibilities of the risk management strategies.

57 See also *Principles of European Tort Law* (European Group on Tort Law), 2016, art. 4:102.

58 See on this topic also C. van Dam, *European Tort Law*, Oxford: Oxford University Press 2014, p. 201 and p. 234–258.

This is a weakness of tort law to adapt clear risk regulatory responsibilities in relation to the protection of the environment and society in general and hence might be a reason for legislative action. On the other hand, courts decide cases on the basis of previous case law and general ideas of proper behaviour that are developed in the laws of tort throughout the years. On the basis of established case law general rules can be identified (e.g. 'more precaution is required when the risk is more severe') that provide some guidance on the applicable legal responsibilities.

Second, in some legal systems, such as the Dutch, the examination of the required level of care is limited to the question whether the actual behaviour of the defendant had been negligent and hence did *not* meet the required level of care. In these situations, courts point out whether the defendant had an *in*adequate reaction to the risk, but they generally do not examine what would have been an *adequate* reaction to the risk. This weakness might be removed by accepting the concept of 'positive ruling', meaning that judges, on the basis of knowledge and insights available at the time of the risky behaviour, substantiate a wrongfulness verdict by stating which specific precautionary measures the tortfeasor should have taken at that time.[59]

5.3 *Comprehensive Risk Regulatory Responsibilities*

With respect to the *comprehensiveness* of responsibilities, a distinction can made between the kind of responsibility questions that are brought to courts, i.e. the input side, and the comprehensiveness of the responsibilities that courts accept in rulings, i.e. the output side. On the input side there are some serious challenges to use tort law as a mechanism to develop comprehensive responsibilities. The fundamental principles of party autonomy and judicial passiveness bring with them that the litigating parties determine when to litigate, the subject matter of the litigation and the facts to consider. This firstly might lead to the consequence that, although questions about responsibility could be implied in the facts, litigation does not necessarily always focus on responsibility issues; questions relating to proof of the facts or procedural rules might provide a short cut to solve the dispute. Moreover, the plaintiffs' decision to initiate litigation against a particular defendant is not necessarily motived by a desire to get clarity on the applicable responsibilities. Plaintiff's might (not) decide to initiate proceedings for a variety of reasons that are not

59 W.H. van Boom, *Efficacious Enforcement in Contract and Tort*, Den Haag: Boom Juridische Uitgevers 2006.

related to responsibility questions, such as deep pockets arguments or the fact that the primary tortfeasor cannot be identified or does not exists anymore.

With respect to the output side, one has to bear in mind that court rulings only have binding force between the parties to the proceedings, which *prima facie* limits tort's potential in generating comprehensive responsibilities as far as it concerns the responsibilities of non-litigants. Moreover, it is not always easy to determine to what extent *specific rulings in tort law* do provide particular areas of industry with guidance on the required behaviour. Nonetheless, it could be said that by deciding upon individual legal disputes, courts set precedents that give legal guidance on the required conduct of non-litigants belonging to the same social group as the defendant.[60] To what extent decisions indeed provide guidance for a group of actors, and hence lead to a set of comprehensive responsibilities and liabilities, depends also on the nature of the court's reasoning. Sometimes courts give ruling upon the particular matter at hand and leave as much as possible undecided, thereby limiting the legal scope of a specific decision, specifically about *and* because of the potential broader implications of that ruling. On other occasions they might provide a broad reasoning in which they accept and state general responsibilities that clearly are also relevant to non-litigants, i.e. regulatory reasoning.

As a general point it should be noted that if courts want to engage in regulatory reasoning, they might face deficits in the information. Civil courts are passive receivers of information and might, therefore, have limited knowledge, methods and tools to evaluate what the (regulatory) effects of a ruling are probably going to be for non-litigants.[61] While the parties to the proceedings have a strong incentive to bring forward adjudicative facts, the availability of facts that relate to the broader implications of a ruling, of course, depends on the nature of the litigating parties (e.g. repeat players versus one shooters) and their interests and tools to generate such information.[62]

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60 W.K. Viscusi (ed.), *Regulation through Litigation*, Washington, D.C.: American Enterprise Institute-Brookings Institution 2002, p. 19–20; P. Cane, 'Consequences in Judicial Reasoning', in: J. Horder (ed.), *Oxford Essays in Jurisprudence*, Oxford: Oxford University Press 2000. Cane focuses on common-law rule making but the same argument can be made for civil law jurisdictions. See in general E.H. Hondius, 'Precedent and the law', in: K. Boele-Woelki & S. van Erp (red.), *General reports of the XVIIth congress of the international academy of comparative law*, Brussel/Utrecht: Bruylant/Eleven 2007, p. 31–50.

61 P. Cane, 'Consequences in Judicial Reasoning', in: J. Horder (ed.), *Oxford Essays in Jurisprudence*, Oxford: Oxford University Press 2000.

62 W.K. Viscusi (ed.), *Regulation through Litigation*, Washington, D.C.: American Enterprise Institute-Brookings Institution 2002, p. 19–20; P. Cane, 'Consequences in Judicial Reasoning',

5.4 *Feasible Risk Regulatory Responsibilities*

In relation to tort's possibility to lead to *feasible* responsibilities, two questions arise. First, what is the actual feasibility of the adopted responsibilities in tort law? A lack of empirical and comprehensive *ex post* evaluations about the feasibility and effectiveness of the responsibilities that are adopted in tort rulings in relation to environmental objectives, makes it very hard to answer this question. Second, the questions arises whether court's in tort proceeding need to assess the potential feasibility of certain responsibilities, and if yes, whether they are in a good position to do so. In examining this issue, the distinction between strict liability and fault liability is relevant.

Under strict liability a judge does not have to deal with questions of the effectiveness and feasibility of preventive or precautionary measures. Because of this feature, strict liability regimes provide a clear liability rule and thus provide the norm addressees with incentives to develop feasible and effective precautionary or preventive measures which ultimately might be helpful in diminishing the risk of damage and hence being strictly liable. If an actor wants to avoid being strictly liable, he simply has to prevent the risk from materializing. This in turns creates an incentive for the norm addressee for determining what is feasible and effective.[63]

Under fault liability, questions about the feasibility and effectiveness of certain measures might be relevant for the examination whether the defendant met the standard of care, particularly if one of the parties discusses the effectiveness and feasibility of certain measures. In that case, a judge faces serious challenges, particularly if there is no clear or ambiguous information about the feasibility and effectiveness of these measures. In such cases there is a risk of second guessing by the court about the effectiveness and feasibility of particular measures.[64]

5.5 *Tort Law and Enforcement Instruments*

Particularly with respect to efficacious enforcement of responsibilities, tort law probably only can fulfil a limited complementary role. When there is a long time lapse between an activity and its negative effects, liability claims might only follow after the harmful activity took place and thus, from a precautionary

in: J. Horder (ed.), *Oxford Essays in Jurisprudence*, Oxford: Oxford University Press 2000, p. 329. Cane focuses on common-law rule making but the same argument can be made for civil law jurisdictions.

63 See e.g. M.G. Faure, L. Visscher, F. Weber, 'Liability for Unknown Risks – A Law and Economics Perspective', *Journal of European Tort Law*, Vol. 7, No. 2, 2016.

64 Sunstein, *One case at the Time*, Cambridge (MA): Harvard University Press 1999.

perspective, come too late.[65] This reactive nature could indeed undermine the effects of tort law on prospective behaviour and hence the way actors deal with risks. Important to note in this respect is that, if the activity that creates a risk is no longer carried out or the product or substance is not on the market anymore, the behavioural incentives of a court's ruling are only present if there are risk general effects, i.e. when it is clear that the ruling applies to other risks.

There are, however, two important nuances to be made in this respect. First, next to claims for damages, tort law's responsibilities can be enforced ex ante through injunction and injunctive relief. Secondly, one should not rule out the possible deterrent effect of proceedings for damages and injunctive relief and the fact that these proceedings could stimulate the adoption of new legislation or both corporate and public policies. The occurrence of such deterrent effects depends on a range of relevant circumstance, like the extent to which the norm addressees know which (tort) obligations apply to them; the fact that not all tortious behaviour is brought before a court and/or successfully remedied; the likelihood of being subjected to litigation might be under- or overestimated and the fact that risk behaviour is influenced by other kinds of non-legal circumstances, such as political forces, public opinion, influence of lobby groups, media coverage, the role of insurers, and heuristics and biases.

6 Discussion and Conclusions

In this article we have identified the potential of and complementary effects between the systems of administrative environmental law and tort law in regulating environmental risks in general and those of chemical mining activities in particular. As both systems have their own functions and characteristics, they have their own specific strengths and limitations in regard to environmental risk regulation. In brief, we conclude that tort law has a potential complementary role in addition to – not as a substitute for – administrative environmental law, but that this role should not be overestimated due to its weak and uncertain general regulatory effect. Environmental risks, in other words, should primarily be regulated through administrative environmental law, whereas tort law mainly functions as a 'safety net' in order to respond *ad hoc* to (inevitable) imperfections of the system of administrative environmental law. Once such an imperfection has emerged, its related risk is preferably to be eliminated through tailored regulatory action, than to be subjected to

65 M.G. Faure, 'The Complementary Roles of Liability, Regulation and Insurance in Safety Management: Theory and Practice', *Journal of Risk Research* 2014, Issue 6, p. 689–707.

tort law litigation. Nonetheless, in practice – for example regarding chemical mining activities, but also in *Urgenda*-like cases – there appears to be a lack of effective environmental risk regulation, so that tort law is forced into the position to function as a substitute for, instead of complementary to, administrative environmental law.

Focusing on the complementary effects between both systems, in this article we have first characterized administrative environmental law as the key system to regulate environmental risks, even though this system will nearly constantly have to deal with regulatory imperfections that have a potential negative impact on its effectiveness. Such imperfections are mostly inevitable, as they often result from developments that introduce new environmental risks or developments in the state of the art regarding such risks, to which the system could only react or adapt relatively slowly. Different types of systemic imperfections can be identified. Besides the mere absence of environmental risk regulation, imperfections can have a substantive, institutional or instrumental nature. They can, in short, be substantively unclear, unfeasible or disproportionate, inappropriately allocated to or divided among actors, or unachievable due to a lack of suitable instruments, competences or resources.

The question then rises whether tort law indeed can effectively function as a regulatory back-up to mend such imperfections. To answer this question, it should first be noted that one of the key functions of tort law is to distribute risks between the parties, whereas risk regulation can only be seen as a possible side effect of tort law. On the basis of the analysis above, we further conclude that tort's regulatory capacity to mend instrumental imperfections in environmental law is rather limited. Tort law is limited capable of generating or expanding powers and competences of responsible actors to be used in pursuit of their responsibilities beyond those that have been granted to them by law. Instrumental imperfections can best be dealt with through environmental legislation. Also it is questionable whether tort law can be effective in mending institutional imperfections. Tort law is not capable of transferring legally allocated responsibilities of a certain actor to another, but it can clarify the responsibilities of a specific actor in a specific case. Tort law could, thus, play a complementary regulatory role in relation to substantive imperfections, as it is capable of determining who is responsible for what in the absence of responsibilities under public environmental law. It, moreover, is capable of further specifying responsibilities that are 'outdated' or unclearly or ambiguously formulated.

As a key conclusion, the above suggests that the complementary role of tort law in regulating environmental risks is mostly limited to the (further) specification and on some occasions enforcement of environmental responsibilities.

Despite this limitation, this is nonetheless to be seen as an important role (i.e. the safety net function as mentioned above). At the same time, the actual regulatory effect of tort law should not be overestimated, mainly because of the systemic characteristics and particularities of this system of law. A dispute solving mechanism at heart, tort law is mostly effective in distributing risks and allocating damage *ex post*; it is less reliable as an *ex ante* regulatory mechanisms. Consequently, it should be stressed that effectively regulating environmental risks requires a proactive regulatory attitude. Administrative environmental law provides a suited framework to adopt such an attitude through the implementation of an optimal combination of risk management strategies and tailored responsibilities and instruments to effectuate such strategies. Moreover, as a dispute solving mechanisms, tort law could also benefit from clear administrative environmental risk regulation, as this will make it easier to determine whether an unlawful act has been committed in the first place.

Focusing on the example of chemical mining activities and the three distinguished mining phases – exploration, exploitation, abandonment – more in detail, it is striking that only a small portion of the chemicals used in chemical mining activities has been regulated under REACH, while the environmental effects of such substances are at best uncertain, yet mostly expected to be harmful.[66] Obtaining more (scientific) insights into their actual effects and regulating more substances under REACH would be a necessary first step in effectively regulating related environmental risks, to be followed by clear communication about the state of the art and importance of REACH toward mining companies and relevant authorities who are responsible for regulating chemical mining activities at the regional/local level and for enforcement. Whereas there could be room for controlled 'experimentation' and gaining insight into the actual environmental effects of specific substances during the exploration phase, substances that in small quantities can lead to severe irreversible environmental harm should in our view preferably be banned from being used during the exploitation phase, as such environmental risks should be avoided. For the substances that can be allowed, clear emission standards or thresholds should be set, alongside the implementation of a combination of preventive and mitigative responsibilities. This means that tailored responsibilities should be created per mining phase to, at first, prevent contamination

66 A.H. Faber et al. 'How to Adapt Chemical Risk Assessment for Unconventional Hydrocarbon Extraction Related to the Water System', in: P. de Voogt (ed.), *Reviews of Environmental Contamination and Toxicology*, New York: Springer 2019; Butkovskyi et al. 'Organic Pollutants in Shale Gas Flowback and Produced Waters: Identification, Potential Ecological Impact, and Implications for Treatment Strategies', *Environmental Science and Technology* 2017, 51/9.

though leakages, spills or blowouts, and subsequently to minimize the environmental effects in case of such events. Regarding the latter, tailored, explicit and clearly allocated monitoring and detection requirements as well as emergency responsibilities are pivotal, not only during the exploitation phase, but also after a well has been abandoned. More in general, environmental risks should therefore primary be regulated throughout the different phases of the use of dangerous substances, whereas tort law may then serve as an additional protection instrument in case environmental damage is likely to occur or has occurred.