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What Makes a Dangerous Goods Disaster? The Regulatory Perspective

Jasmine van Schouwen

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Quels enseignements avons-nous tirés de la catastrophe ferroviaire survenue à Lac-Mégantic
Have the Lessons of the Lac-Mégantic Rail Disaster Been Learned?

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Résumé de l'article

Le présent article examine les failles réglementaires qui peuvent être à la source des désastres industriels, et ce, par l'entremise d'une analyse comparative des désastres de Fukushima Daiichi et de Lac-Mégantic. Au terme de cette comparaison, l'auteure démontrera que, même dans des contextes très différents, les attitudes, structures et cultures réglementaires peuvent mener à des résultats désastreux similaires. Ce travail appréhendera la problématique par une analyse de trois types de failles réglementaires communes aux deux études de cas, soit : (1) des règles d'exploitation vagues ou inadéquates; (2) le manque d'inspections permettant de vérifier la conformité des opérateurs ainsi que l'absence de conséquences en cas de violations réglementaires; (3) la capture réglementaire qui cause l'adoption de pratiques dangereuses, une sous-estimation des risques ou un aveuglement volontaire à l'égard des menaces à la sûreté publique. Cela dit, l'auteure souligne que d'autres failles réglementaires, au-delà des paramètres de l'étude, furent également communes aux deux évènements, dont : le défaut de tenir compte de données essentielles reliées à la sûreté, l'utilisation de protocoles inadéquats pour l'évaluation des risques, la dépendance excessive par rapport aux données fournies par l'industrie, le manque d'indépendance des institutions politiques et le défaut des organes de réglementation de maintenir un registre de données essentielles au maintien de la sûreté, ainsi que leur défaut de mettre en oeuvre des plans d'intervention d'urgence adéquats.

What Makes a Dangerous Goods Disaster? The Regulatory Perspective

Jasmine van Schouwen*

ABSTRACT

The following study aims to identify the various regulatory failures which may lead to industrial disasters through the lens of a comparative study of the Fukushima Daiichi and Lac-Mégantic disasters. Through this comparison, the author aims to demonstrate that even in very different circumstances, certain common regulatory behaviours, structures and cultures may lead to similar disastrous outcomes. This study will focus on three types of regulatory failure: (1) weak or vague operating rules; (2) a lack of inspections to assess compliance with regulatory standards as well as a lack of enforcement when non-compliance is identified; and (3) regulatory capture resulting in the adoption of unsafe practices, underestimating risks or willful blindness to safety threats. However, the author emphasizes that other forms of regulatory failure, beyond the scope of this study, were present in both cases, including the regulators' failure to keep track of essential safety data, the use of flawed risk assessment protocols, over-reliance on industry data, lack of independence from government, and failure to implement adequate emergency response programs.

KEY-WORDS:

Regulation, Regulatory Law, Regulatory Policy, Nuclear Law, Comparative Law, Public Safety, Public Accountability, Regulatory Capture.

RÉSUMÉ

Le présent article examine les failles réglementaires qui peuvent être à la source des désastres industriels, et ce, par l'entremise d'une analyse comparative des désastres de Fukushima Daiichi et de Lac-Mégantic. Au terme de cette comparaison, l'auteure

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démontrera que, même dans des contextes très différents, les attitudes, structures et cultures réglementaires peuvent mener à des résultats désastreux similaires. Ce travail appréhendera la problématique par une analyse de trois types de failles réglementaires communes aux deux études de cas, soit : (1) des règles d'exploitation vagues ou inadéquates; (2) le manque d'inspections permettant de vérifier la conformité des opérateurs ainsi que l'absence de conséquences en cas de violations réglementaires; (3) la capture réglementaire qui cause l'adoption de pratiques dangereuses, une sous-estimation des risques ou un aveuglement volontaire à l'égard des menaces à la sûreté publique. Cela dit, l'auteure souligne que d'autres failles réglementaires, au-delà des paramètres de l'étude, furent également communes aux deux évènements, dont : le défaut de tenir compte de données essentielles reliées à la sûreté, l'utilisation de protocoles inadéquats pour l'évaluation des risques, la dépendance excessive par rapport aux données fournies par l'industrie, le manque d'indépendance des institutions politiques et le défaut des organes de réglementation de maintenir un registre de données essentielles au maintien de la sûreté, ainsi que leur défaut de mettre en œuvre des plans d'intervention d'urgence adéquats.

MOTS-CLÉS :

Réglementation, droit réglementaire, politique réglementaire, droit nucléaire, droit comparatif, sûreté publique, responsabilité, capture réglementaire.

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INTRODUCTION

It has been postulated in the nuclear regulatory community that it is impossible to truly glean any lessons from nuclear disasters. Each disaster is unique, the result of a specific chain of events. As such, once "lessons learned" are adopted by operators, they may prevent an event from unfolding similarly to the previous one, but they cannot prevent the next event, which will likely be the result of an entirely different set of human and technical failures—namely, a distinct causal chain. While it may be true that the trigger or chain of events leading up to any industrial disaster is unique, a cursory look at major industrial disasters over the last 20 years in the energy, food, and manufacturing sectors suggests common regulatory failures: vague operating rules, a lack of inspections to verify compliance with regulatory standards, a lack of enforcement of these same regulatory standards once non-compliance is discovered, and willful blindness to safety risks. These are only a few of the regulatory failures that appear time and time again in major industrial disasters, including the oil train derailment and explosion at Lac-Mégantic, Quebec, and the Fukushima Daiichi nuclear meltdown.

While these events can all be attributed to regulatory failure to some degree, the parallels between the regulatory failures at the heart of the Lac-Mégantic and Fukushima Daiichi disasters require particular attention. At first glance, the Fukushima Daiichi and Lac-Mégantic disasters are very different. One involved a cataclysmic 9 MW earthquake and resulting tsunami which have been portrayed by the Tokyo Electric Power Company (TEPCO), the operator of the nuclear power plant at Fukushima Daiichi, as unpredictable natural events that far exceeded any seismological predictions and design tolerances.[1] The other was portrayed by the Montreal, Maine and Atlantic Railway company as the result of operational and human error.[2] But it was also described by the Transportation Safety Board (TSB)—an independent agency tasked with conducting independent investigations and public inquiries into transportation occurrences to determine their causes and contributing factors—as the result of a non-compliant operator within a dangerous safety culture.[3]

While regulators in the case of Lac-Mégantic overlooked known safety risks, regulators in Fukushima failed to assess necessary risks. While events in Lac-Mégantic resulted almost entirely from human error, events in Fukushima Daiichi involved a powerful natural disaster that seemingly took many by surprise. While events in Lac-Mégantic caused 47 deaths, the effects of the disaster at Fukushima Daiichi are still being debated within the scientific and policy communities, and will likely have to continue being evaluated over the next few decades.[4] These disasters resulted from distinct chains of events and failures on the part of regulators and operators. However, despite the notable differences between the Lac-Mégantic and Fukushima Daiichi disasters, there are common trends that unite the events: patterns of regulatory failure which emerge not only from both the wreckage of the train and from the smoking nuclear power plant, but are also shared with many other industrial disasters. They point to the possibility that regardless

1. Tokyo Electric Power Company called the event "unpredictable." The company claimed that nobody could have predicted an offshore earthquake 9 Mw. Tokyo Electric Power Company, News Release, "The Scale of the Tsunami Far Exceeded All Previously Held Expectations and Knowledge" (24 April 2012), online: <www.tepco.co.jp/en/nu/fukushima-np/info/12042401-e.html>.

2. "Lac-Mégantic Disaster: Engineer Blamed for Canada Blast", *BBC News* (11 July 2013), online: <www.bbc.com/news/world-us-canada-23264397>.

3. Canada, Transportation Safety Board, *Railway Investigation Report*, R13D0054 TSB report (Gatineau: Transportation Safety Board, 2014) at 98 [TSB report].

4. Canada, Canadian Nuclear Safety Commission, *Fukushima and Health* (21 December 2015), online: <nuclearsafety.gc.ca/eng/resources/health/fukushima-health-reports.cfm>.

of the technical nature of the activity being regulated, certain patterns of regulatory failure may lead to dangerous consequences with long-term human and environmental impacts.

A. Purpose and structure of the study

This study will approach the Fukushima Daiichi and Lac-Mégantic regulatory environments by analysing three types of regulatory failure: (1) weak or vague operating rules; (2) a lack of inspections to assess compliance with regulatory standards as well as a lack of enforcement when non-compliance is identified; (3) regulatory capture resulting in the adoption of unsafe practices, underestimating risk or willful blindness to safety threats. It is important to note that other forms of regulatory failure were present in both cases, including the regulators' failure to keep track of essential safety data, use of flawed risk assessment protocols, over-reliance on industry data and, lack of independence from government, and failure to implement adequate emergency response programs. They are, however, beyond the scope of this paper.

I. REGULATORY ENVIRONMENTS PRIOR TO THE ACCIDENTS

It is essential to recognize that this study approaches the issue of regulatory failure from a Canadian perspective, informed by a particular political and administrative context. Regulatory policy has recently fallen under a great deal of scrutiny in Canada, following several controversial developments. As such, there is extensive literature detailing the Canadian regulatory environment leading up to the Lac-Mégantic disaster. The Canadian context is unique in that it involves a government adopting a clear, explicit, overreaching and ideologically driven policy for regulation, which is not paralleled in the Japanese context. While in Canada the federal government adopted an explicit ideological stance against regulation, deregulation was less aggressive but also considerably more discrete in Japan. This marked difference in governmental behaviour is crucial to understanding that common patterns and behaviours can hide behind very different policies and political narratives.

A. The Canadian regulatory context: Red-tape reduction and regulation as a "major irritant"

Although regulatory policy in Canada has typically "operated in the middle and lower ranked realms of politically expressed priorities,"[5] regulatory activities gained attention from both academia and the Canadian public after the 2006 federal election, as deregulation became central to federal government policy. Despite the ebb and flow of regulatory policy and ministerial–agency relationships in recent history, the approach of the federal government towards regulation and safety took a very sharp turn under the Harper Conservative Government first elected in January 2006. While the trend towards regulatory reform and deregulation can be traced back to the mid 1980s, arising first in specific sectors such as oil and gas, transportation, telecommunications, and banking,[6] the Conservative Government's discourse surrounding regulation was characterized by an unprecedentedly explicit opposition to regulation at the federal level.

Previous governments including the Mulroney Conservative administration adopted deregulation policies, while maintaining a relatively neutral discourse towards regulation, never articulating clear policies favouring aggressive deregulation.[7] Similarly, the Chrétien and Martin Liberal administrations largely avoided adopting a polarized approach towards regulation. Rather than adopting an explicit deregulation agenda, the Chrétien Government opted for what it referred to as a "smart regulation" strategy. This approach to regulation aimed to balance economic, incentive-based, flexible regulation while maintaining a public discourse of safety and economic growth.[8] This discrete form of deregulation was adopted in concert with a reassuring discourse that regulatory reform would not diminish protections but rather strengthen the Canadian system of regulation.[9]

5. G Bruce Doern, Michael J Prince & Richard J Schultz, *Rules and Unruliness: Canadian Regulatory Democracy, Governance, Capitalism, and Welfarism* (Montréal: McGill-Queen's University Press, 2014) at 55.

6. *Ibid* at 33, 58.

7. *Ibid* at 58.

8. Canada, External Advisory Committee on Smart Regulation, *Smart Regulation: A Regulatory Strategy for Canada* (September 2004) at 9, online: <//publications.gc.ca/collections/Collection/CP22-78-2004E.pdf>.

9. *Ibid*.

In contrast, the Harper Government adopted a clear deregulation policy embodied in concepts such as "streamlining" and "red-tape reduction," and a discourse of regulation as a burden on business rather than a legal mechanism to protect the public interest. This policy was notably embodied in the adoption of the Cabinet Directive on Streamlining Regulation[10] later replaced by the 2012 Cabinet Directive on Regulatory Management (CDRM), which both favoured a "life-cycle" notion of regulation, in other words, an impact-based rather than an objective-based approach to regulatory policy, favouring continual review and sunset clauses which put regulators constantly on the defensive. The CDRM most notably imposed an obligation on departments and agencies to assess the impact of regulatory proposals at an early stage to determine whether benefits outweigh costs, to ensure that adverse impacts on the capacity of the economy to generate growth and employment are minimized, and that they are exempt of unnecessary regulatory burdens.[11] It also favoured the concept of "not regulating unless there is quantified evidence that regulation is necessary, including through the greater use of quantitative cost-benefit analysis."[12]

The CDRM also introduced the "one-for-one" rule, which required departments and agencies to control the number of regulations they adopted by repealing at least one existing regulation every time a new one that imposed an administrative burden was introduced, and to restrict the growth of "administrative burden" by ensuring that new burdens on business caused by regulatory change were offset by an equal decrease in administrative burden from the existing stock of regulations. This approach, characterized by its explicit reference to regulation as a "burden" on business, did not appear to require agencies to take into account health or safety considerations when applying the "one-for-one rule," apparently reducing the cost-benefit analysis to purely economic considerations. The result was what one Parliamentarian called one of the most aggressive "red tape" deregulation in the world.[13] The Harper Government also adopted other deregulation

10. Canada, Treasury Board Secretariat, *Cabinet Directive on Streamlining Regulation* (Her Majesty the Queen in Right of Canada, Cat No BT22-110/2007).

11. Canada, *Cabinet Directive on Regulatory Management*, (2012), Section 6 (G), online: <//www.tbs-sct.gc.ca/hgw-cgf/priorities-priorites/rtrap-parfa/guides/cdrm-dcgr-eng.asp>.

12. Doern, Prince & Schultz, *supra* note 5 at 63.

13. *House of Commons Debates*, 41st Parl, 2nd Sess, No 162 (26 January 2015) (Hon Dean Allison) [Allison Statement].

initiatives, including in the public sector the Paperwork Burden Reduction Initiative begun in 2008, which directed federal departments to reduce their administrative burden by 20%, and in the private sector the creation of a Red Tape Reduction Commission in 2010–2011, an initiative "driven by business concerns about regulation." The Commission defined red tape as "the time and resources spent by business to demonstrate compliance with government regulatory requirements […] a major irritant for Canadian business owners […]" and presented red tape reduction as a way of helping business compete and create jobs for Canadians, as well as a low-cost way to stimulate the economy and boost productivity.[14] It also introduced the Private Sector Advisory Committee,[15] a body which effectively offered industry leaders a forum to oppose regulation, and put pressure on the Canadian government to reduce existing regulation.

Initiatives like those described above were accompanied by a powerful anti-regulation discourse by the Prime Minister as well as high-ranking ministers and administrative officials. From Prime Minister Harper saying in the House of Commons that climate regulations on the oil and gas sector would be "crazy economic policy"[16] to Conservative members of Parliament (MPs) referring to regulatory requirements as silent killers of jobs,[17] the Harper administration clearly positioned itself in opposition to regulatory regimes which it perceived as impeding innovation and competitiveness, promoting instead non-regulatory options such as voluntary codes or "self-regulation," and encouraging agencies and departments to opt for non-regulatory measures wherever possible.[18]

Considering this context of explicit regulation-averse policymaking, the sequence of regulatory failures that came to light through the Lac-Mégantic disaster is hardly surprising, and calls into question the health of other Canadian regulatory regimes greatly reduced by the Harper

14. Canada, Red Tape Reduction Commission, *Why Cutting Red Tape Matters*, online: <www.reduceredtape.gc.ca/about-apropos/why-pourquoi-eng.asp>.

15. Canada, Networks of Centres of Excellence of Canada, *Private Sector Advisory Board*, online: <//www.nce-rce.gc.ca/About-Apropos/Committees-Comites/PSAB-CCSP_eng.asp>.

16. Shawn McCarthy, "Harper Calls Climate Regulations on Oil and Gas Sector 'Crazy Economic Policy'", *The Globe and Mail* (9 December 2014), online: <www.theglobeandmail.com/news/politics/harper-it-would-be-crazy-to-impose-climate-regulations-on-oil-industry/article22014508/>.

17. Allison Statement, *supra* note 13.

18. See for example Canada, Treasury Board, *Red Tape Reduction Action Plan*, (2012) Cat No BT 22-132/2012E-PDF, online: <www.canada.ca/content/dam/canada/tbs-sct/migration/hgw-cgf/priorities-priorites/rtrap-parfa/rtrapr-rparfa-eng.pdf>.

Government (for example the federal environmental impact assessment system). This research aims to demonstrate the profound dangers of a regulatory system that abandons public safety, precaution and evidence-based lawmaking for the benefit of business efficiency and loosely defined economic growth, and treating these interests as mutually exclusive.

B. The Japanese regulatory context

Deregulation was not undertaken with the same vigour in Japan as it was in Canada over the last decade. According to Nottage, "[p]ublic trust in Japan's bureaucrats, central government politicians and even local government politicians has declined steadily over the last few decades, fuelled by regular public scandal," making it very difficult for political actors to create and maintain an overt deregulation and liberalization policy.[19]

This said, deregulation benefitting economic interests at the cost of public health and safety is a well-recognized pattern in the recent Japanese regulatory environment,[20] and despite the absence of a clear regulation-averse policy direction, incremental deregulation has been discretely occurring in Japan on a sector-by-sector basis since the mid-1980s, due to international market-opening and trade liberalization initiatives.[21] Although domestic product safety was the object of a great deal of concern throughout the 1960s and 1970s,[22] national regulation especially in the field of consumer product safety was gradually eclipsed by globalization.[23] Indeed, throughout the 1980s and 1990s, trade relations between Japan and the United States, driven by powerful deregulation pressures by successive US administrations, focused greatly on harmonization and deregulation on the Japanese side. As such, despite a great deal of activism on the part of Japanese consumer protection groups, the international pressure to diminish *ex ante* regulatory controls on trade and manufacturing prevailed, and

19. Luke Nottage, *Product Safety and Liability Law in Japan: From Minamata to Mad Cows* (London, UK; New York: RoutledgeCurzon, 2004) at 8.

20. Mark A Levin, "Smoke Around the Rising Sun: An American Look at Tobacco Regulation in Japan" (1997) 8 Stan L & Pol'y Rev 99 at 99.

21. Nottage, *supra* note 19 at 62.

22. *Ibid* at 15.

23. *Ibid*. See John Braithwaite & Peter Drahos, *Global Business Regulation* (Cambridge; Melbourne: Cambridge University Press, 2004).

patterns of deregulation and liberalization became entrenched.[24] This move towards regulatory liberalization is well illustrated by the Japanese government's decision to undertake comprehensive deregulation efforts in food safety in the early 1980s, lifting regulations on 11 synthetic additives and eliminating safety checks on imported foodstuffs, despite widespread protests from consumer groups.[25] The international pressure to deregulate increased following the *1994 World Trade Organization Agreement* which meant more scope for foreign imports into Japan and the importation of foreign regulatory ideologies and approaches, most notably from the United States and the European Union. This development was marked by a continued preference for *ex post* compensation for any defective products as a means of encouraging importers and domestic manufacturers to supply safer goods, rather than *ex ante* regulation by Japanese authorities.[26] The result has been, simply put, "a legal and regulatory system that puts producers ahead of consumers," especially in domestically protected sectors of the economy, such as the automotive sector, where quality control is more likely to fail.[27] According to Levin, the lax regulatory response to domestic asbestos- and tobacco-related health problems throughout the 1980s and 1990s is indicative of the regulatory culture in Japan, where "governance for the 'public interest' [...] places the security of Japanese industry, its economy, and the government's public finance needs ahead of public health, even when numerous lives are at stake."[28]

It is interesting to note that the pattern of deregulation has occurred in parallel with court-led development of product liability regimes which have offered an alternate means of sanction and redress, particularly in industries such as the automotive sector which, due to their central role in economic development, benefit from close relations with their regulator.[29] Indeed, as a response to growing concerns about product safety in an era of deregulation, judges began to hand down consumer-friendly judgements as early as the late 1980s.[30] The result

24. Nottage, *supra* note 19 at 62, 64.

25. *Ibid* at 21.

26. *Ibid* at 204.

27. Anonymous, "Product Liability: Damages Limitation", *The Economist* (6 November 1999), 66; Nottage, *supra* note 19 at 6.

28. Levin, *supra* note 20 at 99.

29. Nottage, *supra* note 19 at 59.

30. *Ibid* at 96.

has been the establishment of a civil tort law regime that is noticeably friendly to regulatory negligence lawsuits. According to Rheuben, "[w]hereas courts in common law countries have imposed a high threshold for establishing the liability of public authorities, Japanese courts have acknowledged liability more readily, creating an incentive for the Japanese government to divert potential claims against itself from the courts" for instance, by opting to settle claims before they can be heard in courts.[31]

The lacklustre state of Japanese regulation has nonetheless been in the spotlight since the late 1990s and early 2000s through a series of defective product scandals in a variety of domestic industries from dairy products and beef, to automobiles and televisions.[32] In June 2000, for example, over 14 849 people developed food poisoning symptoms after consuming low-fat milk produced by Snow Brand, the company with the largest market share among Japan's dairy processors at the time.[33] Later that month, a leak from an insider at Mitsubishi Motors led the Ministry of Transport to uncover evidence that the company had been conducting clandestine recalls of automobiles claimed or found to be defective.[34] It is not surprising that these activities went unnoticed by the regulator considering the automotive industry regulatory regime obliged Mitsubishi Electric to report serious safety defects if asked to do so by the Ministry of International Trade and Industry itself.[35] It was shortly thereafter that Mitsubishi Electric announced that in the previous decade, 66 units from 2 series of its televisions had overheated and emitted smoke, and that some had even caught fire.[36]

Despite some strengthening of regulatory regimes in response to this avalanche of product scandals, the *modus operandi* of regulatory bodies in Japan remains dominated by closeness with, and protection of, industry, and a focus on economic concerns that tends to prevail over public health.

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31. Joel Rheuben, "Government Liability for Regulatory Failure in the Fukushima Disaster: A Common Law Comparison" (2014) 23:1 Wash Intl LJ 113 at 113.

32. Nottage, *supra* note 19 at 1.

33. Anonymous, "Product Recalls – Made (Badly) in Japan", *The Economist* (14 September 2000), 68.

34. *Ibid*.

35. *Ibid*.

36. Nottage, *supra* note 19 at 2–3.

II. OVERVIEW OF THE REGULATORY FRAMEWORKS IN PLACE FOR NUCLEAR REGULATION IN JAPAN AND RAILWAY REGULATION IN CANADA (LEGISLATION, REGULATORY STRUCTURE AND ENFORCEMENT MODELS)

Both nuclear power and railway transportation involve similar large, complex and technically sophisticated regulatory frameworks and regulatory organizations which require prior examination before one can delve into a comparison of regulatory behaviours, structures and cultures.

A. Railway and oil-by-rail regulation in Canada

Canada has one of the largest rail networks in the world, with 48,000 km of track.[37] This network is regulated by 14 pieces of legislation related to transportation and 4 regulatory institutions.[38] Those most relevant to this research include the *Railway Safety Act* (*RSA*)[39] and the *Transport of Dangerous Goods Act* (*TDGA*),[40] both administered by Transport Canada, the ministerial department responsible for ensuring safe and secure transportation systems via air, marine, rail, and road, as well as the safe transportation of dangerous goods.

It is important to note that since Canada is a federal State, under the *Constitution Act, 1867*,[41] certain powers are allocated to the federal government, while others are allocated to provincial governments. Sections 91 and 92 set out the areas or subject matters in which the federal and provincial legislatures respectively have exclusive jurisdiction to make laws. Legislation adopted by the federal and provincial governments must fall within their assigned heads of power. The *Transportation of Dangerous Goods Act*[42] was adopted by the federal

37. Canada, Transport Canada, *Rail Transportation*, online: <www.tc.gc.ca/eng/rail-menu.htm>.

38. For description of the institutions involved in railway and oil-by-rail regulation in Canada, see Annex VI.

39. *Railway Safety Act*, RSC 1985, c 32 (4th Supp) [*RSA*].

40. *Transportation of Dangerous Goods Act*, RSC 1992, c 34 [*TDGA*].

41. *Constitution Act, 1867* (UK), 30 & 31 Vict, c 3, reprinted in RSC 1985, Appendix II No 5 [*Constitution Act, 1867*].

42. *TDGA*, *supra* note 40.

government pursuant to its power relative to "criminal law" established by section 92(27) of the *Constitution Act, 1867*. As such, to avoid encroaching on provincial jurisdiction, and to remain within the federal government's jurisdiction, the content of the *TDGA* must respect three elements which ensure that a law is in fact criminal in nature: it must set out a prohibition, establish a sanction for the violation of this prohibition, and seek to remedy a public issue of a criminal nature.[43] This means that it typically cannot set out pre-conditions such as operating licences or certificates for the transportation of dangerous goods, but only set out a regulatory framework for these activities, conditions for their operation and sanctions in case these activities are not carried out in conformity with these conditions, which begin to apply as soon as any individual or company engages in activities covered by the *TDGA* and the *Transportation of Dangerous Goods Regulations*.[44]

Pursuant to the *TDGA*, inspectors of the Transportation of Dangerous Goods Directorate (TDG) of Transport Canada—which regulates the transportation of dangerous goods through the development of policies, regulations and standards, and reviews emergency response assistance plans—may inspect any facility or means of transport where dangerous goods are handled, offered for transport or transported, and any facilities where dangerous goods containers are manufactured, repaired or tested. These inspections usually occur at the location where dangerous goods enter the transportation system, with inspections occasionally occurring en route and at border crossings.[45] During the course of their inspections, TDG inspectors examine safety marks, shipping documents, as well as loading and unloading operations. They do not, however, verify the accuracy of classifications by sampling and testing of the product or by examining the classification processes used by consignors.[46]

In addition to those subject areas listed in sections 91 and 92, the *Constitution Act, 1867* also authorizes the federal government to make

43. *Reference re Assisted Human Reproduction Act*, 2010 SCC 61, and *Reference Re Validity of Section 5(a) of the Dairy Industry Act*, [1949] SCR 1.

44. *Transportation of Dangerous Goods Regulation*, SOR/2001-286.

45. *Ibid* at 95.

46. *Ibid*.

laws for the peace, order and good government of Canada (POGG).[47] The *RSA* was adopted by Parliament under this power. As it is not criminal legislation, it does not have to conform to the same criteria as the *TDGA*, and can set out pre-conditions for the operation of a railway such as railway operating certificates. It is important to note that such measures did not exist before the Lac-Mégantic disaster. To remain within Parliament's jurisdiction under the POGG power, the *RSA* must only apply to matters which are for the advantage of two or more provinces. This means that it is only applicable to railways within the legislative authority of Parliament, ie railways that cross provincial or national borders.

The *RSA* is administered by Transport Canada. It sets out the general regulation-making and enforcement powers of the Ministry of Transport and makes railway companies responsible for the safety of their rail track infrastructure, railway equipment and their operations.[48] There are currently 19 regulations which have been made under this Act, establishing technical specifications regarding various aspects of railway regulation. Many of these were updated or adopted in response to the Lac-Mégantic disaster, including the *Railway Operating Certificate Regulations,*[49] *the Railway Safety Administrative Monetary Penalties Regulations*[50] and the *Railway Safety Management System Regulations*.[51] These changes introduced new fines, mandatory safety certificates setting out conditions that railway companies must comply with to operate in Canada, and new reporting requirements on railways and shippers.[52] In addition to these legal requirements, Transport Canada publishes safety standards, guidelines and policies, which offer companies guidance and suggestions on how to meet regulatory requirements.

What emerges from a quick overview of this regulatory context is a system of regulation with operating rules vague enough to allow

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47. Meaning: "in relation to all matters that are not exclusively assigned to the provinces and in relation to works it has declared, although wholly situated within the Province, to be for the General Advantage of Canada or for the Advantage of Two or more of the Provinces ('the declaratory power')", *Constitution Act, 1867*, *supra* note 41 at s 91.

48. *RSA*, *supra* note 39.

49. *Railway Operating Certificate Regulations*, SOR/2014-258.

50. *Railway Safety Administrative Monetary Penalties Regulations*, SOR/2014-233.

51. *Railway Safety Management System Regulations*, SOR/2015-26.

52. Canada, Transport Canada, *FAQs – Rail Safety and the Transportation of Dangerous Goods by Rail* (2015), online: <www.tc.gc.ca/eng/mediaroom/faq-rail-safety-tsb-7565.html>.

railway companies latitude to make their own safety decisions, and few incentives to meet minimal regulatory guidelines. In sum, the regulatory system in place at the time of the Lac-Mégantic disaster was one that was heavily reliant on industry self-regulation. This will be further analysed in section 5.1 of this article.

B. Nuclear power plant regulation in Japan

Prior to the disaster, Japan possessed 54 operational nuclear reactors, which had a total installed capacity of 48,847 GWe in 2010. These reactors supplied 280 TWh of electricity, or 29% of the total electricity generated in Japan in 2001.[53] The institutional framework for nuclear regulation in Japan at the time of the Fukushima Daiichi disaster[54] was particularly complex, with over nine institutions involved in the promotion and regulation of nuclear energy and technology. The Minister of Economy, Trade and Industry (METI); the Minister of Education, Culture, Sports, Science and Technology (MEXT); and the Minister of Land, Infrastructure and Transport (MLT), all have responsibility for the regulation of nuclear activities, depending on the type of activity involved.[55]

The *Atomic Energy Basic Act*[56] is the starting point for Japanese nuclear legislation. Its aim is to secure energy resources for the future and to promote the research, development and use of nuclear energy for peaceful purposes. Besides creating the Atomic Energy Commission (AEC)—which develops national policies on the research, development and use of nuclear energy—and the Nuclear Safety Commission (NSC)—which defines regulatory policies and issues guidelines for the safety of nuclear fuel, source material and nuclear reactors—it also establishes a framework for the regulation of nuclear activities, including mining of nuclear source materials, control over nuclear fuel materials, nuclear reactors, radiation protection, and compensation for damage caused by nuclear activities.

53. Organisation for Economic Co-Operation and Development (OECD), "Nuclear Legislation in OECD and NEA Countries: Japan" (2001) at 3, online: <//www.oecd-nea.org/law/legislation/japan.pdf> [*OECD Country Guide*].

54. Hideaki Shiroyama, "Nuclear Safety Regulation in Japan and Impacts of the Fukushima Daiichi Accident" in Jeongo Ahn et al, eds, *Reflections on the Fukushima Daiichi Nuclear Accident* (New York: Springer International Publishing, 2015) at 283.

55. For a description of the institutions involved in nuclear regulation in Japan, see Annex VII.

56. *Act No 186 of 19 December 1955*, as amended.

The *Atomic Energy Basic Law* relies a great deal on subsequently adopted legislation and regulation for its full implementation, including the *Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors* (the Regulation Act),[57] the *Act on Prevention of Hazards due to Radioisotopes, etc* (the Prevention Act),[58] the *Act on Compensation for Nuclear Damage* (the Compensation Act)[59] and the *Environmental Impact Assessment Law*.[60]

The main legislation governing nuclear facilities is the Regulation Act, which governs the siting, construction and operation of nuclear facilities.[61] In addition, the Prevention Act regulates radiation protection and establishes criminal sanctions for non-compliance, while two Cabinet Ordinances, the *Ordinance implementing the Regulation Law*[62] and the *Ordinance for the Definition of Nuclear Fuel Material, Nuclear Source Material, Reactors and Radiation*[63] establish the details of the nuclear licensing system. The Compensation Act sets the financial security for damage that must be in place for the operation of nuclear installations and provides for the strict, exclusive and unlimited liability of the operator of a nuclear installation in respect of nuclear damage resulting from its operation.[64] Finally, the *Environmental Assessment Law* establishes the procedure for environmental impact assessments of large-scale projects such as the construction of a power plant.[65]

Licensing for nuclear reactors occurs in three steps: the approval of a site for the reactor; the granting of a construction licence once the applicant has demonstrated that it is in compliance with safety, financial and technical requirements; and the approval to operate the installation.[66] Before a licence can be approved by the METI, the application must be reviewed by the AEC and NSC; and before the reactor can begin operation, inspections are carried out to verify that the

57. *Law No 166, 10 June 1957*, as amended.
58. *Law No 167, 10 June 1957*, as amended.
59. *Law No 147, 17 June 1961*, as amended
60. *Law No 81 of 1997*, as amended.
61. *Ibid*, s 5.
62. *Act No 166 of 10 June 1957*.
63. *Ibid*.
64. *OECD Country Guide*, *supra* note 53 at 6.
65. *Ibid* at 5.
66. *Ibid*.

construction conforms to the approved design and methods, and to all the relevant technical standards.

It is relevant to note that at the time of the Fukushima Daiichi disaster regulatory bodies involved in nuclear regulation and institutions involved in the promotion of the nuclear energy were close, and at times dependent on one another (see Annex VII). For instance, the Nuclear and Industrial Safety Agency (NISA), charged with the regulation of nuclear and industrial safety, is a division of—and reports to—the METI, which is also responsible for the promotion of the nuclear industry.[67]

III. OVERVIEW OF THE CHAIN OF EVENTS

Although both the Lac-Mégantic and Fukushima Daiichi disasters were extensively covered in the media, a brief summary of events will facilitate understanding of the regulatory failures associated with them.

A. Lac-Mégantic

On July 5, 2013, at 1:55 am Montreal, Maine and Atlantic Railway (MMA) freight train MMA-002, consisting of 72 tank cars loaded with 7.7 million litres of petroleum crude oil, one box car, and the locomotive consist,[68] departed Farnham, Quebec destined for Saint John, New Brunswick with stopovers in Nantes and Brownville Junction, Maine.[69] The train was controlled from the lead locomotive by a single Locomotive Engineer (LE). Throughout the trip, the LE reported mechanical difficulties, which "affected the train's ability to maintain speed."[70] At 10:50 pm, the LE brought the train to a stop at Nantes using the automatic brakes, and parked it for the night on a descending grade on the main track. The LE applied the independent brakes to the locomotive

67. Qiang Wang & Xi Chen, "Regulatory Failures for Nuclear Safety – The Bad Example of Japan – Implication for the Rest of World" (2012) 16:5 Renewable and Sustainable Energy Reviews 2610 at 2612.

68. Multiple-unit train control is a method of simultaneously controlling all the traction equipment in a train from a single location. A set of vehicles under multiple unit control is referred to as a consist.

69. TSB report, *supra* note 3 at 1.

70. *Ibid*.

consist and applied the hand brakes on seven cars including the locomotive consist and the buffer car, and shut down the four trailing locomotives. He then released the automatic brakes, conducted a hand brake effectiveness test without releasing the independent brakes, and proceeded to contact the rail traffic controller responsible for train movements between Farnham and Lac-Mégantic Station to indicate that the train was secured.[71] The LE also contacted the rail traffic controller in Maine who controlled the movements of United States crews east of Lac-Mégantic to indicate that the lead locomotive had been experiencing mechanical difficulties and that excessive smoke was now coming from its smoke stack. They mutually agreed to leave the train as it was and to deal with performance issues in the morning, when the crew was to be rotated. The LE then reported off-duty.

At 11:40 pm the Nantes Fire Department responded to a call reporting a fire on a train at Nantes. Once the first respondents arrived on site, Sûreté du Québec (SQ) called the rail traffic controller in Farnham to inform MMA of the fire. As MMA was unable to contact an employee with the proper mechanical experience, the company sent an MMA track foreman to meet with the fire department at Nantes, at which point he was informed that the firefighters had shut down the locomotive to put out the fire, by removing the fuel source, and moved the electrical breakers inside the locomotive cab to the off position to eliminate a potential ignition source, in conformity with railway instructions.[72] Following their discussion, the firefighters and the foreman left the scene. With the locomotive shut off, the air in the train's brake system slowly depleted, resulting in a reduction of the retarding force maintaining the train in place. Consequently, at about 1:00 am on July 6, the train rolled downhill toward Lac-Mégantic, 7.2 miles away, derailing near the centre of town at 1:15 am, releasing 6 million litres of petroleum crude oil, causing a large fire and multiple explosions.[73] The Transport Safety Board described the aftermath:

> As a result of the derailment and the ensuing fires and explosions, 47 people died, and about 2,000 people were evacuated. Forty buildings and 53 vehicles were destroyed […], about 6 million litres of which were released, […]. Crude oil migrated into the town's sanitary and storm sewer systems by way of

71. *Ibid* at 2.
72. *Ibid*.
73. *Ibid*.

> manholes. An estimated 100,000 litres of crude oil ended up in Mégantic Lake and the Chaudière River by way of surface flow, underground infiltration, and sewer systems.[74]

B. Fukushima Daiichi

On March 11, 2011, at 2:46 pm, Japan was struck by the largest recorded earthquake worldwide since 1900.[75] The 9.0 magnitude earthquake centred in the Pacific Ocean about 80 km east of the city of Sendai set in motion a powerful tsunami. Three of the six reactors at the Fukushima Daiichi Nuclear Power Station were operating when the earthquake hit. In response, control rods were automatically inserted into the reactor cores to suppress nuclear fission, however the reactors still required cooling since the highly radioactive material accumulated during operation continues to decay and produce heat.[76] With the reactor shut down, the plant was no longer generating electricity, and as such, the cooling systems required an alternative electricity supply. As all external power lines from Japan's power grid to the plant had been destroyed by the earthquake, on-site emergency diesel generators began operating, but for reasons still unknown, the temperature and pressure of the core of the Unit 1 reactor dropped unexpectedly quickly. To slow the rate of cooling, the operators turned the emergency cooling system on and off repeatedly. During this sequence, all electrical power to the plant was lost when the station was inundated by a series of tsunami waves. "Eleven of the twelve emergency diesel generators in service at the time failed (one connected to Unit 6 continued to work) as they required water cooling, which was no longer possible because the tsunami had destroyed the sea water pumps."[77] The alternate sources of power, direct current (DC) batteries and power distribution buses which allowed an external power source to be connected to the plant also failed, as they too had been rendered inoperable by the flooding. But power failure was not the only cause of disaster. The water pumps and their motors which were responsible for transferring heat extracted from the reactor cores to the ocean and

74. *Ibid* at 3.

75. United States Geological Survey, "Magnitude 9.0 – Near the East Coast of Honshu, Japan" (11 March 2011), online: <earthquake.usgs.gov/earthquakes/eventpage/official20110311054624120_30#executive>.

76. James M Acton & Mark Hibbs, "Why Fukushima Was Preventable" (2012) Carnegie Endowment for International Peace 1 at 4.

77. *Ibid* at 5.

for cooling the emergency diesel generators, were built at a lower elevation than the reactor buildings. As such, they were completely destroyed by the flood. Thus, there was no way of dissipating the heat in the reactors; and even if electricity had been available, the systems responsible for dissipating heat would still have been unable to function. Over the next three days, one by one, the three reactors lost core cooling capability:

> The water in the reactor pressure vessels boiled, uncovering the fuel, which subsequently melted. In this situation, there was a risk that the *corium* (the molten mix of fuel and reactor components) could burn through the steel reactor pressure vessel and the concrete and steel primary containment vessel into the earth below, thus increasing the likely quantity of radiation released into the environment.[78]

As cooling water evaporated, the pressure inside the reactors' containment increased resulting in leaks of radiation. Radiation emission increased when workers vented the containments to try to release the internal pressure. More radiation was released following a series of explosions that occurred inside the reactor buildings in the following four days due to a build-up of highly flammable hydrogen generated from the overheating reactors.

Japanese authorities estimated that the amount of radiation released into the atmosphere as a result of the accident was about 15% that of the radiation released from the events of Chernobyl,[79] but the quantity of radiation released by the Fukushima accident remains controversial and estimates vary depending on the source. A small quantity of radiation was released into the Pacific Ocean, most emanating from the overflow of contaminated water that had been used to cool the reactors.[80] Regardless of the actual amount of radiation emitted, over three hundred thousand residents were evacuated from the vicinity of the plant as a safety precaution; and it is estimated that complete remediation of the site is likely to take three or four decades.

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78. *Ibid* at 6.

79. Nuclear Emergency Response Headquarters, Government of Japan, "Report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety: The Accident at TEPCO's Fukushima Nuclear Power Stations" (June 2011) at VI-1, online: <japan.kantei.go.jp/kan/topics/201106/iaea_houkokusho_e>.

80. Acton & Hibbs, *supra* note 76 at 6.

IV. DIFFERENT EVENTS, COMMON FAILURES: A COMPARISON OF REGULATORY FAILURES INVOLVED IN THE LAC-MÉGANTIC AND FUKUSHIMA DAIICHI DISASTERS

Despite the clear differences in the chain of events in both disasters, it is possible to identify a series of common regulatory failures that were either involved in causing or aggravating the circumstances that gave rise to the events at Lac-Mégantic and Fukushima Daiichi. Some failures involve faulty regulatory structures, while other involve the adoption of reckless or dangerous attitudes and practices, highlighting that even a strong formal regulatory regime on paper can be implemented in ways that put public health and safety at risk.

The following section provides an overview in an effort to identify the regulatory failures common to industrial disasters.

A. Vague operating rules leaving discretion to operators

The laws governing the operation of any industrial facility are the starting point in assessing the strength of any regulatory regime. While a strong set of rules alone does not suffice to ensure safe operations,[81] the detail and rigour of operating rules are nonetheless necessary components of an effective regulatory system. Deficiencies in operating rules played a large role in both disasters, albeit in different ways. In the case of Lac-Mégantic, the operating rules were vague enough to allow railway companies latitude to make their own safety decisions, most notably regarding the number of hand brakes necessary to hold a given train tonnage on various grades.[82] In the case of Fukushima, regulatory guidelines did not clarify the tsunami-prevention measures that were required of operators.[83]

81. This will be explored later in the paper, but has also been noted by Collins and Boyd who point out that despite strong environmental laws and regulations in Canada, non-enforcement has essentially rendered these regulations meaningless. This has made Canada one of the worst-performing jurisdictions in terms of environmental protection, climate change mitigation and greenhouse gas emissions. David R Boyd, *Unnatural Law: Rethinking Canadian Environmental Law and Policy* (Vancouver: UBC Press, 2003), and Lynda Collins, "Tort, Democracy and Environmental Governance: The Case of Non-Enforcement" (2007) 15 Tort L Rev 107.

82. Bruce Campbell, "Willful Blindness? Regulatory Failures Behind the Lac-Mégantic Disaster", Canadian Centre for Policy Alternatives, Report (18 August 2014).

83. Acton & Hibbs, *supra* note 76 at 16.

Lac-Mégantic

The operating rules applicable to Canadian railways came under a great deal of scrutiny after the events at Lac-Mégantic. Leading up the disaster, Transport Canada had moved towards a regulatory system which consisted of setting performance outcomes rather than specifying the safety requirements applicable to railway companies. As such, operating rules left a great deal of discretion to railway companies to determine how performance outcomes would be met, with much of the specific details being embedded in operators' safety management systems (SMS).[84] Under this regulatory approach, regulated entities were expected to develop their own strategies, subject to regulatory approval, for protecting public safety and health. "Federal regulatory oversight and inspection efforts are then increasingly focused on overseeing the implementation of these management systems processes rather than on the actual observation of the regulated firms' activities in the field."[85]

The most notable instance of this practice of self-regulation through regulatory vagueness was Rule 112 of the *Canadian Rail Operating Rules* (CROR),[86] which govern how Canadian railways under federal jurisdiction operate. At the time of the accident, CROR 112 stated, in part:

> When equipment is left at any point <u>a sufficient number of hand brakes</u> must be applied to prevent it from moving. Special instructions will indicate the minimum hand brake requirements for all locations where equipment is left. If equipment is left on a siding, it must be coupled to other equipment if any on such track unless it is necessary to provide separation at a public crossing at grade or elsewhere.[87]

It is relevant to note that the term "special instructions" does not refer to regulatory rules or regulations, but rather to the instructions

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84. Mark Winfield, "'Smart' Regulation and Public Safety: Transport Canada's Safety Management System (SMS) Model and the Lac-Mégantic Disaster" (2015) [Unpublished: archived at York University] at 12.

85. *Ibid* at 6. See Canada, Auditor General of Canada, *Report of the Auditor General of Canada to the House of Commons, Chapter 5 – Oversight of Civil Aviation – Transport Canada* (Ottawa: Minister of Supply and Services, 2012), and Canada, Auditor General of Canada 2013, *Report of the Auditor General of Canada to the House of Commons, Chapter 7 – Oversight of Rail Safety – Transport Canada* (Ottawa: Minister of Supply and Services, 2013).

86. Canada, Transport Canada, *Canadian Railway Operating Rules*, online: <www.tc.gc.ca/eng/railsafety/rules-tco167.htm>.

87. *Ibid* at 44 (emphasis added by the author).

adopted by operators themselves in their safety management systems. As such, the CROR did not specify a particular number of hand brakes to be applied to hold a given train tonnage on a given grade, opting instead for a self-regulation system where the operator is free to determine what "a sufficient number of hand brakes" would be in any given situation, and to embed this self-determined requirement in its safety management system.[88]

Nor did the CROR set any requirements regarding whether air brakes—the power braking system attached to the cars of trains, separate from the independent brakes attached to the locomotive—were to be set when a train was left unattended, even though the use of air brakes as a backup to hand brakes to secure rail cars had been common practice for the last 100 years.[89] The decision whether or not to require locomotive engineers to set air brakes in addition to hand brakes was thus also left to railway companies.

Another example of vagueness in regulation is the absence of rules for the special handling of flammable liquids transported by rail. Despite repeated recommendations from the Canadian and American transportation safety boards[90] that Transport Canada should strengthen safety rules so that crude oil classified as more volatile must be carried in upgraded tank cars, Canadian regulators declined to adopt these recommendations, opting instead to leave it to the railway industry to decide which model of tank car to adopt.[91] Indeed, since the mid-1990s, American transportation authorities had raised concerns regarding the DOT-111 tank cars, which at the time of the Lac-Mégantic disaster represented 85% of the tank cars carrying crude oil in North America, including those hauled by the MMA train. The US National Transportation Safety Board noted that the tank head and shell puncture resistance systems of the DOT-111 were not adequate for transporting dangerous goods.[92] As such, it recommended updating

88. Acton & Hibbs, *supra* note 76 at 6; Winfield, *supra* note 84 at 12.

89. Grant Robinson, "Ten-Second Procedure Might Have Averted Lac-Mégantic Disaster", *The Globe and Mail* (7 March 2016), online: <www.theglobeandmail.com/news/national/new-info-shows-backup-brake-may-have-averted-lac-megantic-disaster/article29044518/>.

90. See for example Canada, Transportation Safety Board, *TSB Recommendation R07-04* (2007), online: <//www.bst-tsb.gc.ca/eng/recommandations-recommendations/rail/2007/rec_r0704.asp>.

91. Campbell, *supra* note 82 at 16.

92. US, National Transportation Safety Board, *Safety Recommendation R-12-005*, online: <www.ntsb.gov/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=R-12-005>.

regulations to require railway companies to adopt upgraded tank cars less likely to puncture. In spite of these calls for regulatory action, Transport Canada maintained its less stringent tank car specifications, effectively allowing railway companies to decide whether they would update their tank cars.[93]

Fukushima Daiichi

The practice of adopting vague regulation was also commonplace in the Japanese nuclear regulatory institutions leading up to the events at Fukushima Daiichi. Most notably, the *Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities* did not set regulatory standards for tsunami safety. In fact, until 2006 the issue was only captured by a catch-all clause about ensuring safety in the event of "other postulated natural phenomena than [an] earthquake."[94] Tsunami safety was mentioned explicitly for the first time in a 2006 revision of a specific guide dealing with seismic safety, which incidentally did not clarify the level or type of protection against tsunami threats that operators were required to meet, nor the steps that operators should undertake to protect plants from tsunami risks.[95] When the Nuclear Safety Commission revised the *Regulatory Guide for Reviewing Seismic Design of Nuclear Power Reactor Facilities* to include tsunami risks, it adopted the following loose wording: "Safety features of the facilities shall not be significantly impaired by a tsunami, which should be reasonably postulated to hit—albeit with a very low probability—during the service period of the facilities."[96] This wording is comparable to the objective-based regulatory model noted in the case of Lac-Mégantic: it sets a performance outcome without specifying the safety requirements necessary to meet this outcome, leaving nuclear power plant operators to decide what a "reasonably" predictable tsunami would be and what a "significantly impaired" safety feature

93. Canada, *Transportation of Dangerous Goods Regulations*, SOR/2015-100 (TC 117 Tank Cars) s. 5.10. Section 5.10 specifies that a means of containment manufactured, selected, and used in accordance with safety standard CAN/CGSB-43.146, last amended July 2008, is a permitted means of containment for the transportation of Class 3, 4, 5, 6.1, 8, or 9 DGs by rail or by ship.

94. Nuclear Safety Commission of Japan, "Regulatory Guide for Reviewing Safety Design of Light Water Nuclear Power Reactor Facilities," NSCRG: L-DS-I.0 (30 August 1990), at 30, online: <//www.nirs.org/wp-content/uploads/fukushima/naiic_report.pdf>.

95. Acton & Hibbs, *supra* note 76 at 16.

96. Japan, The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, "The Official Report of The Fukushima Nuclear Accident Independent Investigation Commission, Chapter 1" (National Diet of Japan, 2012), online: <//www.nirs.org/wp-content/uploads/fukushima/naiic_report.pdf> [Diet report, c 1].

would entail. Thus, operating rules also left a great deal of discretion to operators like TEPCO with regards to the measures they would take to counter tsunami risks such as raising equipment, or constructing sea walls.

Conclusion

In both cases, the pattern of vague regulation essentially left the industry to regulate itself, resulting in the operators downplaying risks, adopting minimal safety measures regardless of whether they in fact properly mitigated safety risks, or simply failing to adopt safety measures altogether. In the case of Lac-Mégantic, this allowed MMA to adopt the most cost-effective and least time-consuming safety measures. For instance, with regard to hand brake requirements, this meant MMA adopting a 10%+2 rule with respect to hand brakes, that is to say 10% of the number of cars plus two (see Annex I), as well as providing specific locations where the minimum number of hand brakes could be reduced.[97] Consequently, despite the descending grade to the Lac-Mégantic Yard, the required number of breaks was less than 10% of the number of cars, a number that would be insufficient to hold the train without the additional braking force provided by the air brakes.[98]

According to the TSB report, the number of brakes mandated by MMA's guidelines was far from adequate: depending on the amount of torque applied to the brakes and the type of air brake application, the train should have been secured with brakes on anywhere between 11 and 26 cars. Since no air brakes had been applied in this case, 22 to 26 brakes would have been necessary to secure the train.[99] It is important to note that due to Transport Canada's non-regulation regarding the application of air brakes, MMA was free to instruct its staff not to use the automatic air brakes, a decision that may have ultimately been the cause of the accident: according to the TSB report which investigated the causes of the disaster, "[w]hile MMA instructions did not allow the automatic brakes to be set following a proper hand brake effectiveness test, doing so would have acted as a temporary secondary defence, one that likely would have kept the train secured,

97. Montreal, Maine & Atlantic Railway (MMA), *General Special Instructions* (1st ed, 17 March 2012) ss 112-1, and 112-2, cited in TSB, report, *supra* note 3 at 19–20.

98. *Ibid* at 20.

99. *Ibid* at 178.

even after the eventual release of the independent brakes."[100] Vague regulation also allowed the industry to avoid upgrading its tank cars to a more puncture-resistant model, another decision that was key to the disaster. Had the railway industry used upgraded tank cars, large breaches in the tank car shells, which released vast quantities of highly volatile petroleum crude oil, igniting and creating large fireballs and a pool fire, may have been avoided.[101]

In the case of Fukushima Daiichi, vague regulation also allowed industry to keep safety systems at a minimum. In 2007, TEPCO conveyed to NISA its intent to adopt tsunami safety measures at the Fukushima Daiichi nuclear power plant, and considered measures such as making seawater pumps watertight and constructing enclosure buildings. However, no measures had been taken before the accident except for some minor measures regarding water-sealing of the seawater pump.[102] The absence of safety requirements allowed TEPCO's safety measures to be led by its negative attitude towards tsunami research, delaying the adoption of safety measures on the basis of the scientific improbability of a tsunami and the absence of sufficient research to justify tsunami safety measures, saying: "We wish to await future progress in the research."[103] According to the Japanese Diet report that assessed the causes of the disaster: "The accident was the result of Tokyo Electric Power Company's failure in preparing against earthquakes and tsunamis, despite repeated warnings about the potential for such catastrophes."[104] Indeed, many concrete tsunami safety measures, many of which had been proposed by TEPCO, could have protected the plant against a tsunami. These included moving emergency diesel generators and other emergency power sources to higher ground on the plant site, establishing watertight connections between emergency power supplies and the plant, building dikes and seawalls to protect against a severe tsunami, installing emergency power equipment and cooling pumps in dedicated, bunkered, watertight buildings or compartments ensuring that seawater-supply infrastructure is robust, and providing additional robust sources to serve as the plants' ultimate heat sink.[105]

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100. *Ibid* at 105.
101. *Ibid* at 139.
102. Diet report, c 1, *supra* note 96 at 28.
103. E-mail sent by TEPCO official to a member of the HERP Subduction Zone Subgroup.
104. Diet report, c 1, *supra* note 96 at 1.
105. Acton & Hibbs, *supra* note 76 at 17.

B. Lack of inspections and enforcement

As noted in section 6.1, strong regulations alone do not suffice to ensure a strong regulatory system. A detailed regulatory regime that is not coupled with inspection and enforcement mechanisms is not likely to be more successful in ensuring public safety than a deficient regulatory regime. Patterns of lax inspection and non-enforcement were apparent in both cases.

Lac-Mégantic

Transport Canada's move towards safety management systems involved a shift from a traditional approach to regulatory oversight, where the regulator inspected railway companies' compliance with operating rules and engineering standards under the *Railway Safety Act*, to a system in which the regulator focused on assessing the implementation of effective safety management systems.[106] In the wake of the Lac-Mégantic disaster, this system, coupled with a lack of resources available in the Transport of Dangerous Goods Directorate in the face of Brobdingnagian increases in the transport of oil, led to a troublingly low number of inspections. The TDG Directorate's annual budget of $14 million was frozen starting in 2010 and as a result there were only 35 Transport of Dangerous Goods inspectors leading up to the disaster, 16 of which were qualified for railway inspection and "the number of tank carloads of crude oil per rail safety inspector increased from 14 in 2009 to 4,500 in 2013."[107] As such, although 11,391 inspections occurred under the *TDGA* between 2009 and 2013, only 1,317 TDG inspections were performed with respect to transportation of dangerous goods by rail, of which only 12 occurred in Quebec.[108] Inspections under the RSA were more common: 50 inspections were conducted by Transport Canada's Quebec Region Operations Group between 2009 and 2013 (though none in 2010 because the inspector assigned to MMA was on a leave of absence); 25 were conducted by the Transport Canada's Quebec Region Equipment Group; and 54 track inspections as well as 48 crossing inspections were conducted by Transport Canada Headquarters and the Transport Canada Quebec Region Engineering Group.[109]

106. Winfield, *supra* note 84 at 9.
107. Campbell, *supra* note 82 at 22.
108. TSB report, *supra* note 3 at 97.
109. *Ibid* at 75–77.

These relatively low inspection rates were coupled with a practice of overlooking breaches of operating rules and regulations in an environment where violations by MMA were habitual. Indeed, Transport Canada found MMA to be in violation of a large number of safety regulations between 2009 and 2013, ranging from failures to secure cars with proper hand brake securement and handling rolling stock in a manner that disregarded the protection of workers on the track, to failing to qualify car inspectors to perform single car air-brake tests and to identify defects remaining in the track.[110] Although the TSB report does not specify the number of violations uncovered through these different Transport Canada inspections, it does indicate the types of defects uncovered in the course of track and crossing inspections between 2009 and 2013. The table of defects (see Annex IV) demonstrates a pattern of repeated and sustained non-compliance on the part of MMA: the company was repeatedly found to have insufficient or ineffective ties, railway corrugation and defects, crushed heads and rail surface collapses, insufficient ballast, and excessive vegetation.[111] The condition of MMA's railways was so poor at the time of the Lac-Mégantic accident that trains using the railway were required to travel at half their normal speed on most of their route.[112] This pattern of non-compliance was accompanied by a questionable safety record. Joseph Hüsler, the mayor of Farnham (where MMA was headquartered), has pointed to repeated incidents involving tank cars filled with crude oil detaching from MMA's trains and rolling through the town's main street. According to Hüsler this occurred on a yearly basis.[113] Only three weeks before the disaster at Lac-Mégantic, a badly maintained MMA track punctured the reservoir of a locomotive, causing its derailment and the dumping of 13,000 litres of diesel in the city of Frontenac, situated only 5 km away from Lac-Mégantic.[114]

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110. *Ibid* at 75–78.

111. *Ibid* at 77.

112. Sylvie Fournier, *Manquements et aveuglements*, Radio-Canada, *Enquête* (13 February 2014), online: <//ici.radio-canada.ca/emissions/enquete/2013-2014/reportage.asp?idDoc=328279> [*Enquête*].

113. *Ibid*.

114. Murray Brewster & Benjamin Shingler, "Lac-Mégantic: Oil Shipments by Rail Have Increased 28,000 Per Cent Since 2009" (8 July 2013), online: <//www.thestar.com/news/canada/2013/07/08/lac_megantic_oil_shipments_by_rail_have_increased_28000_per_cent_since_2009.html>; *Enquête*, *supra* note 112.

Although Transport Canada took a series of enforcement actions, including issuing letters of non-compliance and letters of concern between 2009 and 2012, according to MMA workers these fell on deaf ears. When Transport Canada would recommend a series of actions to be taken by MMA, the company would implement a small fraction of them and simply ignore the rest.[115] It appears MMA faced no serious sanctions for its pattern of non-compliance, as Transport Canada failed to resort to some of the more serious forms of enforcement available to it pursuant to the *Railway Safety Act*, such as fining and prosecution.[116] MMA employees interviewed by Radio-Canada's *Enquête* investigation into Lac-Mégantic, described the state of the railway as being so poor that employees were occasionally required to attempt to fix broken rails on route.[117] A similar pattern appears on the Transport of Dangerous Goods front. TDG inspections resulted in a total number of 22 actions taken to address identified instances of non-compliance, none of which were prosecutions.

Fukushima Daiichi

Lack of inspection and non-enforcement were also ubiquitous in Japanese nuclear regulation leading up the Fukushima Daiichi incident. Inspection data was not provided in the Japanese Diet report on the causes of the accident,[118] but the report underlines the rarity and poor quality of inspections undertaken by regulatory officials at the Fukushima power plant. Nuclear Regulatory Commission inspections tended to be incomplete, were often undertaken on the basis of outdated guidelines, and the regulator sometimes even deferred to the operator to conduct inspections and verify compliance in its place. According to the Diet report, the Nuclear Regulatory Commission was not in the habit of carrying out inspections of operators' premises, and did not always require operators to implement voluntary self-inspection programs.[119] When earthquake safety standards were established in 2006 they left plant operators to do their own

115. *Ibid*.

116. *RSA*, *supra* note 39, s 41.

117. *Enquête*, *supra* note 112.

118. Diet report, c 1, *supra* note 96 at 55. The report identifies the lack of transparency regarding licence applications and inspections as a major issue necessitating reform.

119. Japan, The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, "The Official Report of The Fukushima Nuclear Accident Independent Investigation Commission, Chapter 5" (National Diet of Japan, 2012), at 26 [Diet report, c 5].

inspections to ensure their plants were compliant.[120] The inspections that were carried out tended to be infrequent and incomplete. For instance, detailed surveys of pipe joints were not performed for every section during the regular inspections; and even the highest frequency inspections, such as the inspections of the recirculation system piping, only consisted of a once-over of the system every five years.[121] Inspectors sent to verify compliance with safety standards also tended to be insufficiently qualified to be able to fulfil their duties.[122]

Despite the poor quality of inspections, Japanese regulatory bodies were nonetheless able to identify long-standing patterns of non-compliance on the part of TEPCO analogous to those of MMA, some dating back to 2002. TEPCO was found to have falsified more than 200 safety inspection reports for the Fukushima power plant; its seismic safety facilities did not meet the 2006 seismic guidelines;[123] it failed to prepare any measures to lessen or eliminate tsunami risks; it failed to inspect 33 pieces of equipment at the plant, including a backup power generator;[124] and withheld information about safety violations and accidents that occurred at the plant.[125] Just as in the case of Lac-Mégantic, these repeated violations were not met by regulatory sanctions. When TEPCO was found to have fabricated repairs reports in 2002, the maximum fine that companies could be faced with for a false report was 100 million yen ($1.3 million), but TEPCO never paid any fines related to falsifying records.[126] When NISA ordered TEPCO to conduct seismic back-checks to address deficient seismic safety facilities, TEPCO faced no regulatory sanctions when it did not complete these seismic back-checks by the deadline.[127] NISA's only instruction to TEPCO was to speed up the seismic back-checks; it gave no

120. Norimitsu Onishi & Marin Facklermay, "Japanese Officials Ignored or Concealed Dangers", *The New York Times* (16 May, 2011), online: <www.nytimes.com/2011/05/17/world/asia/17japan.html?_r=0>.

121. Diet report, c 1, *supra* note 96 at 21.

122. *Ibid* at 55.

123. Rheuben, *supra* note 31 at 133.

124. Kevin Krolicki & Ross Kerber, "Special Report: Fuel Storage, Safety Issues Vexed Japan Plant", *Reuters* (21 March 2011), online: <//www.reuters.com/article/us-japan-nuclear-idUSTRE72K47A20110321>.

125. E Scott Reckard, "Fukushima Nuclear Plant's Owner Is Slammed for Lacking Candor", *Los Angeles Times* (21 March 2011), online: <//articles.latimes.com/2011/mar/21/business/la-fi-japan-quake-tepco-20110322>.

126. Wang & Chen, *supra* note 67 at 2612.

127. Diet report, c 5, *supra* note 119 at 5.

other specific instruction, nor did it attempt to gauge or supervise progress when they ran four years later.[128] The result was that at the time of the accident, the final report on seismic back-checks of the Fukushima Daiichi Nuclear Plant had not yet been submitted.

Conclusion

Lack of inspection and enforcement contributed directly to both accidents by allowing operators to adopt practices and activities known to be dangerous. In the case of Lac-Mégantic, non-inspection allowed MMA to transport crude oil on the Lac-Mégantic train which was more volatile than its least volatile classification indicated, while non-enforcement allowed MMA to engage in improper hand brake securement, which was one of the principal causes of the accident. In the case of Fukushima Daiichi, lack of oversight and inspection led to faults in equipment and facilities being overlooked, which contributed directly to the accident,[129] while lack of enforcement allowed TEPCO to maintain inadequate tsunami safety systems. Had regulatory authorities pressured TEPCO to upgrade its safety design in accordance with international standards, the Diet report postulates that the plant would have withstood the tsunami.[130]

C. Regulatory capture

Regulatory capture theory emerged in the 1950s as a theory that critiqued public utility regulation by focusing on the power relations between regulated businesses, regulatory bodies and consumers.[131] Capture theory can be divided into two streams of argument. The first, centred on the work of Bernstein, contends that regulators gradually tend to be captured by the industry they regulate as they go through a lifecycle beginning with public interest vigour, then gradually working out a comfortable *modus vivendi* with the industry, and eventually morphing into a regulator captured by industry interests.[132] The second, centred on the arguments of public choice economists, contends that capture is not the result of a lifecycle, but rather the result

128. *Ibid* at 9.
129. *Ibid* at 63.
130. *Ibid* at 48.
131. Doern, Prince & Schultz, *supra* note 5 at 29.
132. Daniel Carpenter & David A Moss, *Preventing Regulatory Capture: Special Interest Influence and How to Limit It* (Cambridge: Cambridge University Press, 2013) at 50 [Carpenter & Moss].

of initial policy design and regulatory structure.[133] Though this theory was initially developed by theorists including George Stigler as a critique of regulation as a barrier to market entry,[134] more modern adaptations of the idea have evolved as a critique of regulation as a process which has fallen into the hands of the industry that it is intended to oversee. Regulatory capture theorists point to the involvement of a regulated industry in writing regulation, as well as its ability to delay, dilute, block and remove regulation, as key elements of regulatory capture. Regulatory capture occurs when regulators select policies that benefit the industries they regulate but that would not gain the support of an informed public.[135] In sum, regulatory capture is a state of affairs in which regulators tend to identify with the interests of the regulated industry over their obligation to regulate in the public interest, resulting in underestimations of risk and the adoption of unsafe practices by the industry. Although bribery and industry lobbying are often pointed to as the main mechanisms through which regulators become captured by industry, regulatory capture may occur in many ways: "regulatory agencies may be dependent for funds on the firms they regulate, firms can provide support to legislators, who then apply pressure to agencies through oversight committees or individual regulators may be attracted by higher-paying jobs in the industry they oversee."[136]

Two main mechanisms allowed for regulatory capture to occur within the regulatory bodies in the cases studied: (a) powerful lobbying and industry involvement in drafting regulations, and (b) a revolving door structure in which experts transitioned from the regulator to the industry and *vice versa*.

1. Powerful lobbies, weak regulators: when industry writes the regulations

Lac-Mégantic

The ability of the railway and oil industries to influence regulatory decision-making regarding the transport of oil by rail in Canada was

133. Doern, Prince & Schultz, *supra* note 5 at 29.

134. See George J Stigler, *The Theory of Economic Regulation* (Chicago: University of Chicago Press, 1971).

135. *Ibid* at 75, "Preventing Regulatory Capture", chapter on cultural capture.

136. *Ibid*.

undeniable leading up to the Lac-Mégantic disaster. In the months leading up to the incident, industry lobbyists fervently advocated against new safety measures for the transportation of dangerous goods and for the elimination of safety measures already in place.[137] One senior industry executive appeared before the Senate Energy, Environment and Natural Resources Committee a few weeks before the accident, stating: "There is no further requirement for Transport Canada to do any more than what they currently do."[138] Industry lobbies not only appeared before committee meetings: they also met on a regular basis with MPs and bureaucrats. In the year leading up to the accident, representatives of the railway lobby, the Railway Association of Canada, met 21 times with about 30 civil servants and MPs.[139] The industry is also able to exert influence informally through communication with the government's rail advisory groups and collaboration with the regulator in the preparation and presentation of safety management systems.[140]

This powerful industry pressure was likely at the heart of Transport Canada's decision to continue allowing the use of unsafe DOT-111 and to lift regulations on single person train operation (SPTO). Indeed, despite repeated warnings from the US National Transportation Safety Board regarding the weaknesses of DOT-111 tank cars, most notably their high incidence of tank integrity failure during derailments and their unsuitability for the transportation of crude oil and ethanol,[141] Transport Canada did not require the rail industry to enhance rail safety measures and replace the defective tank cars. Canadian railway lobbies have publicly been quiet regarding their desire to maintain DOT-111 cars, pointing the finger at the chemical and petroleum companies, who own the vast majority of tank cars, for stonewalling efforts to speed up the replacement of the defective tank cars.[142] However, American lobbies have not been so discrete. The oil and railway industries have resisted calls to retrofit existing cars, pointing to the billion-dollar price

137. Campbell, *supra* note 82 at 23.

138. Canada, *Senate Committee on Energy, Environment and Natural Resources*, (August 2013), at 38, cited in Campbell, *supra* note 82 at 23.

139. Linda Gyulai, "Railways Have Been Lobbying Against More Stringent Safety Regulations", *The Montreal Gazette* (3 October 2013).

140. Campbell, *supra* note 82 at 30.

141. TSB report, *supra* note 3 at 48; Canada, TSB, *Railway Investigation Report*, No R95D0016 (21 January 1995); Canada, TSB, *Railway Investigation Report*, No R94T0029 (30 January 1994).

142. Campbell, *supra* note 82 at 26.

tag of this venture, asking the government to instead focus its rule-making on cars built after October 2011. The Canadian and American governments did just that.[143]

Transport Canada's decision to lift the ban on SPTO also appears to be a direct result of industry lobbying. As noted in the TSB report, "[a]t the time of the accident, there were no rules or regulations preventing railways from implementing SPTO."[144] Indeed, although until September 1996, railways had to obtain exemptions in order to implement SPTO, that year Transport Canada suggested modifying the CROR to allow for SPTO subject to a set of guidelines in order to avoid having to offer companies exemptions. In 2000, the Railway Association of Canada produced SPTO guidelines based on industry review and consultation which allowed companies to adopt SPTO, at the condition that they conform to a list of 69 Transport Canada mandated operating conditions. But in 2008, with the approval of Transport Canada, the Railway Association of Canada introduced General Rule M into the CROR (see Annex V), which effectively created a loophole allowing railway companies to assign a single person to undertake work usually done by two people wherever it could prove that this could be done safely. In this case, no conditions would apply to the train's use of SPTO.

This change represents a radical industry-led effort to reduce regulation, as was the decision to allow MMA to adopt SPTO. When MMA first sought permission from Transport Canada in 2009 to operate with one-person crews, department officials at the Montréal office opposed this request due to the company's history of safety violations and the warnings issued by the TSB regarding one-person crews. These pointed to the risk of runaway equipment due to employee fatigue and the impossibility of verification by another crew member which was known to reduce error rates.[145] However, after MMA senior executives met with officials at the Transport Canada headquarters, the regulator allowed MMA to have one-man American crews operate trains from the Maine border to Lac-Mégantic. A similar pattern occurred a few years later, when MMA requested to be allowed to operate one-person

143. Matthew Daly, "Obama Administration Delays Oil Train Safety Rules", *Portland Press Herald* (29 July 2013), online: <www.pressherald.com/2013/07/29/obama-administration-delays-oil-train-safety-rules/>.

144. TSB report, *supra* note 3 at 64.

145. Canada, TSB, *Railway Investigation Report,* No R13D007 (2013), online: <www.tsb.gc.ca/eng/rapports-reports/rail/2013/r13w0257/r13w0257.pdf>.

crews from Farnham through populated areas including Sherbrooke, Nantes and Lac-Mégantic. When MMA faced opposition from unions and from Transport Canada's Montréal office, a new meeting was convened with MMA and Transport Canada at Ottawa headquarters. In 2012, MMA's request was granted despite the red flags raised by the National Research Council in its 2012 study of SPTO commissioned by Transport Canada, which concluded that "reducing the train crew to one person without appropriate operational changes and technological intervention diminishes safety"[146] and recommended that a pilot-project be conducted to evaluate the impacts of SPTO.

Fukushima Daiichi

Lobbying and industry pressure have also played an important role in shaping the nuclear regulatory environment in Japan. Leading up to the Fukushima Daiichi accident, nuclear and electricity industries tended to be more influential than nuclear regulatory bodies. Institutions responsible for monitoring and oversight could not override the opposition of these industries to risk assessments and strengthened regulations. The NSC's Chairman Haruki Madarame recognized this tendency following the accident: "When an operator proposes the lowest safety standard or the like, the regulatory agency has a tendency to go along with them. [...]. This is the way operators stop making efforts to improve safety. I believe we were trapped in a vicious circle."[147]

Industry players were often at the table of discussions regarding regulatory reviews and independent risk assessments, where they clearly and directly influenced regulatory decision-making. For instance, just eight days before the accident, MEXT's Earthquake and Disaster Reduction Research Division held an informal meeting with TEPCO, Tohoku Electric Power Company, and the Japan Atomic Power Company regarding its long-term earthquake evaluations meant for the use by NISA to assess the need for tsunami prevention measures. In the course of this meeting, TEPCO disagreed with the evaluation's finding that large-scale earthquakes can occur more than once. Following this meeting, the evaluation was revised to read: "Regarding

146. National Research Council, Centre for Surface Transportation Technology, Identification and Evaluation of Risk Mitigating Countermeasures for Single-Person Train Operation, TP15176E, March 2012, cited in Bruce Campbell, "Lac-Mégantic: Loose Ends and Unanswered Questions" Canadian Centre for Policy Alternatives, (January 2015) at 29.

147. Nuclear Safety Commission, 4th NAIIC Commission meeting on February 15, 2012.

whether such earthquakes occur repeatedly, data is not appropriate enough to make such a determination, and therefore, further research is necessary."[148]

In some cases, capture was so severe that industry members simply had to make their wishes known to the regulator in order to avoid undesirable changes in regulation. For instance, the NSC's *Safety Design Guide* stated that a station blackout (SBO) lasting many hours, such as the one that occurred at Fukushima Daiichi, did not need to be taken into consideration in safety design. Following the implementation of SBO considerations in the United States in 1988, the NSC considered including SBOs in Japan's guidelines from 1991 to 1993. However, no revisions were made by the time of the accident. This was due to fervent resistance from operators regarding the inclusion of SBOs as a consideration in safety designs. When the industry approached NISA with these concerns, the regulator informed them that they could exclude SBOs at their will. NISA simply asked operators to write a report that would give the "appropriate rationale" for why this consideration was unnecessary.[149]

TEPCO was also able to influence regulations and operating rules applicable to its Fukushima nuclear plant. It resisted the inclusion of tsunami prevention measures in regulations—as they would have interfered with plant operations—by aggressively lobbying against these safety regulations and drawing out negotiations with regulators through the Federation of Electric Power Companies. This influence, combined with the NISA's tendency to underplay risks and to emphasize the safety of nuclear power due to its position within the ministry responsible for the promotion of nuclear power, created an environment where operators were able to essentially write the regulations that suited them.[150] The result was that no significant tsunami prevention measures were required or taken at the time of the accident.

The industry also exerted its influence regarding radiation control regulation. The Japanese Diet report on the accident noted the following:

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148. Diet report, c 5, *supra* note 119 at 11.

149. *Ibid* at 16.

150. Japan, The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission, "The Official Report of The Fukushima Nuclear Accident Independent Investigation Commission, Summary" (National Diet of Japan, 2012) at 17, online: <//www.nirs.org/wp-content/uploads/fukushima/naiic-report.pdf>.

> Since it was expected that domestic regulation would be tightened in the wake of the global standard ICRP 2007 recommendations, the operators were conducting lobbying and other activities [...]. It is clear that the operators' views on these matters were actually reflected in MEXT's Radiation Council and other forums regarding radiation.[151]

This said, the most egregious case of regulators bowing to industry demands remains NISA's extension of TEPCO's operating license for the Fukushima Daiichi nuclear power plant. Although regulatory documents listed the power plant as one of the most trouble-prone nuclear facilities in Japan over last decade, the most hazardous nuclear facility in Japan for worker exposure to radiation, and one of the five worst nuclear plants in the world between 2004 and 2008, NISA nonetheless allowed its operation. The regulator even approved its Unit 1 reactor for a 10-year license extension after the reactor ended its designed lifecycle.[152]

2. Revolving doors and descents from heaven

The ebb and flow of industry experts moving into regulatory offices and regulatory officials moving out of these offices into well-paying industry jobs is well-known in both the Canadian and Japanese regulatory environments. However, while this practice has been offered in-depth attention by political scientists, anthropologists and sociologists in Japan, it remains outside the spotlight in the Canadian regulatory world—an elephant in the room, well-known but little-talked about by employees of regulatory institutions.[153] The phenomenon of the revolving door works two ways to create regulatory capture. The movement of regulators to industry, attracted by high-ranking lucrative positions, creates a class of regulators concerned with appearing friendly to industry in order to prepare their exit from public office, while the movement of industry experts into regulatory offices imports a culture of profit-driven safety laxness into regulatory bodies.[154] According to James Kwak, regulatory capture can occur not only through material mechanisms of political pressure and financial gain; it can also occur considerably more discretely through non-rational

151. Diet report, c 5, *supra* note 119 at 27.
152. Wang & Chen, *supra* note 67 at 2611.
153. Interview with an anonymous source.
154. Carpenter & Moss, *supra* note 132 at 75.

forms of influence. "Regulators are human beings and are therefore subject to the same sets of cognitive shortcomings as other human beings."[155] As such, when industry experts migrate to regulators, even with the best intentions, they tend to bring with them the logic of profit-driven efficiency, regulation-slashing, and regulatory bargaining.

Lac-Mégantic

Though little attention has been given to the revolving door phenomenon between the railway industry and Transport Canada, it is well known within the regulatory community. According to one former senior insider with Transport Canada and the TSB, almost all of the regulator's rail safety experts and operations staff were hired from the railway industry. According to this insider, ex-industry members tended to fulfil their mandates using the industry's operating culture. They tended to view safety issues from an economic perspective, seeking to make regulation as unobtrusive as possible for operators. As a result they tended to contribute to patterns of non-enforcement and deregulation. "People forget to take their [industry] hat off when they work for government. They want to help their old colleagues out. They are not really looking out for public good, they are looking out for business good."[156]

Given the nature of a regulator's required skills, potential opportunities for career advancement often lie with the regulated industry. The pattern of entrance into the regulatory institutions from industry was paralleled by a flow of regulators to high-ranking lucrative industry positions, typically offered as an informal reward for the adoption of an industry-friendly regulatory approach. For instance, one official who played a central role in modifying the manner of calculating taxable income to the benefit of the industry, making it possible for Railway Companies to pay lower corporate tax rates, was offered a position with the Railway Association of Canada. This is problematic, as it encourages high-ranking regulators to take important decisions with career advancement in mind.[157]

155. *Ibid* at 76.

156. Interview with an anonymous source.

157. *Ibid*.

Fukushima Daiichi

The ebb and flow of personnel between industry and government has been well documented in Japan; it has even been given a name: *Amakudari* ("descent from heaven") refers to the well-known practice in which senior regulators are appointed as senior executives in major utilities, while *Amaagari* ("ascent to heaven") refers to the practice in which industry experts are employed by NISA's technical support agency, the Japan Nuclear Energy Safety Organization.

Amakudari allows government bureaucrats to take up lucrative positions at the companies they used to oversee once retired: "In a pattern reflective of the rigid hierarchy in Japan's regulatory agencies and nuclear utilities, the senior officials went to work at bigger nuclear utilities, while those of lower ranks ended up at smaller utilities."[158] For instance, one of TEPCO's senior advisers, Toru Ishida, was hired by the company less than six months after retiring as the head of the Agency for Natural Resources and Energy (ANRE), the regulatory institution charged with ensuring a stable and efficient supply of energy, promoting appropriate uses of energy, ensuring industrial safety, determining where it is safe to build nuclear facilities.

It is salient that four former senior officials from nuclear regulatory agencies successively served as vice presidents of TEPCO from 1959 to 2010.[159]

Amaagari allows for the flow of business-oriented industry experts into ministries and regulatory institutions, who have direct ties with nuclear plant operators, such as Tokyo Electric.[160] When Associated Press examined the business and institutional ties of 95 people currently at 3 main nuclear regulatory bodies in Japan, it found that 26 of them have been affiliated either with the industry or with lobby groups that promote nuclear power.[161] Though the impact of this ebb-and-flow is difficult to quantify, it may explain the collaborative approach Japanese nuclear regulatory institutions tend to take to regulation, as well as their reluctance to sanction the operators they oversee. The

158. Wang & Chen, *supra* note 67 at 2612.

159. Norimitsu Onishi & Ken Belson, "Culture of Complicity Tied to Stricken Nuclear Plant", *The New York Times* (26 April 2011), online: <www.nytimes.com/2011/04/27/world/asia/27collusion.html>.

160. *Ibid*.

161. Associated Press, "A Look at Japan's History of Nuclear Power Trouble", *The Mercury News* (17 March 2011).

practice of "lending" experts to regulators suffering from a dire lack of independent expertise is also problematic. Industry experts on loan to the regulator may be reluctant to criticize their employers. But even those who have formally severed their ties with industry may be less able or less willing than experts without much nuclear industry expertise to identify new potential safety issues and sanction non-compliant operators.[162]

Conclusion

Regulatory capture worked hand-in-hand with weak operating rules and non-enforcement to create an environment of industry self-regulation in both cases. In the case of Lac-Mégantic, it facilitated patterns of non-enforcement and deregulation, and allowed the railway and oil industries to effectively set the rules by which they would operate. This implied the delay of upgrades to tank cars that were unsafe and unsuitable for their cargo, and the adoption of cost-cutting SPTO—two factors which were considered key to the Lac-Mégantic disaster in an initial draft of the TSB report, which mysteriously disappeared from the final version.[163]

In the case of Fukushima, it led regulators to ignore the risks of a large-scale earthquake, allowing industry to avoid taking the possibility of such an event into account in risk assessments. It allowed operators to avoid including SBOs as a consideration in their safety designs; let industry decide what measures it would take to assure tsunami safety—that is to say none; and lead regulators to extend the operating license of one of the most accident-prone and hazardous nuclear facilities in Japan past its designed lifecycle.[164] Had recommended tsunami safety measures been adopted and SBOs been considered in safety designs, the accident may not have been as grave as it was. Had the license of an operator with a troubling safety record for a problematic, ageing nuclear power plant not been extended, the accident might not have occurred at all.

162. Wang & Chen, *supra* note 67 at 2612.

163. Sylvie Fournier, *Lac-Mégantic : version corrigée*, Radio-Canada, *Enquête* (22 January 2015), online : <ici.radio-canada.ca/tele/enquete/2014-2015/episodes/350642/enquete-0176-pompiers-megantic>.

164. Wang & Chen, *supra* note 67 at 2611.

FINAL REMARKS

This study aimed to identify the common trends in regulatory failure that have been at the heart of two recent industrial disasters: the Lac-Mégantic train derailment and the Fukushima Daiichi nuclear meltdown. It demonstrates that even when the circumstances, causes and cultures involved in industrial disasters differ, the regulatory failures at play are often very similar. This finding allows us to draw lessons learned from disasters, which are easily transferable to various industries. While it remains true that the natural disasters and human error often at the heart of industrial disasters are unavoidable, weak operating rules, lack of inspections and enforcement, and regulatory capture are not. As such, applying the lessons learned from a regulatory perspective may in fact prevent the next disaster, regardless of the industry in which it may arise.

This study has uncovered faulty structures, problematic patterns of behaviour and dangerous approaches to regulatory oversight and concludes that four conditions need to be met in order to help avoid the next Lac-Mégantic or Fukushima Daiichi:

1. Operating rules and regulations must be stringent and safety-focused. They should impose clear positive and precise safety obligations on industry rather than be so vague as to essentially allow industries to self-regulate. This ensures that the measures taken to ensure safety are adopted on the basis of sound risk assessments rather than profit-driven concerns.

2. A strong regulatory framework must be coupled with a system of complete, frequent and comprehensive inspections as well as strong sanction and enforcement mechanisms that deter operators from violating safety rules. In order to ensure that inspection and enforcement mechanisms are used effectively by regulators, the adoption of third-party oversight mechanisms may be necessary.

3. Mechanisms must be in place to prevent regulatory capture:

   a. Rules surrounding lobbying and industry access to high-ranking political personnel should be strong enough to ensure that business interests do not have a louder voice than the public interest.

   b. Cooling-off periods and bars on transitioning between industry and the regulator for high-ranking regulators should be in place to prevent the revolving door phenomenon. These should be coupled with adequate training for personnel entering the regulator from industry, to ensure that an industry mindset is not imported into regulatory institutions.

4. Although lack of resources and lack of institutional independence from government and industry were not explicitly studied in this analysis, measures need to be taken to remedy these regulatory issues as well:
   a. Regulatory bodies must have sufficient resources to be able to complete independent risk assessments and inspections, so as to avoid needing to defer to or rely on industries to undertake these activities.
   b. Regulatory bodies must be sufficiently independent from branches of government engaging in the promotion of the activities they regulate to be able to devise their own regulatory policies and approaches without undue influence from political offices.

In summary, it should not be surprising that in an environment where operators are free to decide the degree to which they are willing to invest in risk assessments, self-inspection and safety systems, business interests take precedence over public safety. While regulators cannot be held solely responsible for the failures of the industries that they regulate, the fact that regulators left it to industries to take important safety decisions, that they ignored violations, and that they shaped regulations based on industry wishes, calls into question the very purpose of these regulators. What is the purpose of establishing a regulator if industry is setting regulatory standards itself, either by showing no intention of complying with regulatory standards, or by putting pressure on regulators to adopt the standards that suit them? A regulator that does not ensure public safety through the creation of effective safety regulation, does not conduct independent safety assessments of industry-proposed practices and technologies, does not verify compliance with these standards, and does not sanction non-compliance, is a regulator in name only. Such a regulatory body evokes Bruce Schneier's notion of "security theatre"—the practice of investing in countermeasures to security threats intended to provide the feeling of improved security while doing little or nothing to actually achieve it. Where regulators are failing to fulfil their most basic duty of oversight, they are engaging in "safety theatre": convincing the public that regulated activities are safe due to the very existence of a regulator, when in fact the regulator is closing its eyes to the very safety risks it is intended to prevent.

ANNEX I — MMA'S INSTRUCTIONS ON RULE 112

Montreal, Maine & Atlantic Railway's (MMA), *General Special Instructions on Rule 112*

Section 112-1 (Hand Brakes) in MMA's GSIs provided instructions on the minimum number of hand brakes required, and stated in part:

"Crew members are responsible for securing standing equipment with hand brakes to prevent undesired movement. The air brake system must not be depended upon to prevent an undesired movement.

[…]

Cars	**Handbrakes**	**Cars**	**Handbrakes**
1 – 2	1 hand brake	50 – 59	7 hand brakes
3 – 9	2 hand brakes	60 – 69	8 hand brakes
10 – 19	3 hand brakes	70 – 79	9 hand brakes
20 – 29	4 hand brakes	80 – 89	10 hand brakes
30 – 39	5 hand brakes	90 – 99	11 hand brakes
40 – 49	6 hand brakes	100 – 109	12 hand brakes

Note: […] If conditions require, additional hand brakes must be applied to prevent undesirable movement."[165]

The numbers in the table are commonly referred to by MMA employees as the "10% + 2" instruction.

Section 112-2 (Hand Brakes: Reduced Minimum Number, Designated Specific Locations) provided specific locations where the minimum number of hand brakes had been reduced. For example, at Sherbrooke, between cautionary limit signs, including the main track and sidings, and at Farnham, the minimum number of hand brakes equated to approximately 10%. For Lac-Mégantic Yard, the required number was less than 10%.

165. *Supra* note 97 at 19.

ANNEX II — TDG INSPECTIONS — ALL MODES OF TRANSPORTATION

Canada, Transportation Safety Board, *Railway Investigation Report*, R13D0054 TSB report (Gatineau: Transportation Safety Board, 2014) at 97.

Table 11. Transportation of dangerous goods inspections and actions taken (all modes)

Year	No. of TDG inspections performed	Actions taken		
		No. of detention orders issued	No. of directions issued	No. of prosecutions initiated
2009	2537	11	20	1
2010	2357	14	9	5
2011	2208	27	6	3
2012	2290	14	19	3
2013	1999	30	22	2
Total	11 391	96	76	14

Note: 2013 data represents January to June only.

ANNEX III — TDG INSPECTIONS — RAILWAY TRANSPORTATION

Canada, Transportation Safety Board, *Railway Investigation Report*, R13D0054 TSB report (Gatineau: Transportation Safety Board, 2014) at 97.

Table 12. Transportation of dangerous goods inspections and actions taken (rail mode only)

Year	No of TDG rail mode inspections performed	Actions taken		
		No of detention orders issued	No of directions issued	No of prosecutions initiated
2009	249	0	2	–
2010	239	7	0	–
2011	315	2	0	–
2012	277	0	4	–
2013	237	3	4	–
Total	1,317	12	10	0

Note: 2013 data represents January to June only.

ANNEX IV — DEFECTS FROM SELECTED TRACK AND CROSSING INSPECTIONS

Canada, Transportation Safety Board, *Railway Investigation Report*, R13D0054 TSB report (Gatineau: Transportation Safety Board, 2014) at 77.

Table 8. Defects from selected track and crossing inspections

Date	Subdivision mileage	Defects noted						
		Insufficient/ ineffective ties	Rail wear/ corrugation/defects	Battered/ broken joints	Crushed heads/ rail surface collapse	Defective crossing surface	Insufficient ballast	Excessive vegetation
July 2009	92.87 to 125.6	X						X
August 2009	0.28 to 124.9							X
September 2009	101.8 to 115.85							X
August 2010	41.6 to 87.0	X	X	X			X	
September 2010	46.0 to 57.0	X	X	X				
August 2011	45.0 to 66.0	X	X		X		X	X
July 2012	0.0 to 42.0		X		X		X	X
October 2012	38.0 to 87.0		X		X			X
November 2012	Not specified		X		X			
May 2013	0.0 to 87.0		X		X	X	X	X

ANNEX V — GENERAL RULE M

Wherever the following: engine, train, transfer or movement appear in these rules, special instructions or general operating instructions, the necessary action will be carried out by a crew member or crew members of the movement. In addition:

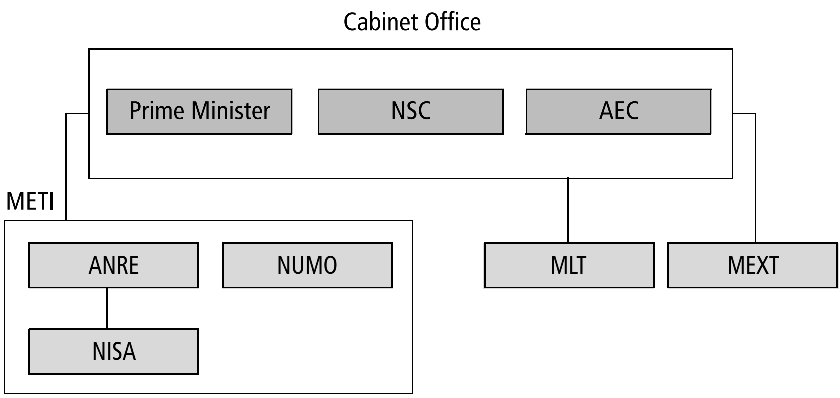
1. Where only one crew member is employed, operating rules and instructions requiring joint compliance may be carried out by either the locomotive engineer or conductor, and
2. In the absence of a locomotive engineer on a crew consisting of at least two members, the conductor will designate another qualified employee to perform the rules required duties of the locomotive engineer.

ANNEX VI — REGULATORY BODIES INVOLVED IN OIL-BY-RAIL REGULATION IN CANADA[166]

Regional Railway Safety Inspectors (RSIs)	Monitor and promote regulatory compliance regarding railway operations and conduct SMS audits and enforcement activities.
Transport Canada	Ministerial department responsible for ensuring safe and secure transportation systems via air, marine, rail, and road, as well as the safe transportation of dangerous goods. It fulfils this mandate through the development and enforcement of safety regulations and standards, or in the case of railways, the facilitation of the development of rules and safety management systems (SMS) by the rail industry to manage their safety risks.
Transport Canada's Rail Safety Directorate	Sets the direction for railway safety oversight through the development of policy and programs that are implemented by its regional offices.
Transport Canada's Transportation of Dangerous Goods Directorate (TDG)	Regulates the transportation of dangerous goods through the implementation of the *Transport of Dangerous Goods Act*. TDG is responsible for the development of policies, regulations and standards, and registers facilities involved in the manufacture, inspection, maintenance, or repair of containers. TDG is also responsible for the review and approval of emergency response assistance plans as well as providing guidance during emergency response activities. Finally, TDG conducts research aimed at improving safety and administers compliance, monitoring and enforcement programs.
Transportation Safety Board	The Transportation Safety Board of Canada (TSB) is an independent agency, created by the *Canadian Transportation Accident Investigation and Safety Board Act*, RSC 1989, c 3. The TSB, composed of no more than five members appointed by the Governor-in-Council, is tasked with conducting independent investigations and public inquiries into transportation occurrences to determine their causes and contributing factors (although in practice there has never been a public inquiry until the Lac-Mégantic disaster) as well as identifying safety deficiencies, making recommendations designed to eliminate or reduce any such safety deficiencies, and reporting publicly on these investigations and their findings. The TSB also reviews "developments in transportation safety and identifies safety risks that it believes government and the transportation industry should address to reduce injury and loss." The TSB is currently composed of a former air-traffic control executive, a former military officer, a former senior officer of Canadian Pacific Railway, a public-service regulatory expert, and a former air force commandant.

166. For more detailed descriptions of the mandates of each regulatory body, see TSB report, *supra* note 3.

ANNEX VII — REGULATORY BODIES INVOLVED IN NUCLEAR REGULATION IN JAPAN[167]



Bodies within the Cabinet Office	
Atomic Energy Commission (AEC)	Develops national policies on the research, development and use of nuclear energy. It operates in an advisory role, making recommendations to other ministries and agencies involved in regulating the use of nuclear energy which are obliged to consult with the AEC when carrying out most of their own licensing and regulatory activities. The AEC establishes policies on the use of atomic energy, co-ordinates between government agencies involved in regulating nuclear activities, determines the content of regulations dealing with nuclear fuel and nuclear reactors (apart from safety issues), promotes nuclear energy research and sets policies for the training of professional staff working in nuclear energy.
Nuclear Safety Commission (NSC)	Composed of a chairperson and four commissioners appointed by the Prime Minister for a period of three years, it is responsible for the safety aspects of nuclear activities. It defines regulatory policies, issues guidelines for the safety of nuclear fuel, source material and nuclear reactors, issues guidelines on the prevention of ionising radiation hazards resulting from the use of nuclear energy and radioactive fallout, and makes recommendations "on any other aspects of radiation safety as it considers appropriate." Licensing authorities are also required to consult the NSC on safety and radiation protection issues in the course of their licensing procedures: the NSC is responsible for confirming subsequent inspections performed by administrative authorities.

167. For more detailed descriptions of the mandates of each regulatory body, see Wang & Chen, *supra* note 67.

Bodies under the Minister of Economy, Trade and Industry (METI)	
Minister of Economy, Trade and Industry (METI)	Responsible for securing a stable and efficient energy supply, and policymaking regarding the uses of nuclear energy and the development of nuclear technology. It also governs safety regulation and licensing of milling and refining, nuclear fuel fabrication, nuclear power generation, reprocessing and storage of spent fuel, and disposal of radioactive waste.
Agency for Natural Resources and Energy (ANRE)	Tasked with ensuring a stable and efficient supply of energy, promoting appropriate uses of energy and ensuring industrial safety. Its Nuclear Energy Policy Planning Division administers nuclear energy policy, nuclear energy technology development, and improvement and co-ordination of nuclear radioactive waste management. Its Nuclear Fuel Cycle Industry Division ensures a stable and efficient supply of nuclear materials, technology development for nuclear fuel materials, and management of nuclear facility siting, determining where it is safe to build nuclear facilities.
Nuclear and Industrial Safety Agency (NISA)	Special organization within ANRE responsible for the regulation of nuclear and industrial safety. It drafts safety regulations and licenses milling and refining, nuclear power reactors, nuclear fuel fabrication, reprocessing and storage of spent nuclear fuel.
Nuclear Waste Management Organisation (NUMO)	Regulates the disposal of radioactive waste, including the implementation of final geological disposal.
The Minister of Land, Infrastructure and Transport (MLT)	
The Minister of Land, Infrastructure and Transport (MLT)	Responsible for all forms of transport of radioactive materials—rail, road, ship or air.
The Minister of Education, Culture, Sports, Science and Technology (MEXT)	
Minister of Education, Culture, Sports, Science and Technology (MEXT)	Responsible for policy and regulation making with regards to research and development of nuclear technology, including research reactors, radiation protection, the use and transportation of nuclear materials (not originating from nuclear fuel cycle facilities and nuclear power plants) as well as the use, storage and transportation of radioisotopes and non-proliferation. The MEXT is also responsible for nuclear third party liability.