

An Empirical Comparative Study on Recognition of Nuclear Safety and Recognition of the Cause of Nuclear Accident in Korea and Japan

- Focusing on the post-Fukushima nuclear accident -

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1. Nuclear Policy Trends in East Asian Countries

✓ The recent trends in nuclear power generation in East Asian countries are as follows.

country	trends
Korea	<p>Cardinal number in operation: 24 units Ratio of nuclear power to total power generation: 23.7% The Moon administration, which was born in May 2017, declared a shift to a nuclear-free policy, and in June 2018, decided to close one unit early and cancel the construction plan for four units.◦</p>
Japan	<p>Cardinal number in operation: 9 units In Japan, nuclear power plants have been out of operation for a long time after the Great East Japan Earthquake, and after the enforcement of the new regulatory standards in August 2015, nine units were restarted by November 2019, capacity factor remains sluggish.</p>
China	<p>Cardinal number in operation: 45 units Ratio of nuclear power to total power generation: 4.2% In the plan announced in January 2013, the target for 2020 installed capacity of 58 million kW was presented.</p>
Taiwan	<p>Cardinal number in operation: 4 units Ratio of nuclear power to total power generation: 11.4% In January 2017, the bill to amend the Electricity Business Act, which included the shutdown of all nuclear power plants by 2025, was deleted as a result of a referendum in November 2018.◦</p>

- Cardinal number in operation: As of January 2019 / Ratio of nuclear power to total power generation: 2018 actual value
- (Source: Trends in the development of nuclear power generation in the world, Japan Atomic Industries Association)

2. The need for research

- ✓ After the Fukushima accident, Korea and Japan established safety checks and measures and quickly implemented them. At the same time, the two countries carried out activities to improve nuclear safety related laws and administrative systems focusing on strengthening nuclear safety regulations.
- ✓ Therefore, contrary to public concerns, the governments of Korea and Japan and the nuclear industry argued that after the Fukushima accident, the risk of accidents was significantly lowered by sufficient safety measures of nuclear power plants.
 - After the Fukushima nuclear power plant accident in Japan, 75.6% of the Korean nuclear experts recognized that Korean nuclear power plants are "safe"(Hong Sa-gyun et al., 2011).
- ✓ However, despite various policy changes and safety measures since the Fukushima accident, safety accidents at nuclear power plants continue to occur as shown in<Table1>.
- ✓ Looking at these cases, even after the Fukushima nuclear accident, we are compelled to raise questions about the safety of nuclear power plants.

<Table 1> Nuclear power plant incidents by year in Korea
(as of the end of 2019)

Year/Grade	0	1	2	More than 3	Total
2010	13	0	1	0	14
2011	10	2	0	0	12
2012	14	1	1	0	16
2013	5	3	0	0	8
2014	8	4	0	0	12
2015	4	1	0	0	5
2016	14	2	0	0	16
2017	4	1	0	0	5
2018	9	1	0	0	10
2019	3	1	1	0	5
Total	84	16	3	0	103

(source: OPIS, <https://opis.kins.re.kr/opis?act=KROCA1100R>)

※ In the International Nuclear Event Class (INES), classes are classified from 1 to 7 according to the safety importance of events in nuclear power, and 1 to 3 are defined as accidents, and 4 or more are defined as accidents. . Events that are not critical to safety are classified as minor Deviation as below grade (0 grade/below scale). (source : OPIS)

3. Purpose and background of the study

O. Purpose of the research

- ✓ To clarify these issues, I conducted an empirical comparative study (survey and in-depth interview) with nuclear experts in Korea and Japan in this study. Through this study, I would like to clarify the reality of nuclear safety and to suggest the direction of a relevant nuclear safety policy.

O. Research background

- ✓ This thesis can be said to be a convergence research in which a researcher in humanities studies a specialized field of engineering called nuclear power.
 - I am a researcher in humanities and is currently working in the safety department of POSCO, a major steelmaker.
- ✓ This paper was prepared by extracting and summarizing the safety assessment part of the doctoral thesis.
- ※ My doctoral thesis is “An Empirical Comparative Study on Nuclear Safety Management Systems in Korea and Japan”(2019.2).
 - 7 sectors: *safety assessment, safety policies and systems, safety regulatory agencies, facility safety and operation organizations, international cooperation, safety infrastructure construction, safety culture*

4. Survey design

✓ Subject and method of investigation

- A total of 400 questionnaires were distributed to nuclear experts in Korea and Japan, each of 200 copies.

	Korea	Japan
Object	Government officials, nuclear power plant-related industries, nuclear-related research institutes, and other public institutions, educational institutions such as universities, civil organizations, etc.	
Period	November 1-November 30, 2017	December 1-December 25, 2017
Method	Online and visit research using List	
Sample	Discretionary allocation by field for nuclear work-related workers	
Respondents	51 people	83 people
Collection tools	Structured Questionnaire	

5. Survey results: Nuclear safety

- ✓ The analysis results showed no difference in perception of nuclear safety. Both countries were generally perceived as safe.
 - This is because 82.3% of Korean experts answered 'yes' and 'very yes', whereas 79.5% of Japanese experts answered 'yes' and 'very yes'. However, Japan had somewhat more negative opinions on nuclear safety than Korea.
- ✓ <Table 2> Comparison of perceptions on nuclear safety (Unit: persons)

Items		Korean (%)	Japanese (%)	Total (%)
How safe do you think your country's nuclear power plants are?	Not safe at all	1(2.0)	5(6.0)	6(4.5)
	Not safe	1(2.0)	1(1.2)	2(1.5)
	it's average	7(13.7)	11(13.3)	18(13.4)
	safe	24(47.1)	51(61.4)	75(56.0)
	It is very safe	18(35.2)	15(18.1)	33(24.6)
Total		51(100)	83(100)	134(100)
Average		3.84	4.12	
Standard Deviation		.943	.864	

6. Survey results: Factors causing accidents

- ✓ There was a difference in perception of the possibility of causing an accident.
 - Korean experts were thinking about the possibility of accidents due to natural disasters such as earthquakes and tsunamis (43.1%). However, Korean experts thought that there was little (7.8%) the possibility of accidents caused by external factors such as war and terrorism.
 - However, Japanese experts thought the most about the possibility of accidents caused by external attacks such as war and terror (51.8%).
- ✓ <Table 3> Comparison of perceptions on factors causing accidents (Unit: persons)

Items	Korean (%),	Japanese (%)	Total (%)
1. Serious accidents caused by natural disasters such as earthquakes and tsunamis	22(43.1)	24(28.9)	46(34.3)
2. Severe accidents caused by external attacks such as war and terrorism	4(7.8)	43(51.8)	47(35.1)
3. Accidents caused by human factors such as neglect of safety rules	20(39.2)	9(10.8)	29(21.6)
4. Secondary pollution accident by radioactive waste	2(3.9)	3(3.6)	5(3.7)
5. Other	3(5.9)	4(4.8)	7(5.3)
Total	51(100)	83(100)	134(100)

7. In-depth Interview design

✓ Subject and method of interview

- Interviews were held in Korea and Japan for about two and a half months from mid-January to late March 2018. For in-depth interviews, 15 people were selected from four expert groups in Korea and Japan.

	Korea	Japan
Government agency official group	Korea Institute of Nuclear Safety and Technology	Former high-ranking official of the Ministry of Economy, Trade and Industry
Nuclear power plant operator group	Nuclear power plant executive	Nuclear power plant executive
Public sector groups such as research institutes	Researcher, Korea Atomic Energy Research Institute, Researcher at the Nuclear Cooperation Foundation	Researcher, Japan Atomic Energy Research Institute, Electric Power Research Institute Researcher
General Expert Group	University professor, Nuclear power plant civil monitoring center director, Newspaper reporter	University professor, Atomic Energy Society executive, Representative of the zero nuclear power plant movement

✓ Composition and Analysis of Interview Questionnaire

- **The question content of the in-depth interview was composed of variables with differences in the survey.**
- **The accident occurrence factors were classified into three types: human factor, natural disaster, war and terrorism**

8. Safety awareness

- ✓ There was no difference in perception of nuclear power plant safety by country and by expert group. It is generally safe, but it cannot be said that there is no possibility of an accident.
 - The survey results showed that 82.3% of Korean experts answered 'yes' and 'very much' about safety, and 79.5% of Japanese experts answered 'yes' and 'very yes'.
- ✓ The differences in perception of each expert group are as follows.

	an nuclear power plant expert	an anti-nuclear power plant expert
Safety awareness	This confirmed that experts are generally convinced of the safety of nuclear power plants.	However, an anti-nuclear power plant expert said that nuclear power plants are very dangerous and not safe.

9. Recognition of factors causing accidents: Differences in recognition by country

- ✓ The differences in perceptions by country are as follows.
 - Korea mentioned natural disasters and human factors as the possibility of causing an accident, but war and terror were not considered. This was thought to be due to the increase in natural disaster factors after the 2016 earthquake in Gyeongju.
 - Japan said war, terrorism and human factors could be caused by accidents, but it did not consider natural disasters. This is because the government agency officials groups sufficiently supplemented safety measures and systems, the nuclear power plant workers groups had a perception of concern that police officers would reside before Fukushima in the power plant, and the public sector workers groups was thinking about the possibility of a North Korean missile attack.

10. Recognition of factors causing accidents: Recognition by type/ expert group

✓ The differences in perception of each expert group are as follows

	A human factor	A factor of natural disasters	the factors of war and terror
Government agency official group	Korean considered the possibility of an employee's mistake as a factor that caused the accident because they prepared for natural disasters sufficiently.		Japanese had sufficient safety preparations and system enhancements.
Nuclear power plant operator group		Korean said that it was due to an extreme disaster that we did not expect	Japanese had a perception of concern that police officers would reside in the power plant before the Fukushima accident.
Public sector groups such as research institutes	Korean thought that there was no possibility of a natural disaster, as it had taken sufficient safety measures unlike Fukushima by installing emergency generators on the ground.		Japanese were thinking about North Korean missile attacks.
General Expert Group	Korean considered the possibility of corruption or mistakes of employees rather than technical factors, and Japanese experts thought that it was a person's carelessness or mistakes.	Korean said that it was due to the change in public perception after the Pohang and Gyeongju earthquakes	

11. Conclusion

- ✓ **The research results are as follows.**
 - **Korea considered natural disasters and human factors, and Japan recognized war, terrorism and human factors as factors of accident.**
 - **In particular, most experts in Japan, unlike Korea, considered war and terrorism as causes of accidents. This is because they have sufficiently prepared for accidents caused by natural disasters and human factors through institutional supplementation.**

- ✓ **The difference in perception between the two countries is as follows..**
 - **First, Korean experts were not aware of the possibility and danger of war and terrorism. In the in-depth interview, they vaguely perceived war and terrorism as a national risk, not just nuclear power plants.**
 - **Second, since Japan has sufficiently established safety measures after the Fukushima nuclear accident, they are more concerned with the possibility of war or terrorism than natural disasters and human factors.**
 - **Third, in general expert groups, Korean experts were thinking about the possibility of employee corruption or mistakes. However, Japanese experts thought that humans were vigilant or making mistakes.**

12. Future Work

- ✓ **Safety awareness improvement and accident prevention plan**
 - We say that the safety evaluation of nuclear power plants is high, so we should not be relieved or overconfident. This is because some of the reasons the Fukushima nuclear accident was caused by policy decisions only by nuclear experts.
 - Therefore, I generally think that the safety awareness of experts is quite high, but I think that sufficient review and countermeasures should be prepared for factors that may cause accidents even a little.

- ✓ **Proposal for joint research**
 - I would like to propose joint research and presentation by selecting a theme on nuclear safety in East Asia. For example, nuclear safety awareness survey, safety standard setting, emergency notification plan in case of accident, etc.

- ※ **If you are interested in joint research, please contact me.**

13. REFERENCES

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Read it to the end, Thank you very much

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