Nuclear Regulatory Regimes in South Korea:

Law & Liabilities

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Introduction

Nuclear power is one of the major sources of electricity worldwide. It has garnered growing interest as a replacement for carbon-emitting fossil fuels and a solution to problems of energy independence and security (Rhodes, 2018; Nuclear News, 2023). However, nuclear energy reactors also create risks of wide-scale harm to the public. The primary way to protect the public are various regulatory laws surrounding nuclear energy. South Korea is an important nuclear power state as the reactors are both a key source of electricity and a product developed for export (South Korean Ministry of Trade, Industry and Energy, 2022). It is a key player in East Asian energy politics and the international market for nuclear parts, designs, and expertise. Moreover, the current presidential administration by President Yoon's renewed focus on nuclear has catalyzed public controversy due to its direct contradiction with the previous presidential administration by President Moon. As the previous administration had propelled a plan to progressively denuclearize the country, many citizens have mixed opinions about the nuclear energy's efficiency and concerns about radiation and safety across the entire fuel cycle (Kang, 2022; Na, 2022). This research is based on archival studies and secondary data analysis to explore the public controversy and legal issues surrounding nuclear energy and safety in South Korea.

This research is also a part of a broader multidisciplinary, comparative, international collaboration headquartered at Northwestern University in the United States. I focus on the nuclear regulatory regimes and its application in South Korea to analyze the issues and possibility of improvements in the face of new reactor designs that emerged to uphold the new demand for nuclear energy in comparative, international context. This study will contribute to a broader academic collaboration, co-organized by my research advisor M. X. Mitchell together with Northwestern University Associate Provost for Global Affairs Annelise Rile, and Northwestern University Kay Davis Professor of Anthropology Hirokazu Miyazaki. Mitchell, Riles, and Miyazaki are convening a multidisciplinary, international group of collaborators to explore the intersection between risks introduced by emerging, next generation small modulator reactor (SMR) designs and the liability regimes used to govern them in comparative, international context.

This research is a multidisciplinary initiative, which will involve perspectives from experts in the natural sciences and engineering, law and sociolegal studies, and insurance and actuarial science. This research will aid to develop a foundation of knowledge on history and present state of South Korea's nuclear programs and regulatory regimes. This report is focused on the most prevalent issues among the findings.

Outline

The main research questions of this research were originally: *What are South Korea's nuclear regulatory regimes and practices surrounding harm to the public? What is the status of public liability in the context of development of novel reactor designs?* With these questions in mind, I investigated research reports about nuclear regulatory regimes, as well as case laws, books, and legislations. Due to the transparency of many reports and legal documents of South

Korea, many documents were able to be accessed online. I have, however, visited archives and, mainly, university libraries to access most of the books and reports I've focused on this report.

In this report, I will first discuss the research process to provide an understanding of my research's final analysis. The research process consisted not only of secondary data in the form of texts, but also a deeper understanding of South Korea's culture, which intersects with the issues present in current nuclear regulatory regimes. As this research does not solely focus on the law-in-books, but also law-in-action influenced by human behaviour and socialization, such experience became a valuable input. Then, the collected data will be analyzed in several parts. This research is different from scientific, quantitative research as it requires a deeper understanding of the history and culture that extends beyond legal frameworks of South Korea. Therefore, the history behind nuclear regimes must be discussed while considering the South Korean history. The context of this history and the legal framework will first be explained to help the understanding of the findings. Thereafter, the issues identified through primary and secondary data will be analyzed to understand why these issues are important to be addressed for safer future of nuclear energy industry and the people that must live along with nuclear reactors in their vicinity. Lastly, the outcomes of this research will be briefly discussed to guide the research path of nuclear regulatory regimes in South Korea henceforth.

Research Processes

The research process involved accessing both primary and secondary data from the archives and libraries. I have reviewed various data over the span of six weeks as regulated by the Laidlaw Scholars Program. The dates of these data vary from 2002 to 2023 to understand the changes that the regulatory regimes have undergone. Although some data may seem outdated, the slowly changing legal framework and safety regulations unlike the rapid technological development highlights the issue present in the South Korean nuclear energy industry.

In the initial plan, the research process included not only the national archive and university libraries, but also information from the private companies that are involved in the construction of nuclear reactors. However, the first few weeks of the research revealed that this plan did not suit the nature of the nuclear issues in South Korea, requiring modification. South Korea's nuclear energy industry is largely a federal business, meaning that it is not a private business, but owned by the government. All businesses involved in energy provision, mostly fossil fuels and nuclear energy are owned by the government institution called the Ministry of Trade, Industry and Energy (MTIE). MTIE owns the Korea Hydro & Nuclear Power Corporation (KHNP), which is the main provider of nuclear energy; KHNP is also owned by the Korea Electric Power Corporation (KEPC), which is a public corporation that oversees many of the energy corporations divided within. This causes the private companies involved in the industry to be reduced to a manufacturing role by providing nuclear reactors to the government institution, working without autonomy. Thus, the decision-making power exists within the public corporations rather than the manufacturing companies that are more reliant on the administrative institutions and government bodies that gather the parts and oversee the installation of nuclear reactors. As ethical issues mostly rise within the public corporations' decisions, I've decided to

review reports and books surrounding issues around such institutions rather than investigating private companies.

Another change from the initial plan was using data from the government archives. I have initially planned for more visits to the national archives for necessary documents. However, after reviewing few research reports that analyzed the nuclear history in South Korea, as well as those published from the public institutions; I realized that the government reports are unreliable to truly understand the issues that arose from the nuclear industry (Korea Academy of Nuclear Safety (KANS), 2010; Korea Institute of Nuclear Safety, 2013; Honesty & Passion Partners Co., Ltd., 2018; NSSC, 2018; Korea Atomic Energy Research Institute, 2004). For instance, reports published by the Korean Legislation Research Institution and written by independent scholars contained crucial information about the flaws in the legislations as well as the issues in the construction of many commissions involved in overlooking nuclear safety. However, the research reports from public institutions like KANS failed to address the issues that required review but focused on improving promotion of the usage of nuclear energy. Although it is understandable that the public corporations seek out means of revenue, the lack of effort in safety concerns was obvious upon review. Thus, I focused on external reports as well, including books written by scholars and other retired politicians who have been involved in the nuclear regulatory regimes. However, to avoid any bias in interpreting the documents, I referred to the actual legislations – the Nuclear Safety Act (NSA) and the Enforcement Decree of the Nuclear Safety Act (EDNSA) – to compare the past research and arguments against the current law, as well as any news articles that updated on the situation after the reports were published.

Since the nuclear energy industry is controlled by the public corporations that control and oversee every manufacturing process of the private companies, the government is, predictably, biased towards nuclear energy. This means that the MTIE will actively seek means to advertise the benefits of nuclear energy to increase its revenue and avoid budget reductions. Since the President makes a decision that can override any of the Ministry's plans for revenues, the government's reports and papers only spotlight the benefits of nuclear energy without addressing any concerns that might risk their business. For instance, the reports written by the NSSC contained numerous errors in its official translation from Korean to English. This included subtracting the details of their research and subtle changes in nuances of the translation by editing the more mechanical tone of the original Korean report to something more emotional. In the case of the NSSC report "Promotion of Radiation Safety Culture" (2010), the report added a detailed explanation on the public's fear regarding nuclear energy and radiation in the English translation:

> Some people do not give a credit to nuclear safety and are even unnecessarily fearful to radiation. Even if natural radiation existing everywhere in the surroundings cannot be perceived, human beings are unavoidable to receive it around the clock. Radiation and radioactive substances are currently utilized in a wide variety of areas such as medical, industrial, food, and other many sectors. However, not only do a majority of people misunderstand their usefulness, but also they have an unthinkably uneasy feeling. Furthermore, they reflect an allergic reaction to nuclear energy (p. vii).

However, the original Korean report made a detailed explanation on how to improve promotion of the Safety Culture with only a single sentence describing the public's anxiety and fear regarding nuclear energy (NSSC, 2010, p. iii). This seemed as though the translation was not

merely a mistake due to the language differences, but more purposeful and meticulous in its design. Thus, it was necessary to investigate external papers that analyze the situation. In this process, it was crucial to take account of the political situation of the time that the different reports were written in as nuclear energy is a highly politicized topic due to its history in South Korea.

University libraries were the primary off-line source for documents. Since South Korea is highly digitalized in terms of information, most public reports and papers were able to be accessed through online. On the other hand, external papers and books written by scholars were best accessed through university libraries. I primarily visited Seoul National University's Central Library and Yonsei University's Central Library to collect data. Although there were libraries dedicated on legal research for each university, I accessed books in the Central Libraries instead to interpret the legal issues in an inter-disciplinary perspective. For this reason, the books that I've analyzed were written by a combination of legal scholars, politicians, scientists, economists, and sociologists to understand the issue in different paradigms. This allowed a richer scope of the issue with a focus on the Sociolegal perspective.

Unlike other documents and reports that were easily accessed through government's online websites and the libraries, the court decisions required more screening processes to access the details of individual cases. After being approved by the Supreme Court Library of Korea, I went into a secluded office that only allowed access to a summary of the case and the case numbers. I separately applied to the copies of the case laws so I can receive it through electronic mails. The online copies of the court cases were not sent out within predictable dates but was sent out irregularly, some taking two to three weeks upon request. I was not able to request for several court decisions for this specific report due to this delay. Another set of court decisions were also unavailable due to the restriction that any records that has not been anonymized are unavailable, while others were unavailable due to the discretion of the courts. However, many of the court decisions provided sufficient evidence for the overarching analysis of this research.

My initial plan involved reviewing around thirty reports or relevant data for the research. However, unforeseen circumstances over the six weeks had caused delay in reviewing data according to the plan. It had significantly reduced the number of data reviewed for this research. However, I was able to focus on few main issues, especially of administration, legal framework, and work culture in relation to the nuclear regulatory regimes that hindered any efforts to ensure safety of the public. This report contains an overview of the findings based on reviewing 20 secondary data, including reports, books, and court decisions. Supplementary data such as news articles, legislations, and supporting evidence are put into consideration as I write the report.

Context: History of Nuclear Energy in South Korea

The history of nuclear energy industry in South Korea started in 1962 with the introduction of TRIGA MARK-II, which was an American nuclear reactor used for an academic research purpose rather than energy production (J. G. Kim, 2002, p. 178). Despite bringing in an American reactor to mark the start, the development of South Korean nuclear history diverges from other developed countries.

The start of an actual nuclear reactor development occurred in 1978 with Gori Unit 1 (고리 1 호), which indicated the change in energy politics (M. Kim. & J. H. Choi, 2013, p. 18). This was under President Park Chung-Hee's presidential regime, who was a president ruling with an iron fist and cruelty. He is more well-known for his authoritarian approach to politics by purporting democracy. Yet, he was largely responsible for the rapid economic development from 1961 to 1979 despite the country being in ruins after the Korean War as well (Wilson Center, n.d.). Subsequently, the nuclear energy industry was able to start off as a national business, which continues today in the form of a public corporation controlled by the government ministries. The expansion of the nuclear energy continued until late 1980s as the presidential regime changed to Chun Doo-Hwan, who had a similar ideology as President Park. By 1986, the usage of nuclear energy throughout the country exceeded coal, which was unlike the global trend of declining nuclear energy usage due to Three-Mile Island Accident of US in 1979 and the Chernobyl Disaster of Ukraine in 1986. By 1987, the nuclear energy took up more than 50% of energy production in South Korea (M. Kim & J. H. Choi, 2013, p. 18). This was all possible due to both President Park and Chun's "authoritarian" (M. Kim & J. H. Choi, 2013, p. 18) regime that prevented any social movements against the nuclear energy expansion. Since both regimes reigned when massive democratic movements occurring against them, resulting in both violent killings from the government and media oppression; it was impossible for anyone to be aware of the nuclear energy expansion, let alone oppose them. However, once democracy settled into a more stable structure after the struggles for freedom, the public was allowed to share more opinions about nuclear energy – including any kind of fear and academic opinions. By the 1990s, the nuclear energy production reduced to around 40% of total energy production throughout the country as a response to these concerns. Then, reduced to one-third by 2013 (M. Kim & J. H. Choi, 2013, pp. 18-19).

South Korea's nuclear energy development followed the track that was alike to how the economy grew. There are no natural resources that the country can rely on, but there are human power that it can rely on for growth. As such, despite the lack of natural resources such as uranium, South Korea developed to possess independency in terms of the technology to build reactors and relevant facilities. This contributed to the nuclear energy industry's growth along with the fact that the country gained more wealth to purchase the natural resources for nuclear reactor constructions. As the nuclear energy industry drastically developed in a short period of time, especially during the period where people could not freely express their opinions, the decision-making power solely relied on elitism of the industry as well (M. Kim & J. H. Choi, 2013). The paradigm that only the academic experts could make an input for all matters relevant to the nuclear energy industry had solidified. This was an idea that aligned with the vertical hierarchy that pervades most professional relationships within the nation until nowadays. However, the Fukushima Nuclear Disaster in 2011 along with exposures of corruption cases surrounding the nuclear energy industry brought changes. It led to more social movements about nuclear energy as the public started to regard nuclear energy with more caution while becoming aware of its impact to the environment.

The nature of nuclear energy industry in South Korea is highly politicized due to its history. The nuclear energy industry drastically grew during the oppressive regimes, which the current conservative party supports; while it reduced when more liberal party's members were elected as the president. This is evident even in the recent policy changes. President Moon Jae-

In, a member of the more liberal party The Minjoo Party of Korea, had started a plan to gradually reduce reliance on nuclear energy for the next thirty years since his regime started in 2017 (J. Lee, 2019). His plan was to transition to renewable energy such as solar power or wind turbines. This national energy plan included shutting down old nuclear reactors that had their life span extended beyond what they were intended for; and preventing new nuclear reactors from being built. According to the Third National Master Plan for Energy, the plan was to proceed diverting from nuclear energy over the span of next 40 years (J. Lee, 2019). However, when President Yoon Seok-Yeol was elected in 2022, who is a member of the conservative party People Power Party, he upturned the previous regime's plans. He restarted the nuclear reactors that were planned to shut down, such as SinHanul Units 3 and 4 (신한울 3, 4 호기) (Yoo, 2023; H. Ko, 2023; MTIE, 2023). According to the Tenth Basic Plan of Long-Term Electricity Supply and Demand written in 2022 by President Yoon's regime, it planned to increase the percentage of nuclear energy from 23.3% in 2022 to 31.7% by 2036. Such politicization and historical elitism of the industry had impacted most of the policies as well as various judicial decisions, deeply impacting the safety of the people living around the areas where nuclear reactors are built.

Context: Legal Framework and South Korean History

The nuclear laws of South Korea were written based on Japan and American legislations (J. G. Kim, 2002, p. 179). The general framework is alike to Japan, like the Atomic Energy Act (원자력법령체계) that was based on Japanese law. However, the specific standards for oversight, testing, and inspection are based on the U.S.' Code and Standard (J. G. Kim, 2002, pp. 179-181). This is due to the history behind the start of nuclear energy development. As South Korea was in reconstruction from the ruins of both Japanese colonization and the Korean War, it was inevitable for the nation to bring in the laws from neighbouring countries for reference. Since the Japanese remnants of the 35 years-long, violent colonization existed within the government institutions, the administrative structures followed the Japanese nuclear institutions' structures. On the other hand, the U.S. model for technical regulations were modified just as it did for democracy after the Korean War. This was necessary since the country was not slowly building up from the foundation, but rapidly developing in an abnormal speed, enough to be called a "Miracle of the Han River".

The subsequent rapid development of nation's nuclear energy technology also led to difficulties in tailoring the details of the law. For instance, the regulatory regimes that are tailored within the country is very weak and fragile. In fact, it is impossible to plan/construct/inspect a single nuclear reactor without utilizing/referring to the U.S. Nuclear Regulatory Commission's code and standards despite the vast differences of the environment and the composition of the nuclear energy industry (Ha, 2022, pp. 86-88). According to Kim Jae-Gwang (2002), it is generally accepted by the countries to decide practical regulation regimes through minor legislations, especially for safety regulations. This is what emphasizes the importance of administrative rules' authority regarding nuclear energy law. However, South Korea has weak administrative rules that cannot be applied fairly and effectively due to the fast-paced development culture as demonstrated in this report.

South Korea's practical safety regulations are usually under the EDNSA rather than the NSA, which has more legal power and stronger enforcement power than EDNSA. This characteristic also emphasizes the fact that the law is designed to be applied on a case-by-case basis rather than having a certain framework that every stakeholder must follow (J. G. Kim, 2002). This lack of uniformity of the law caused confusions and issues despite its purpose to adjust to the rapid development of technology and volatile circumstances of the nuclear energy industry. Moreover, there is a contradiction in the law's purpose. Despite the law being designed to be flexible, these volatile decrees of the EDNSA are not as easy to be fixed and adjusted as needed. There is a requirement of the relevant Ministries – usually the Ministry of Science and Technology (MST), and the MTIE – to agree upon any planned amendments. This often leads to delays when there is a disagreement, leading to further hindrance over any safety regulation regimes (J. Kim, 2002).

This analysis of the legal framework's history is based on a report written in 2002. However, there were no amendments made to address these issues of the legal framework since 2002, only marking edits to specific decrees or minor edits based on the changing names of the ministries. Thus, despite the data that should be outdated, the information is still relevant to the research today.

Another major framework of the nuclear regulatory regime of South Korea is the administrative body: NSSC. It is a separate body that oversees the nuclear energy industry, which is separate from the Ministries and the public corporations involved. Even though the NSSC is supposed to be an independent body functioning to ensure a fair and honest oversight over the nuclear energy industry, the decision-making power over the NSSC's members solely rely on the president (J. G. Kim, 2002; Ha, 2022). This is related to the fact that the NSSC was first founded in 2011 to encompass both the technology issues and safety issues regarding nuclear energy, long after the industry settled in the nation. As does the many decrees of the EDNSA, these presents an issue considering how politicized the nuclear energy controversy is within South Korea.

Findings: Issues

The administration mainly relies on the NSSC, which is supposed to be a reliant independent body that the nuclear energy industry can rely on for safety inspections and regulations. Yet, as stated above, the NSSC's 9 commissioners are elected by the President. This system would not have been problematic if the industry was a private business. However, since the entire industry's main bodies are public corporations with deep ties to the government, this did not provide the adequate independence required for impartial inspections. Moreover, the NSSC contains only two standing committee members. Due to the lack of members to deal with the issues that arise in a nation with a strong nuclear energy industry, most of the duties that should have been a part of the standing committee members' responsibilities are delegated to the lower bureaus within the NSSC (Ha, 2022). These bureaus are composed of non-experts who only deal with technical issues that arise, meaning that the delegations of duties are not as efficient and well-thought out as it would be among the experts elected as commissioners and the standing committee. The more scientific issues that arise, which happen to be less concerned

with safety regulations also end up being delegated to Korean Institute of Nuclear Safety (KINS) rather than the NSSC (Ha, 2022, pp. 89-90). Thus, the NSSC ends up taking the role of getting reports rather than autonomous decision-making. The lower bureaus of the NSSC and KINS must necessarily cooperate with one another as they both deal with the issue that came from the same upper bureau. However, as the KINS is a separate institute from the NSSC despite it being a large body within the commands of NSSC, the communication process is delayed.

The issue of NSSC is exacerbated by the fact that the delegation of duties to lower bureaus and KINS does not give the authority to the NSSC to directly administrate the issues regarding their innerworkings and human resources (Ha, 2022). This creates a doubt as to whether the NSSC truly has the autonomy it needs when ensuring the regulatory regimes are followed within the nuclear energy industry. This is connected to the legal issues in terms of work delegation. The NSSC does not have a defined responsibility or function regarding the "efficient performance of research and development work" (Ha, 2022, p. 87) of the commission's bodies. This results in the NSSC being prevented from using any of the research and development findings from the delegated work to be used for creation and amendments of the legal regulatory regimes (Ha, 2022). Despite the NSSC being the largest authority to have control over the nuclear regulatory regimes, it does not have the capacity to complete safety related practices as it lacks the structure to pass its own budget autonomously. Thus, the NSSC is not effectively performing its duties to ensure that the relevant corporations are following the regulatory regimes for safety, simply due to lack of administrative power.

Another main issue exists in the legal framework itself. For instance, there is no "cost-benefit analysis" or "reparation policy for radiation exposure" (Ha, 2022, p. 91) legalized in the South Korean Nuclear Safety Act framework. There are legislative regulatory regimes regarding "nuclear energy facility technology standard" and "technology standard for radiation exposure inspection" (Ha, 2022, p. 91) with 97 sub-regulatory standards. The problem is that many of these legislations overlook the importance of "current licensing document" or "licensing basis document" (Ha, 2022, pp. 91-2) for the nuclear reactor facilities, allowing them to avoid responsibilities in case of industrial accidents. Another legal framework that must be considered is the KINS' Operation Permit Inspection Standard (OPIS). This OPIS translates and adjusts the U.S. NRC's NUREG-0800 (Standard Review for NPPs) to be utilized without loyally following every standard, leading to lack of legal standards and requirements being fulfilled. Yet, this standard has been continued to be used for both nuclear energy development and reactor operation permit inspection. In fact, Chapter 18 Human Factors Engineering and Chapter 19 Severe Accident are not following the format of NUREG-0800, which leads to fatal flaws when compensating human resources that fell victim to radiation exposure (Ha, 2022, pp. 91-93).

Furthermore, these do not sufficiently address any radiation exposure experienced by people working in nuclear energy facilities or living around the nuclear reactors. There is, indeed, a reparation act ensured for those who have been exposed to radiation while working in nuclear reactor facilities through the Act on the Honorable Treatment of and Support for Persons of Distinguished Service to the State. However, as seen by a court case from 2019 and decision finalized in 2023, an individual who have passed away due to a disease, which is suspected to be a result of their work in a radioactive environment, was not able to be compensated through this Act. The final judgement was based on the lack of proof to demonstrate that the radiation

exposed during work was significant enough to result in the victim's illness and eventual death. This was based on a very detailed number of radiation exposure, meaning that although a certain amount of radiation could have affected a worker's health, it cannot be compensated without exceeding that amount. Since there are no other legal regimes to properly address the nuclear energy industry's dangers and risk, this case was unable to consider how the individuals might be pre-disposed to become more susceptible to radiation exposure. In fact, it is more common for the cases to be determined that the fault lies with the worker who have worked despite a certain risk to be more vulnerable rather than addressing the lack of inspection and administration in ensuring that workers have all followed the regulatory regimes ensuring their safety.

These problems are exacerbated due to the gap between technology development and independence of regulatory regimes. Although South Korea is unable to design/construct/ensure safety through its own regulatory regimes, KHNP and the relevant institutions are continuing to advertise how the nation possesses one of the world's top design technologies for next generation nuclear reactor modules like APR1400 (Ha, 2022, pp. 92-93). It is true that there are sublime standards and requirements for nuclear reactor designs and constructions. However, there are no methodologies for radiation analysis or safety analysis.

The convergence between the administration's lack of administrative power and a fragile legal framework leads to extreme advantages of the public corporations against NGOs and other civic organizations composed of inhabitants around the nuclear reactors. For instance, WolSeong Unit 1 (월성 1 호기) was planned to undergo a life span expansion construction in 2015, which allows the nuclear reactor to operate longer than its estimated life span of 60 years. However, this business was plagued with controversies around safety issues and illegal deeds in administrative actions. The civic organization composed of 2167 civilians went into court about this case, hoping for its deactivation. The accused of this case was the NSSC as the commission was *legally* responsible for approving the nuclear reactor's operation and technological inspection. However, the true stakeholder who was responsible for the controversies was KHNP, the business operator. As the KHNP was not the accused despite their responsibility with the case, it allowed them to avoid submitting many of the documents requested from the court. This included every necessary document related to technological review related to the life span extension business. The KHNP only submitted a fraction of these documents under the justification that the submission would infringe on intellectual property rights and trade secrets (J. H. Choi, 2019; J. S. Kim, 2021; Ha, 2022, p. 133; J. Jeong, 2021). This resulted a disadvantage for the civic organization that accused the NSSC as they were unable to properly inspect the nuclear reactor's safety concerns nor be compensated for the risk the people experienced. It took 6 years until the nuclear reactor facility was shut down for its illegal transactions involved in its life expansion business, proving the difficulty to go against the government's corporations and institutions.

Another major issue of the nuclear energy industry that leads to safety concerns beyond the legal framework is the work culture. According to Kim Sung-Hwan and Lee Seung-Jun (2014), there is an overwhelming amount of pressure that the field workers of the industry experience due to frequent accidents and breakdowns of the nuclear reactors. The drastic changes of the energy policies depending on the presidential regimes also contribute to these structural issues. The field workers would not have the time to physically adjust the system to the

drastically changing policies while the administration pressures them to change as quickly as possible – alike the rapid changes that the country often undergoes despite its impossibility. This pressure often leads to concealment to avoid reprimand and any legal consequences when the reactor experiences an error or a breakdown. Although the breakdowns occur more frequently than what the public perceives, there is a work culture where both the field workers and administrations hide these accidents under the justification to avoid unnecessary fear mongering. It is true that the nuclear reactors are designed to stop automatically even for a minimal error of a single part as they are constructed with two to three million parts. It is also true that these breakdowns and stops do not result in severe accidents such as an explosion or radiation exposure – South Korea has not experienced any major nuclear disasters (S. Kim & S. Lee, 2014; J. G. Kim, 2002). However, this does not mean that these accidents can be written off from the reports to seem safe. On March 14th of 2012, for instance, the Ministry of Knowledge Economy and the KNHP apologized for concealing an accident of Gori Unit 1, a blackout for 12 minutes that increased the temperature of the coolant, which had the risk of transforming into a severe accident/meltdown. This accident did not follow through the normal report system that goes through "Gori Unit 1 → Gori nuclear energy agency → KNHP → MKE → NSSC" (S. Kim & S. Lee, 2014, p. 18). Instead, the accident was hidden for an entire month since the accident in January. This accident was revealed to the administration only after a politician overheard a conversation about the blackout in this nuclear reactor while drinking in a small restaurant at the seaside. The accident was alike to the cause the Fukushima Nuclear Disaster, meaning that this concealed accident had the potential of becoming a severe disaster. In fact, at the time of this blackout, one of the two emergency generator was broken while the other was getting fixed. Yet, this severe risk was never planned to be revealed until the conversation was overheard by an outsider. It is more striking since this accident had occurred less than a year after the Fukushima Nuclear Disaster.

This Gori Unit 1 accident was a result of three things: 1) the field worker's mistake; 2) dysfunction of emergency facilities; 3) the field administrators' concealment of the accident (S. Kim & S. Lee, 2014, pp. 17-27). The accident report and the subsequent investigation eventually revealed that the major parts used to construct nuclear reactors did not pass the appropriate tests to ensure its safety. The corruption such as this is common throughout the nuclear energy industry in South Korea. There are fake parts used for the construction of nuclear reactors for cheap budgets because of supply corruption. According to the 2013 ~ 14 major corruption incident, 100 workers of KHNP was sued for using 7,733 unverified parts for 20 nuclear reactors in function, eventually leading to 83 workers being confirmed guilty (J. Lee, 2019). However, the retired executives of KNHP often get re-hired in related corporations, allowing the continuation of supply corruption (J. Lee, 2019). The past court decisions also reveal that the punishment of the crime does not prevent these corrupted individuals from getting involved in the industry again, especially within the elitist industry that requires expertise for people to be involved in the decision-making process. The cycle must be discontinued for a safer legal and work culture to settle in the country.

Conclusion

This research will provide a foundation for the ongoing comparative and international work on reactor risk and regulation. The South Korean legal framework of the nuclear regulatory regimes was built based on the US and Japanese laws, becoming relevant to the international context. The issues around the legal framework that failed to be tailored to the circumstances and the culture of the country revealed how it is insufficient for existing laws to be implanted without considering different circumstances of other nations. It also divulged into many structural issues in both the legal aspects and administration work that look at the flaws of the laws and the issues within the field workers prone to concealment to evade consequences and fear mongering among the public.

Considering the historical, political, and legal contexts of South Korea while looking at the visible issues in the nuclear regulatory regimes further reveal that adjustments in the legislations will not be sufficient to ensure safety. For instance, it is likely that more concealments may occur in the future to avoid legal consequences if the law is amended without any efforts to deal with the work culture and the overall perception of the nuclear energy industry. The politicization of the nuclear energy industry further hinders safety and progress for this reason. Constant changes in energy policies with focus on politics rather than health and environment will continue to pressure the field workers and increase concealments of potentially dangerous accidents that may mount to major meltdowns. More efforts should be made to address the safety concerns, administrative issues, as well as the NSSC's structural dysfunction since the gap between technological development and regulatory regimes continues to widen in the face of next generation nuclear reactor modules.

The research was able to understand the intersections between law and the South Korean context not solely based on the secondary data analysis but the understanding of the language, cultures, and institutions of South Korea as a researcher and a normal citizen of the nation as well. This research can become a foreground to further address the gaps between legal regulatory regimes and the expansion of nuclear power in South Korea.

There is a need for uniformity and impartial legal decision-making to ensure safety of the nuclear energy industry to prevent drastic changes of the political regimes from increasing risk to health and environment. However, this report does not address the exhaustive list of issues within the South Korean regulatory regimes. There are other issues regarding politicization of nuclear energy controversy, and corruption within the judiciary and the prosecution services. I hope this research report will be able to promote public discussion surrounding South Korean nuclear regulatory regimes while being impartial to political parties and economic benefits; and to focus on health and environment threatened by weak legal protections.

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