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TRACK TWO: COMMENTARY

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Economic and Legal Obstructions to Nuclear Safety Culture in International Law: A Study of Fukushima Dai- ichi

LEE, Soohyun[†]

[†] The author is a graduate from the United Nations University postgraduate programme (2013), where he focused on international economic law and development economics. He continues to work and research in this field today.

ECONOMIC AND LEGAL OBSTRUCTIONS TO NUCLEAR SAFETY CULTURE IN INTERNATIONAL LAW: A STUDY OF FUKUSHIMA DAI-ICHI

ABSTRACT

Disasters at the scale of the Fukushima Dai-ichi after the 2011 Tohoku earthquake and tsunami can result in enormous pressures both domestically and internationally, which in turn can often lead to immediate and provisional responses. In the case of Japan, this response was to cease further nuclear power generation and create a national commission to draft the laws for the country's future energy policy with closer coherence to the Convention on Nuclear Safety. While harmonization with and through international law oftentimes represents a positive development, Japan is uniquely positioned in that it can contribute to the very fabric of regulation surrounding nuclear power. This paper examines and introduces a few of the challenges that Japan is likely to face as it further engages with international law in the process of solidifying its energy policy for the future by taking into consideration Japan's energy and economic contexts.

KEYWORDS: *Fukushima, Dai-ichi, Convention on Nuclear Safety, law and economics, international law, foreign energy dependence, safety culture.*

1. INTRODUCTION

On 26 April 1986, a technical failure that resulted in the meltdown of a nuclear facility in Chernobyl caused thousands of radiation-related deaths and the abandonment of a city. Nearly 25 years later, on 11 March 2011, another disaster rang similar tones of fear, but this time involving a far more technically advanced facility and a cause that was none other than a lack of planning for what became the most powerful earthquake and tsunami to have ever hit Japan. While the Japanese nuclear industry maintained some of the strictest safety regulations in the world involving nuclear energy following major reforms after the *Tokai-mura* uranium incident of 1999, the magnitude nine earthquake and the 40.5 metre tsunami that hit Tohoku taught Japan and the world a rather grim lesson. Given the sheer volatility of nuclear energy, any concept of acceptable levels of safety and the extent and frequency of technical improvements mandated by legal obligation is a difficult and inherently limited standard to specify.

This paper seeks to identify aspects from international law of the legal and macroeconomic challenges behind implementation of “safety culture” in responding to the Fukushima crisis. After identifying these challenges, this paper provides recommendations to avoid the potential consequences of transplantation and to instead contribute to the expansion of both the literal and legal iterations of safety culture.

2. SAFETY CULTURE IN INTERNATIONAL LAW

In the text of the widely ratified Convention on Nuclear Safety (CNS) of the International Atomic Energy Agency (IAEA), the third of the ten principles in the preamble states that the signatory states desire to “promote an effective nuclear safety culture.”⁷⁵ While this concept is not further expounded upon in the CNS, though one may identify Article 10 as being

⁷⁵International Atomic Energy Agency (IAEA), 38th Regular Session. *Convention on nuclear Safety* (1994). INFCIRC/449. 6 July 1994. Web. 11 March 2014. [www.iaea.org/Publications/Documents/Infcircs/Others/inf449.shtml]

further elucidating, this paper looks to the commonly accepted definition of safety culture authored by the International Nuclear Safety Advisory Group (INSAG) of the IAEA for substantiation: “Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance.”⁷⁶ Japan employed the language of safety culture through an ongoing legislative process towards fulfilling the obligations provisioned by the CNS, such as the establishment of the Nuclear Regulatory Authority (NRA) in 2012. The creation of the NRA was, according to the Sixth National Report on the Convention on Nuclear Safety, a response to the “lack of a true safety culture at the [Tokyo Electric Power Company, TEPCO].”⁷⁷ Yet amidst these developments is a problem of interpretation of safety culture that may eventually result in a sort of a legal paradox.

Yet there are considerable complications to implementing safety culture, at least through accession, in the Japanese context, particularly given the country’s dependency on imported petroleum. This contradiction gives some insight into the legislative and institutional problems that Japan may continue to face as it finds an appropriate place for what was once an ambitious nuclear energy programme.

In terms of industrial safety, the creation of the NRA and other large revisions to Japanese law have tended to show that generally employed projections of industrial safety on nuclear power plants, which constitute a range of human factor databases and organizational factors, is most likely ill-fitting for Japan’s specific safety needs. This is because the country faces a unique set of natural hazards that serve to contest the high reliability often assigned to civic nuclear facilities. Indeed, Japanese nuclear power sites appear to be more stringent in safety assessments when compared to nuclear plants in the United States.⁷⁸ This was also applicable in the situation of *Dai-ichi* plant, which was equipped with contingency diesel generators and water injection mechanisms.⁷⁹ However, the combination of a high magnitude earthquake and the consequently sizable tsunami rendered these preparations inadequate. Thus, it is apt here to recall the conundrum highlighted earlier: there can be no end to the technical improvements that can be made to enhance industrial safety. This makes setting a legally mandated threshold, no matter how comprehensively drafted, an endeavour that is fundamentally limited and limiting from the start.

This has been noted regarding the CNS, which tends to employ fairly broad terminology in terms of nuclear safety: Article 1.1 identifies the goal of the CNS to ensure a “high level of nuclear safety” while Article 6 requires signatory states to make “all reasonably practicable improvements” to the safety systems of nuclear plants. Extensive commentary exists on whether the safety regulations within the CNS are legally meaningful.⁸⁰ Important to note here,

⁷⁶International Atomic Energy Agency. 1991. “Safety Culture: A Report by the International Nuclear Safety Advisory Group.” *Safety Series No. 75-INSAG-4*. Vienna, Austria (IAEA): p. 1.

⁷⁷Nuclear Regulatory Authority. 2013. “6th Review Meeting 2013.” *Convention on Nuclear Safety: National Report*. Tokyo, Japan: Nuclear Regulatory Authority, p 8.

⁷⁸Kuroda, Isao. 2001. “Lessons on Safety Culture: A Review of Industrial Safety on Japan” in Wilpert, Bernhard and Itoigawa, Naosuke, eds., *Safety Culture in Nuclear Power Operations*. London, England: Taylor & Francis: p. 175.

⁷⁹Soble, Jonathan and Dickie, Mure. “How Fukushima failed.” *Financial Times Magazine* 6 May 2011. Web. Accessed 11 March 2014. [<http://www.ft.com/cms/s/2/5207d550-76b9-11e0-bd5d-00144feabdc0.html>].

⁸⁰The volume edited by Horbach, Nathalie L.J.T. 1999. “Contemporary Developments in Nuclear Energy Law: Harmonizing Legislation in CEEC/NIS.” Alphen aan den Rijn, Netherlands: Kluwer Law International.

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however, is that even before the events at Fukushima, Japan was not only a signatory state to the CNS, which it signed in 1994 and entered into force in 1996, but also one of the leading countries in nuclear energy generation and consumption. Therefore, it is logically tenable that before the disaster, regular *Dai-ichi* improvements may have well been classified as satisfying the safety regulation provisions of the CNS. This means that in future interpretations of CNS, the industry safety standards of the *Dai-ichi* reactor may be employed as a sort of precedent in gauging a baseline standard for future facilities. In this way, Japan as precedent can serve as a useful *de facto* test to add precision to legal provisions such as Articles 1.1 and 6, adding to its overall efficacy in promoting safety culture.

However, enhancing safety standards and enacting new legislation surrounding the use of nuclear energy is only one aspect of the challenge facing Japan post-Fukushima. Another aspect, which is far more ubiquitous and historical, deals with Japan's foreign energy dependency and trying to envision a long-term energy policy that does not involve nuclear power. The interplay between these two aspects is perhaps best illustrated by Article 6, the first half of which emphasizes the "urgency to upgrade the safety of the nuclear installation," but whose latter half insists:

"If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact."

Herein lays the challenge of implementing nuclear safety culture: while the "social and environmental"⁸¹ concerns of continuing nuclear power generation may suggest that the shut-down of relevant facilities be the only plausible solution against the upgrading necessary to fully realize the safety culture implied by the INSAG post-Fukushima, the energy context and economic needs of Japan complicate accession.

3. TWO CHALLENGES TO JAPAN'S COMMITMENT

Regarding the energy context of Japan, the country decreased energy generation through nuclear power dramatically as an immediate and provisional response to the Fukushima event in hopes of subsequently switching to a mixed energy scheme.⁸² Yet, it is difficult to imagine a boost in energy generation from alternative sources to replace nuclear energy entirely. The drop in the electricity generation by nuclear sources in Japan went from 29.2% in 2010 to 2.1% in 2012,⁸³ but this dramatic decrease does not necessarily signal substantial progress in the transition of the Japanese power grid to a mixed energy scheme. This can be seen in the total percentage of energy consumption in Japan that is accounted for by alternative and nuclear energy, which dropped from 17.16% in 2010 to 2.91% in 2012 according to World Bank data.⁸⁴ This should illustrate just how little alternative energy sources are depended on

⁸¹While these aspects are not explored in this paper, one may refer to Kitada, Ato and Matsuda (2001) for survey-based studies on public perceptions on nuclear power plants and the transparency of their operations.

⁸²Koyama, Ken. 2014. "Japan's Future Energy Policy Challenges." *A Japanese Perspective on the International Energy Landscape*. Tokyo, Japan: Institute of International Energy Economics.

⁸³International Energy Agency (IEA). 2013. "Energy Statistics and Balances of Non-OECD Countries." *IEA Statistics*. Paris, France: International Energy Agency.

⁸⁴World Bank. 2014. Alternative and nuclear energy (% of total energy use). Data retrieved 11 March 2014 from World DataBank: World Development Indicators database.

to generate electricity in Japan. To fill its place, between 2010 and 2012, total energy consumption from fossil fuels increased from 81.01% to 94.8%, which is roughly similar to the percentage of energy use accounted for by energy imports in 2012 at 93.38%.⁸⁵

Beyond the energy context of Japan, the economic impact of shifting away from nuclear energy also deserves attention as returning to a state of near total foreign energy dependence can have serious macroeconomic consequences. First of all, there are the potential losses from adjustment when considering immobile factors of production, such as labour or capital, when moving from domestic energy production to foreign imports, particularly in the situations where there has been considerable private or public investment in related fields of education or innovation. Secondly, other potential long-run consequences of imported energy dependence include such risks as oil cartels and potentially predatory behaviour of petroleum exporters. Lastly, in case of a sudden discontinuation of the nuclear energy programme, lacking sufficient development in other forms of alternative energy sources, the elasticity of import supply is expected to decrease, at least in the short-run, raising the prices of the imported energy source. If one were to consider elasticity through the Bohi and Montgomery formulation (1982), which is reproduced below, then the so-called monopsony wedge is expected to widen.

$$n_I = n_X \left(\frac{X}{I} \right) + \frac{e_R I_R}{I} \quad (1)$$

This equation shows that elasticity, n_I , is the sum of the elasticity of global export supply, n_X , at total world exports, X , over domestic imports, I , and the absolute import demand elasticity of other countries that are oil importers, e_R , by the imports of countries, I_R , over total domestic imports. In doing so, the Bohi and Montgomery formulation as represented above demonstrates that the elasticity of imported energy sources can have a significant multiplier effect.

Given a few of the challenges identified above, the possibility of Japan discontinuing its nuclear energy programmes by permanently shutting down or decommissioning its nuclear power plants seem unlikely. This is also considering not only the recent creation of the NRS to implement future nuclear policy and law, but also the fact that 48 out of 60 facilities remain operational and two are currently under construction.⁸⁶

4. REDEFINING SAFETY CULTURE

When the situation surrounding the *Dai-ichi* reactor spiralled out of control, the exponential accumulation of international and domestic pressure quickly halted further nuclear development in Japan. Further operation of nuclear power plants in a country as prone to natural disasters as Japan became unthinkable. However, the extent to which Japan was able to implement a mixed energy scheme, while much of it was nuclear, is certainly remarkable considering that the country is traditionally dependent on imported energy. In fact, the relatively accident-free operation of nuclear generation facilities in the context of Japan is

⁸⁵World Bank. 2014. Fossil fuel energy consumption (% of total). Data retrieved 11 March 2014 from World DataBank: World Development Indicators database.

⁸⁶IAEA. 2014. "Country Statistics: Japan." *Power Reactor Information System* (PRIS). Vienna: IAEA.

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perhaps just further testimony to the level of development that this sector has enjoyed in the country.

The challenges described in the earlier sections of this paper identified an incompatibility of commonly accepted interpretations of nuclear safety culture, particularly if taken from the view of the obligations provisioned in the CNS, with the national interests of Japan- namely its energy context and macroeconomic concerns. While the specific obligations that apply *mutatis mutandis* to Japan post-Fukushima regarding the industrial safety standards of its nuclear power facilities are currently unclear, perhaps in part due to Japan still being in a drafting stage concerning its energy policy, one recommendation that this paper makes is to avoid the transplantation of safety culture. That is, ratification of international law, such as those related to nuclear safety culture, should be done so with amendments reflecting the country's context and needs, which have changed and perhaps better reflect the true volatility of nuclear energy than current international standards currently envisions. Japan is uniquely positioned to provide substantive additions to the definition, at least in legal interpretations, of safety culture, potentially offering greater precision to such provisions as Article 6 of the CNS. In this regard, Japan should look to add to the iterations of safety culture and relevant legal mechanisms such as the CNS.

As the only other nuclear disaster given a “major accident,” or level seven, the highest rating on the International Nuclear and Radiological Event Scale (INES) after Chernobyl, Japan is uniquely positioned to provide technical information on the details of the disasters and their fallout. The collection and dissemination of information involving nuclear power is undoubtedly important for an age that is more widely embracing the values of nuclear power. While the recovery effort should most certainly be a priority for Japan when addressing the Fukushima crisis, another task in the interest of a safety culture will be collecting data for research on the fallout of such a large-scale disaster. Fallout research from nuclear power plant failures depend largely on case studies. Fukushima *Dai-ichi* will undoubtedly become one of the most important references in nuclear power safety studies. In terms of recovery studies, research and short-term activities such as testing and further developing existing methodologies in remediation, such as resurfacing roads and potassium fertilizers, during the decades of caesium-137's half-life will be important. Since sustainable recovery cannot be realized due to the radioactivity of the area, an active radioactive zone can be conducive for such experiments in remediation and recovery. The documentation of these activities can add further specificity to definitions of safety culture and its influences on law, particular when operating in post-crisis or fallout conditions.

While this section only provided examples of the ways in which Japan can conduct research on subject areas that may otherwise be inaccessible, such research is vital as it can then influence the legal iterations of safety culture in application to energy regulations. The industrial safety provisions in the CNS can replace interpretively broad conditions like “high levels of safety,” with specific measures or procedures using Fukushima and Japanese regulations as a backdrop. This can provide greater clarity and precision for existing and future laws that regulate nuclear power generation. In doing so, Japan may be able to avoid transplanting international standards in situations where they do not apply or may even be harmful in the Japanese context. Furthermore, through the continued effort of Japan, the very regulatory environment surrounding nuclear energy generation can have greater specificity, narrowing legal ambiguities that make current *de facto* law either unattractive for ratification, or meaningless in practise.

5. CONCLUDING REMARKS

The road ahead for Japan as it deals with the Fukushima nuclear power plant will undoubtedly be a difficult journey for both the government and the people. Amongst the many challenges ahead, this paper attempted to contextualize and introduce those obstacles that Japan will face in upcoming years as it further embraces international law regarding nuclear power. The degree to which future energy policy in Japan harmonizes with international law will undoubtedly be dictated by the energy and economic needs of the country. However, in this harmonization process, Japan can contribute significantly to the very fabric of the regulatory framework surrounding nuclear power, the concept of safety culture and its interactions with legislation.

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