**Safety issues raised by North Korea’s nuclear activities**

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**Introduction**

To date nuclear safety aspects of North Korea’s nuclear activities have attracted relatively limited attention, being seen as a second order problem compared with nuclear proliferation issues. However, current developments underscore the need to also address nuclear safety.

North Korea is well advanced with construction of a small indigenous pressurised light water reactor (PWR), and has revealed the existence of an operational gas centrifuge uranium enrichment facility. Both these facilities are at the Yongbyon nuclear complex. In addition to these and the other known facilities at Yongbyon, North Korea may well have other nuclear facilities, e.g. it is highly unlikely that the Yongbyon enrichment plant is North Korea’s only centrifuge enrichment facility.

The key lesson from the Fukushima nuclear accidents is that nuclear programs cannot be regarded as the exclusive preserve of individual states – a major nuclear accident will have consequences well beyond the borders of the state concerned. Considering the proximity of neighbouring states, this is a particular concern in an area like the Korean Peninsula – the Yongbyon site is only 100 kilometres from the Chinese border and 200 kilometres from South Korea. Every state with a nuclear program has an international responsibility to manage this program safely, to ensure it does not present a danger to other states.

Effective management of nuclear programs requires a high degree of international cooperation. The vital international interest in the safe operation of nuclear programs is reflected through treaties such as the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the IAEA’s nuclear safety standards, and institutions such as WANO (World Association of Nuclear Operators). It is essential for states with nuclear programs to participate in these treaties and activities.

Today all the states with nuclear power reactors, except Iran, are party to the Nuclear Safety Convention. All such states, except Iran, Mexico[[1]](#footnote-1) and Pakistan, are also party to the Joint Convention. North Korea cannot afford to stay outside the international nuclear safety community, all the more if it continues with a power reactor of its own design and construction, with all the risks this entails. And other states, especially those in the region, cannot afford to have North Korea outside nuclear safety norms.

**International safety principles**

The IAEA, in cooperation with several other international organisations, has established fundamental nuclear safety principles to be applied in the management of nuclear activities. These principles are briefly outlined as follows:

1. The prime responsibility for safety must rest with the person or organisation responsible for facilities and activities that give rise to radiation risks.
2. An effective legal and governmental framework for safety, including an independent regulatory body, must be established and sustained.
3. Effective leadership and management for safety must be established and sustained in organisations concerned with, and facilities and activities that give rise to, radiation risks.
4. Facilities and activities that give rise to radiation risks must yield an overall benefit.
5. Protection must be optimised to provide the highest level of safety that can reasonably be achieved.
6. Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.
7. People and the environment, present and future, must be protected against radiation risks.
8. All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.
9. Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.
10. Protective actions to reduce existing or unregulated radiation risks must be justified and optimised.

These fundamental safety principles are elaborated in the IAEA’s Safety Standards Series document SF-1, and are given legal effect through the Nuclear Safety Convention.

North Korea has not undertaken any legal commitment to give effect to these safety principles. There is no information on whether any of these principles are applied in North Korea, and if so, to what extent. One of the consequences of Fukushima was that the members of WANO have agreed to mandatory peer reviews of safety at nuclear facilities. North Korea does not participate in any peer review process – peer reviews, either through the IAEA or WANO, would be important for providing confidence about its nuclear safety performance.

The international community knows nothing about nuclear safety in North Korea. For instance, what are the safety standards and practices it applies, and can North Korea’s National Nuclear Safety Commission be considered an independent nuclear safety regulator?

**The North Korean nuclear program and potential nuclear safety risks**

Without knowing the full extent of the North Korean nuclear program, it is not possible to assess the extent of nuclear safety risk in North Korea. Some general remarks are as follows.

Historical program: North Korea has operated the following facilities at the Yongbyon site:

* an indigenous gas-graphite reactor of around 30 megawatts (MW) thermal power, usually referred to as the 5 MWe (megawatts electrical) reactor. Being a graphite-moderated reactor, there is a potential risk of fire if Wigner energy forming in the graphite is not dealt with effectively.[[2]](#footnote-2) In the event of a reactor fire, radioactive contamination could spread over a very wide area. This risk does not apply currently as the reactor is not operational (its cooling tower was demolished in 2008), but would have to be taken into account if the reactor were restarted;
* a Russian-supplied IRT-2000 pool-type research reactor, understood to be still operated occasionally. This type of reactor is not considered to present any safety risk beyond the immediate area;
* a fuel fabrication plant, disabled in 2007. Any safety risk from this facility when it was operating was likely to have been localised;
* a reprocessing facility, disabled in 2007 but claimed to have been re-activated in 2009 and subsequently disabled again. The safety risks from this facility are not clear – it is understood that some years ago IAEA inspectors had found areas of the facility were badly contaminated, indicating accidental release of radioactive material;
* a suspected high-level liquid radioactive waste store for reprocessing wastes. The potential for significant radioactive releases from this facility is not known.

Current activities: In 2009 North Korea announced it would build an indigenous experimental light water reactor and an associated uranium enrichment program:

* light water reactor – construction of an indigenously designed PWR commenced in 2010, on the site of the former cooling tower for the 5 MWe reactor at Yongbyon. It appears this reactor is to have a thermal power of 100 MW, and electrical output of 25-30 MWe. The start-up target date was announced as being 2012. Although it appears construction is now well advanced, a 2012 start-up seems unlikely to be achieved.

This PWR gives rise to serious concerns. Nothing is known of the safety of the design, nor of North Korean capabilities to produce pressure vessels, major pipework and other safety-critical components to the necessary high safety standards. International practice is for all aspects of a reactor design and construction to be subject to rigorous approval and inspection procedures. Likewise, fuel design and fabrication require rigorous safety scrutiny. Absent any information on North Korean design, construction and operational standards, there is good reason for concern that if this reactor enters operation it could present the potential for a serious accident, with widespread radioactive contamination;

* uranium enrichment – due to small in-process inventory and low radiation levels, the centrifuge enrichment plant, and any other such facilities, present only a localised safety risk.

On 29 February 2012 North Korea announced it would suspend operation of the Yongbyon enrichment facility with a view to maintaining a positive atmosphere for resumed U.S.-North Korea talks on nuclear and related issues.

**Ensuring nuclear safety is a paramount concern**

The future direction of North Korea’s nuclear program is the subject of negotiation in the Six-Party Talks. Obviously the key issue is termination of the nuclear weapon program, leading to denuclearization of the Korean Peninsula. The negotiations are also likely to cover North Korea’s future energy requirements. Other parties have already argued that pursuing nuclear power is not cost effective for North Korea, and that other energy sources, particularly natural gas from a Russia-South Korea pipeline transiting North Korea, would be both cheaper and faster to bring into production.

However, North Korea has a long-running and consistent interest in nuclear power. If North Korea remains firmly committed to nuclear power, it would be better for all parties, including North Korea itself, if this were provided by imported rather than indigenous reactors. Even if North Korea is able to safely build and operate a small experimental PWR, this would not demonstrate that it can safely scale up to reactors of the size needed for significant power generation. For example, the difficulties of building pressure vessels increase substantially with size.

North Korea has neither the enrichment capability nor the uranium resources to supply a power program. North Korea’s continued operation of an enrichment program is not likely to be endorsed by the other parties because of the ongoing proliferation risk this would present. This is the reason why enrichment was renounced under the 1992 Joint Declaration on the Denuclearization of the Korean Peninsula.

Faced with the technical, economic and safety uncertainties of pursuing an indigenous nuclear power program, revival of the KEDO concept, under which light water reactors were to be constructed in North Korea and supplied with fuel, would be a better option both for North Korea and for neighbouring states.

Whatever the outcome of these negotiations, however, nuclear safety must be regarded as non-negotiable. That is to say, whether North Korea applies international standards of nuclear safety should not be regarded as a matter for negotiation. North Korea has an international responsibility, as well as a responsibility to its own population, to ensure the safety of its nuclear activities.

In view of its stance on other international nuclear issues, is it realistic to expect North Korea to be concerned about its nuclear safety responsibilities? The difference is that the other issues are seen by North Korea as matters of national security – the aims of the Six-Party negotiations include persuading North Korea that its security does not depend on nuclear weapons. These negotiations involve difficult strategic and political issues. When it comes to nuclear safety, however, ensuring high standards of safety is indisputably in North Korea’s own interest. North Korea should not need convincing of this. The only matters for discussion should be, what does North Korea need to do to ensure that its own interests and those of neighbouring states and the international community are met, and how can others assist in this – what cooperation arrangements can be developed?

There are several steps North Korea needs to take:

* joining the relevant treaties, starting with the Nuclear Safety Convention and the Joint Convention;
* ensuring it meets the international fundamental safety principles, especially the requirement for an independent nuclear safety regulator;
* rejoining the IAEA, and taking advantage of the IAEA’s advisory services in ensuring necessary training and capacity building for nuclear safety personnel.

**Conclusion**

It can be expected that North Korea will require encouragement and practical support in taking the steps necessary to meet its nuclear safety responsibilities. Nuclear safety should be an essential element in the resolution of North Korean nuclear issues – but considering the importance of ensuring nuclear safety, all parties, including North Korea itself, should be prepared to take action on safety matters as a high priority without waiting for the overall package to be finalised.

1. . Mexico is planning to sign the Joint Convention. [↑](#footnote-ref-1)
2. . Wigner energy refers to build-up of energy potential in a material, such as graphite, due to the displacement of atoms by neutron irradiation. This energy can release suddenly, generating high temperatures. Release of Wigner energy was the cause of the 1957 Windscale reactor fire. Uncontrolled release of Wigner energy in graphite can be avoided through an annealing process. [↑](#footnote-ref-2)