National Security of Nuclear Energy: A Peaceful Use in the Korean Peninsula

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Introduction

Since the end of the Korean War, security tensions between the South and North Korea have been real and acute. Over the years, national security issues between two Koreas has been characterized by the primacy of military security. For the South, minor conflicts along the border have constantly irritated South Korean security. In order to cope with insecurity, South Korea has attempted to maximize its military power, to mobilize human and material resources, and to maintain an effective alliance with the United States. At the same time, diplomatic normalization with the former Soviet Union and the People's Republic of China has forged a security environment favorable to South Korea, reducing the probability of war in the peninsula.

For the North, ensuring national survival amidst a precarious security environment has remained the primary national goal. Realizing the presence of nuclear weapons in South Korea, North Korea has undertaken gradual but determined development of its own nuclear program. Under international pressure, North Korea did sign the nuclear Nonproliferation Treaty (NPT) in 1985, but delayed until 1992 its ratification and mandated International Atomic Energy Agency (IAEA) safeguards agreement. Conditions for North Korea had radically changed since 1979 to 1980, however, when the decision to produce nuclear weapons were made.[1] With North Korea's announcement of its

1. Paul Doty and Steven Frank, "Arms Control for New Nuclear Nations," in Robert D. Blackwill

Pacific Focus, Vol. XV, No. 2 (Fall 2000), 23-48.

withdrawal from the NPT in 1993 brought about a series of negotiation for nonproliferation between North Korea and the U.S. The negotiation has settled under the so called "Agreed Framework" in 1995 which calls for the establishment of an international consortium, subsequently named the Korean Peninsula Energy Development Organization (KEDO), to build two light-water reactors in North Korea by 2003, while the North pledges to freeze and terminate its nuclear program.

This research examines the nuclear energy issues in the Korean Peninsula toward a particular purpose of analyzing a possibility of establishing multilateral nuclear safeguard system in the Korean Peninsula. It will first discuss the national security environment in the Korean peninsula, followed by nuclear energy issues. Then it will present the analysis of various nuclear safeguard models, including those offered by IAEA and the European Atomic Energy Community (EURATOM). Finally, the three models of regional nuclear safeguards system–(1) KEDO-based model, (2) East Asian atomic energy (ASIATOM) model, and (3) Asia-Pacific atomic energy (PACATOM) model–will be presented and discussed as a building block for the regional arrangement to assure a peaceful use of nuclear energy in the Korean peninsular, and for greater East Asia and Pacific.

National Security Environment in the Korean Peninsula

National security involves multiple dimensions and their dynamic interactions. The first dimension is the security environment, which shapes the nature and type of threats and subsequently national security policies as a whole. The second dimension is the institutional foundation of national security, which involves ideology, political structure and the decision-making process. It is the institutional foundation through which external threats are perceived, assessed, national security policies are developed, and actions are taken. Finally, national security involves a military hardware dimension composed of strategies, tactics, force structure, weapons choice, and related military, industrial, and technological capabilities and resources. While security environment and defense hardware are objectively identifiable, the institutional foundation of national security policy requires subjective evaluations.

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and Albert Carnesale, eds., *New Nuclear Nations: Consequences for U.S. Policy* (New York: Council on Foreign Relations Press, 1993), pp. 69-70.

In the Korean context, the impacts of the democratic opening and the demise of the Cold War on the areas of security environment and defense hardware appear minimal. Despite the end of U.S.-Soviet rivalry and the rise of congenial regional system, the military standoff between North and South Korea remains. The recent nuclear quagmire has heightened military tension on the peninsula, and both Koreas have now entered a high degree of military alert.[2] The precarious security environment has strengthened, not weakened, the previous strategic postures and degree of military mobilization. It is so more because of North Korea's domestic political uncertainty and unpredictable external behavior followed by the death of Kim Il Sung. In fact, North Korea under Kim Jong Il has become more hostile and hysterical toward South Korea than under his father, as evidenced by the recent submarine incident.

Over the years, South Korea has been one of the most rigid and regimented security states in the world. Having undergone traumatic insecurity in the 1950s and 60s, it has preoccupied itself with national security, especially military security. The primacy of national security has been justified through a peculiar form of national security ideology, which emerged in the early 1970s with the advent of the authoritarian Yushin regime. Park Chung-Hee an ideology of "total security *(Chongryuk Anbo),*" which emphasized nationalism (i.e., supremacy of nation-state over individuals), anti-communism, military self-help, and economic growth. The ideology justified the sacrifice of social, economic and political values; for the sake of military buildup, growth was emphasized over equality. In the name of domestic stability and unity, civil liberties were structurally repressed. At the same time, civil society was reorganized, indoctrinated, and mobilized for national security through legal constructs such as the "Anti-Communist Law" and "National Security Law." These often superseded the Constitution.[3]

Along with the ideological dimension, national security decision-making had been overly centralized. Executive dominance prevailed,

2. The United States and North Korea aborted the nuclear crisis by reaching mutual compromise in Geneva. In return for diplomatic recognition and economic assistance to build an alternative nuclear reactor, North Korea agreed to comply with inspections by the International Atomic Energy Agency (IAEA) and to halt further nuclear development. The nuclear fiasco, however, has severely undermined inter-Korean confidence-building. For an overview of the issue, see William J. Taylor and Michael J. Mazarr, "North Korea and the Nuclear Issue: U.S. perspectives," *The Journal of East Asian Affairs*, VII, 2 (1993), pp. 345-370.

3. Dae-kyu Yoon, *Law and Political Authority in South Korea* (Boulder: Westview Press, 1990).

and power and authority were heavily concentrated in a few political elites, such as the President, the presidential staff, the Ministry of National Defense and the Agency for National Security Planning (formerly KCIA). The centralization of decision-making power placed national security issues in a privileged position by insulating them from contending social and political pressures. Strategic doctrines were formulated and implemented without any social and political resistance. Weapons choices, resource mobilization and articulation of defense and foreign policies were subject to neither legislative check and balance nor public screening. Defense spending was exempted from ordinary budgetary processes. Overall civilian participation was fundamentally restricted. The National Assembly was nothing but a rubber stamp, and dissenting public opinions were not tolerated. Using the legal and institutional shield of the National Security Law, the Anti-Communist Law and the Military Secrecy Act, the government tightly controlled and manipulated the flow of information on national security affairs. The production and dissemination of national security information belonged exclusively to the four organizations; the Agency for National Security Planning (ANSP), the Defense Security Command (DSC), the Defense Intelligence Agency (DIA) under the Ministry of National Defense and the Defense Intelligence Command (DIC).[4] National security affairs was long considered a "sacred domain."

This decision-making structure was by and large a reflection of underlying political structure. The military in South Korea had traditionally regarded control over the national security machinery as its prerogative, and often intervened in civil politics for security reasons. The military coups in 1961 and 1979 both exemplified this. Military supremacy in national security matters is clearly visible when the pattern of personnel recruitment in national security is examined. National security-related positions have been virtually all filled by active or retired military officers. After the military coup in 1961, no civilian has ever held the position of defense minister. Civilians in national security agencies have been either discriminated against or excluded from every aspect of personal recruitment and promotion and even decision-making process. This was possible because of the military dominance in Korean politics, which was authoritarian.[5]

Despite its authoritarian character and the resulting backlash, the old pattern of the software of national security management in South Korea

4. Chung-in Moon, "Democratization, National Security and Civil-Military Relations: Some Theoretical Issues and the South Korean Case," *Pacific Focus*, 5, 1 (1989), pp. 5-22.
5. *Ibid.*

has proved to be effective. While the executive dominance had facilitated speedy and effective formulation and implementation of security policies, ideological penetration and centralized decision-making structure allowed neither conflicting views on the ends and means of national security nor artificial bureaucratic compartmentalization. Domestic resources were extracted and mobilized for security purposes without any significant social opposition. There was no need for muddling through a web of contending social and political interests and pressures. As a result, comprehensive security policies were easily formulated and effectively implemented.

The democratic opening in 1987, however, began to alter the overall landscape of the software of national security management in South Korea. In the wake of democratization, the Korean people, particularly the youth, no longer accept national security as *deus ex machina*. For some, the ideology behind it is nothing but an instrument used to justify domination by the military, technocrats, and the capitalist class. They strongly call for change in the ideology of national security, and favor individual liberty over repression in the name of total security, equality over growth, welfare over defense and ideological tolerance over rigid anti-communism. This popular dissent resonates in growing demands for the abolition of the National Security Law and Anti-Communist Law, which have served as the legal and institutional backbone of the national security ideology. The dissent is a response to the changing security environment amidst the post-Cold War era but also to the use of national security issue as a rationale for oppression designed for regime security and survival.[6] For the past three decades, Korean political leaders have utilized national security as a tool for indoctrinating the masses, controlling civil society and ultimately consolidating and maintaining political power.

All these developments imply that democratization has created a major realignment of domestic political structure in South Korea, in which the military's role in civilian politics has diminished. Analytically speaking, the Park and Chun regimes cannot be regarded as "military regimes" like those commonly found in Latin America since the military in South Korea did not intervene in politics as an institution or a collective entity.[7] Yet, these regimes had made extensive use of the

6. Byungki Kim, "North Korea's Nuclear Policy in the Year 2000: Sources, Strategy and Implication for the Korean Peninsula," *The Journal of East Asian Affairs*, VII, 1 (1993), pp. 32-57.

7. For more detailed description, see Chung-in Moon and Mun-gu Kang, "Democratic Opening and Military Intervention in South Korea: Comparative Assessments and Implications," in James Cotton, ed., *Korean Politics in Transition* (Sydney: Allen and Unwin, 1994).

military for political purposes, and in return, had insulated the institution of national security from political and social pressures. The military was embedded in the state structure through organic networks, elevating the position of the military to that of prominence. The democratic opening and consolidation have fundamentally changed this, and the military has been forced to be professionalized and civilianized. There is more civilian control of the national security machinery. In fact, after Kim Young Sam was inaugurated as the first civilian president in more than three decades in 1993, the South Korean military underwent immense internal changes: the removal of the Hanahoi as the dominant military faction, an extensive anti-corruption campaign targeted at the military, and the firm civilian control of the military.[8] These changes reflect the civilian control of the military as well as civilian influence over the other features of national security machinery.

The democratic transition has opened new venues for overhauling the foundation of the software of national security management. These have important implications for the conceptualization and conduct of national security.[9] The dominance of national security ideology has become decolored, while executive leadership in national security management has been increasingly undermined by bureaucratic politics and interventions by political and civil society. The limited insulation of national security machinery from social and political pressures reflects its changing institutional landscape followed by democratization. South Korea's recent handling of the North Korean nuclear problem epitomize the changed climate of national security policy-making par excellence. Ideological polarization, weak executive leadership commitment, bureaucratic infighting, interest group politics, and mass media interference, all of which were bred by democratic governance, literally crippled coherent, consistent and effective national security policy-making.

It seems, however, premature and even misleading to equate the democratic transition with immediate and automatic reforms in the

8. "Hanahoi" refers to the dominant faction in the Korean military during the Chun Doo-Hwan and Roh Tai Woo regimes. As Hanahoi became a political issue, President Kim Young Sam undertook an extensive military reform in order to dissolve the faction. President Kim has replaced and retired all 9 generals, 73 percent of lieutenant generals, 63 percent of major generals. *Joong-Ang Daily*, February 23, 1994.

9. For an extensive discussin of security environment, software and hardware, see Chung-in Moon and Seok-soo Lee, "The Post-Cold War Security Agenda of South Korea : Inertia New Thinking and Assessments," *Pacific Review* 8, 1 (January 1995). Also see Chung-in Moon and Ronald McLaurin, *Arms Control on the Korean Peninsula* (Washington : United States Institute of Peace, 1994).

software of national security management. There are several factors impeding such reforms. Lack of consensus on security environment, the perception of threat, and the end and means of national security could make the process of the reforms more difficult and extended. The structure of deterrence in the region and recurring memories of the Korean War also prevent South Koreans from accommodating the new security environment at its face value. More importantly, a conservative ideology is still dominant and well entrenched in the national security decision-making process. The initial triumph of progressive ideology immediately following democratization did not last long. Facing social chaos, South Korean society swung back to the old conservative camp, reviving and even accelerating the old inertial. The recent confrontation with North over nuclear weapons has further consolidated the conservative resurgence, which blocks changes in national security policy. One of the most ironical changes is the ideological transformation of mass media. Such leading daily newspapers as *Chosen* and *Dong-a,* which used to be the champions of liberal perspectives, took the ultraconcervative position significantly altering public opinion and policy outcomes in favor of conservative stance.

Despite the recent civilian triumph over the military, civilian control of the military and of the national security machinery still remains uncertain. Efforts to decentralize the national security machinery have so far been slow. Imprudent transition of power in the domain of national security could easily invite military opposition, undermining not only the civilian control of national security decision-making but also the very process of democratization. Democracy has not yet been able to dislodge the power of vested interests associated with military security and economic growth. In addition to the military, the ruling regime, the military-industrial complex and other conservative elements favor the status quo.[10] While the Cold War security environment, tense military confrontation with North Korea and a defense burden-sharing with the United States offered an external rationale for the criticality of defense budgets, the authoritarian mode of governance remains in South Korean national security dynamics.

In recent years, North Korea has concentrated in building the legitimacy of Kim Jung Il's political succession by maintaining the Jucke ideology of his father, Kim Il Sung. Despite recent economic crisis and broadcasted news of food shortage and starvation, North

10. Chung-in Moon, "The Political Economy of Defense Industrialization in South Korea: Constraints, Opportunities and Prospects," *Journal of East Asian Affairs,* 5, 2 (1991), pp. 438-465.

Korea has reinforced its North Korean Peoples Armed Forces in order to pacify and consolidate the power based of Kim Jung Il. North Korea indeed has a credible fighting force with more than one million regular troops, 3,800 tanks, 10,000 artillery, 850 combat aircrafts and 460 various naval vessels. While South Korea's military capability includes about 650,000 regular troops, 2,000 tanks, 4,600 artillery, 520 combat aircrafts and 200 naval ships.[11] It is estimated that South Korea's military capability is about 75 to 87 percent of the North's capability but is forecasted to reach the parity level before the beginning of the 21st century.[12] Certainly, in the post-Cold War era, national insecurity exits in both Koreas. South Korea has had catch up mentality to build up its military force in the 1960s and 1970s, in addition to maintaining security alliance with the U.S. North Korea, despite its military preponderance, continue to maintain and expand its capability in all front including chemical weapons, showing its insecurity. In this vein, several events, such as the presence of nuclear weapons in South Korea up to late 1980s, South Korea's diplomatic normalization with Russia and China in the 1990s which in turn has dramatically undermined the North's relations with them may have prompted the North's decision to produce nuclear weapons.

Nuclear Energy Issues in the Korean Peninsula

Since 1979, North Korea has undertaken gradual but determined development of nuclear program. Although North Korea signed the Nuclear Nonproliferation Treaty in 1985, it failed to enter into the required nuclear safeguards agreement with the International Atomic Energy Agency (IAEA). Even after signing a series of historic bilateral agreements with South Korea–the Agreement on Reconciliation, Nonaggression and Exchanges and Cooperation in 1991, and the Joint South-North Agreement on the Denuclearization of the Korean Peninsula–the North refused to implement them. After the high round talks between the U.S. and North Korea, the North finally signed a standard safeguards agreement with the IAEA.

Although several inspections of declared facilities took place, the North resisted IAEA efforts to examined undeclared but suspected sites at its nuclear research complex in Younbyon. The North insisted that the

11. Young-ho Lee, "An Analysis of North Korean Military Capabilities," *Strategic Studies*, IV, 3 (1997), pp. 177-178.
12. *Ibid.*, pp. 181-183.

complex was for purposes of electric power generation. But there was a significant discrepancy existed in the number of times the North said it had reprocessed and the number of times in reality it had. When IAEA demanded the special inspections of sites where evidence of activities inconsistent with North Korean agreement, the North made the announcement to withdraw from the NPT in 1993, stonewalling the secrecy about its nuclear weapons program. Timing was critical in 1994 as North Korea decided to unload the fuel in its research reactor without permitting orderly IAEA inspections. If reprocessed, freshly unloaded fuel contained enough plutonium to produce five to six bombs worth of plutonium. With intermediate range missiles based on its Scud-C missiles and with material for perhaps up to a dozen warheads, North Korea would be a significantly armed nuclear state.[13] Against this backdrop, in order to maintain peace and security on a nuclear-free Korean peninsula, the U.S. and North Korea (officially known as the Democratic People's Republic of Korea, DPRK) in late 1994 announced the agreed framework for the resolution of nuclear issues in the Korean peninsula. The major provisions of the Agreed Framework include the followings:

1. Both sides will cooperate to replace the DPRK's graphite-moderated reactors and related facilities with light-water reactor (LWR) power plants. The U.S. will undertake to make arrangements for the provision to the DPRK of a LWR project with a total generating capacity of approximately 2,000 MW(e) by a target date of 2003. The U.S. will organize under its leadership an international consortium to finance and supply the LWR project to be provided to the DPRK.

2. The U.S., representing the consortium, will make arrangements to offset the energy foregone due to the freeze of the DPRK's graphite-moderated reactors and related facilities, pending completion of the first LWR units. Alternative energy will be provided in the form of heavy oil for heating and electricity production. Deliveries of heavy oil will begin within three months of the date of this Document and will reach a rate of 500,000 tons annually.

3. Upon receipt of U.S. assurances for the provision of LWR's and for arrangements for interim energy alternatives, the DPRK will freeze its graphite-moderated reactors and related facilities and will eventually dismantle these reactors and related facilities.

13. Paul Doty and Steven Frank, *op. cit.*, p. 70.

4. The DPRK will remain a party to the NPT and will allow implementation of its safeguards agreement under the Treaty.[14]

The agreed framework established KEDO as the organizational body with the U.S. as the main actor although not the chief funder. The U.S., South Korea, and Japan are the original members, and assistance is being sought from China, Russia, other Asian, European and Gulf states.[15] Quite obviously, North Korea was pressured from its (former) allies: "...explicit pressure which Moscow has placed on North Korea to sign the accords, together with the emerging reorientation of the PRC's stance towards Pyongyang, has made their impression."[16] Moscow has publicly called for the North to submit to international inspection. At the same time, the only trustworthy ally of North Korea, the People's Republic of China (PRC) announced that it will not support, encourage, or engage in nuclear proliferation. China, who became the signatory of the NPT in 1992, feared that North Korea's alleged nuclear program might trigger a chain reaction that South Korea and even Japan might follow suit. China reaffirmed that it will support the de-nuclear program initiatives in the region and will not support nuclear proliferation pursued by any party on the Korean peninsula.[17]

The agreed framework drew much controversies in the U.S. and elsewhere. During the Congressional hearing in 1995, a question was raised about creating a double standard: "U.S. technology in South Korean reactors will be transferred *(to North Korea)*, but U.S. companies cannot sell the same technology to China. Why, giving it to the North Korean, can't we sell to the Chinese?"[18] Another question was raised about the provision of heavy oil to North Korea: *"(North Korean nuclear reactor)* was never connected to a grid. It was never connected to a grid. So now we are going to give them oil to replace that they never used."[19] The Congressional hearing also pointed out the scale of

14. Council on Foreign Relations, *Success or Sellout? The U.S.-North Korean Nuclear Accord*, Report of an Independent task Force (New York: Council on Foreign Relations Press, 1995), pp. 18-21.

15. According to Ambassador Bosworth, as of 1997, KEDO has some 35 headquarters staff in New York, evenly divided among, South Korea, U.S. and Japanese nationals. The European Union has joined the founding members on the Executive Board. See, Stephen W. Bosworth, "Keynote Address," in *Conference Report: The Council on U.S.-Korean Security Studies 12th Annual* Conference (Washington, D.C.: Council on U.S.-Korean Security Studies, 1997), p. 3.

16. Byungki Kim, *op. cit.*, p. 54.

17. Dingli Shen, "A Chinese view on Nuclear Disarmament," in George A. Lopez and Nancy J. Myers, eds., *Peace and Security: The Next Generation* (Lanham, MD: Rowmand & Littlefield Publishers, 1997), pp. 202-203.

18. U.S. Senate, *Joint U.S. North Korea "Agreed Framework" on Nuclear issues*, U.S. Senate 104th Congress, January 19, 1995, p. 2.

the North Korean nuclear program: "Had the North Korean nuclear program which evolved over the 1980's and 1990's been allowed to continue unabated, it would have a potential plutonium production capability sufficient to produce enough separated plutonium to make between 60 or 100 nuclear weapons...by the year 2000."[20] The framework also assured nuclear safeguard in which the North Korean nuclear program will be frozen by prohibiting further separation of weapon grade plutonium, by containerizing the plutonium-laden spent fuel, and by preventing further construction or operation of graphite reactors. The Hearing concluded that the agreed framework is "...in the U.S. interest, in North Korea's interest, in the interest of the region, and in the interest of reducing the nuclear danger on the Korean peninsula."[21]

The Report of an independent task force finds that the U.S.-North Korea Agreed Framework deserves the support of the U.S., the South Korea, Japan and others. Despite its shortcomings and uncertain future, it provides a mechanism for avoiding a nuclear weapons program in the North, something that would pose a direct threat to the regional security and the international non-proliferation regime. It also deserves the support of North Korea as the accord provides the North with a viable energy alternative, and it offers the North a path by which it could join the international community and benefit from political and economic interactions.[22] Finally, the Report concludes that KEDO umbrella is the best way to manage the issues of South Korea's participation in the reactor project and that arrangements must be made to ship the spent fuel from the newly constructed LWR out of the North before the it becomes operational.[23]

Founding Executive Director of KEDO, ambassador Bosworth affirms that KEDO is the only regular channel of contact between North and South and the atmosphere on the peninsula is much improved over 1994. Plus, KEDO gives North Korea a window on the outside world. Through it passes information on the society's technological backwardness and on how the international economic system works. The North now appears strongly interested in KEDO, would like to see it add members and would like a similar organization established to handle humanitarian aid. Further, KEDO is a valuable shock absorber

19. *Ibid.*, p. 10.
20. *Ibid.*, p. 14.
21. *Ibid.*, p. 17.
22. Council on Foreign Relations, *op. cit.*, p. 13.
23. *Ibid.*, pp. 14-16. For the time line of the Agreed Framework, see Appendix 1.
24. Stephen W. Bosworth, *op. cit.*, pp. 3-4.

on the peninsular and help keep North Korea from going too far with provocations. Finally, KEDO offers valuable practice in multilateralism, which is not well developed in Northeast Asia. This is important experience for Japan and both Koreas, and serves American interests. More multilateralism in the region is badly needed and KEDO is a useful model.[24]

Survey of Nuclear Safeguards Systems

The International Atomic Energy Agency (IAEA), founded in 1956, is a system designed to ensure the activities in the field of atomic energy are not conducted in such a way as to further a military purpose. Stemming from the President Eisenhower's address to the United Nations General Assembly in 1953 for establishing an international effort to use atomic energy for the welfare of man, Article III of the Statute of the IAEA affirms that the Agency is authorized to "(t)o establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities and information made available by the Agency...are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement."[25]

For nuclear safeguards, Article IX stipulates that the Agency has the rights and responsibilities to "...examine the design of specialized equipment and facilities, including nuclear reactors, assuring that it will not further any military purpose,...(and) to require the maintenance and production of operating records to assist in ensuring accountability for source and special fissionable materials used or produced in project or arrangement."[26] Further, the Agency shall establish a staff of inspectors who has the responsibility of examining all operations conducted by the Agency for the health and safety measures and whether adequate measures to prevent the source and special fissionable materials in its custody or used or produced from being used in furtherance of any military purpose.[27]

The safeguards system was formalized through the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Opened for signature in 1968, currently the Treaty boasts 185 signatory states.[28] In short, the

25. Allan McKnight, *Atomic Safeguards: A Study in International Verification* (New York: United Nations Institute for Training and Research, 1991), p. 38.
26. *Ibid.*, p. 38.
27. *Ibid.*, p. 39.

NPT is a landmark international treaty whose objectives are to prevent the spread of nuclear weapons and weapons technology, to foster the peaceful uses of nuclear energy, and to further the goal of achieving general and complete disarmament. The Treaty established a safeguards system under the responsibility of the IAEA, which plays a central role in the area of nuclear safeguards and technology transfer for peaceful purposes. Article I and II of the Treaty stipulate

> *Article I:* Each nuclear-weapon State Party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons of explosive devices directly, or indirectly; and not in any way to assist, encourage, or induce any non-nuclear-weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices.
>
> *Article II:* Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transfer or whatsoever of nuclear weapons or other nuclear explosive devices of control over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.[29]

The NPT also provides the safeguards system in accordance with the Statute of the IAEA to prevent diversion of nuclear energy from peaceful uses to nuclear weapons or other explosive devices.

The IAEA affirms that its safeguards are applied most intensively at facilities containing fissionable materials (i.e., plutonium and highly enriched uranium) that could be used to manufacture a nuclear explosive. Inspection goals, which take into account potential diversion paths and other technical criteria, are formulated accordingly and give top priority to safeguards at such facilities to verify the whereabouts of these materials.[30] More precisely, the Agency's safeguards system consists of three major components: (1) Accountancy, i.e., reporting by States on the whereabouts of the fissionable material under their

28. South Korea signed the Treaty in April 1975, Japan in June 1976, North Korea in December 1985 and China in March 1992. Officially, there are 5 NPT Nuclear-Weapon States —United Kingdom, the United States, Russian Federation, China and France.

29. Allan McKnight, *op. cit.*, p. 254.

30. International Atomic Energy Agency, *International Safeguards and the Peaceful Uses of Nuclear Energy*, 1997, p. 1, available on line at<http://www.iaea.or.at/worldatom/inforesource/factsheets/safeguards.html>.

control, on stocks of fuel and of spent fuel, on the processing and reprocessing nuclear material, etc.; (2) Containment and surveillance techniques, such as seals which allow conclusions that no material has disappeared, film and TV-cameras which record any action, occurring in a particular area of a nuclear installation; and (3) Inspection by Agency inspectors, checking instruments and seals installed, verifying books, confirming physical inventories of fuel or spent fuel.[31]

Similarly, U.S. Nuclear Regulatory Commission insists that an effective nuclear regulator requires: (1) A strong and effective regulatory authority, to monitor and enforce high levels of safety, must be based on a firm legal foundation; (2) The regulator must have the necessary resources to support a well-trained and adequately paid staff to perform on-site inspections, review plants at all stages from design to decommissioning, analyze errors to improve future operations, and develop and maintain a confirmatory research capability; and (3) Both the operators and the regulators must apply rigorous nuclear standards which covers all aspects of the nuclear fuel cycle.[32]

According to 1996 Annual Report, the IAEA is still unable to verify the correctness and completeness of the initial declaration of nuclear material made by North Korea, thus the Agency is still unable to conclude that there has been no diversion of nuclear material in North Korea. The safeguards agreement between North Korea and the Agency remains in force, and the Agency is continuing to implement safeguards measures in the North under this agreement, including the monitoring of the "freeze" of North Korean graphite moderated reactors and related facilities, as requested by the UN Security Council.[33] Further, the Agency has maintained a continuous presence of inspectors in the Yongbyon area in North Korea since May 1994. By the end of 1996, half of the spent fuel rods from the shutdown 5 MW(e) graphite reactor had been loaded into canister for long term storage. The canning operations were temporarily suspended at the beginning of November, but resumed in mid-January 1997. Three technical meetings between North Korean and the Agency were held during the year, one of them in Vienna. Little progress was made on the issue of preservation by the North of information relevant to the history of North Korean nuclear program as required by the Agency for the eventual verification of the

31. *Ibid.*, p. 1. More detailed discussion of IAEA safeguards implementation is provided in Appendix 2.
32. U.S. Senate, *op. cit.*, p. 65.
33. International Atomic Energy Agency, *1996 Annual Report*, p. 1, available on line at <http://www.iaea.or.at/worldatom/inforesource/annual/anrep96/sfgds.html>.

completeness and correctness of North Korea's initial declaration. Also, North Korea has still not enabled the Agency to implement certain inspection measures, such as measurements of the plutonium content of the spent fuel rods from the 5 MW(e) reactor and monitoring of the nuclear liquid waste at the reprocessing plant, Radiochemical Laboratory.[34]

In Europe, the European Atomic Energy Community (EURATOM) serves as its nuclear safeguards system since 1970. The member states include Belgium, Denmark, Germany, Ireland, Italy, Luxembourg and the Netherlands. EURATOM works closely with the IAEA and adheres to its safeguards measures. The basic agreement of EURATOM includes,

- To accept safeguards, in accordance with the terms of this Agreement, on all source or special fissionable material in all peaceful nuclear activities within their territories, under their jurisdiction or carried out under their control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.

- The International Atomic Energy Agency (Agency) shall have the right and obligation to ensure that safeguards will be applied in accordance with the terms of this Agreement, on all source or special fissionable material in all peaceful nuclear activities within the territories of the States, under their jurisdiction or carried out under their control anywhere for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.

- The objective of the safeguards procedures set forth in this Agreement is the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection.

- The Agency may make routine inspections in order to (a) verify that reports are consistent with records; (b) verify the location, identity, quantity and composition of all nuclear material subject to safeguards under this Agreement; and verify information on the possible causes of material unaccounted for, shipper/receiver differences and uncertainties in the book inventory.[35]

34. *Ibid.*, p. 3.

Clearly, the Agreement of EURATOM provides a concise and detailed accord on peaceful uses of nuclear energy. It provides explicit guidelines on safeguard measures, inspections, finance, records system, report system, definitions, and most important, legal and formal arrangement between EURATOM, member states and the IAEA.

In Latin America, *the Treaty for the Prohibition of Nuclear Weapons in Latin America,* known as the Tlatelolco Treaty, serves as the regional nuclear safeguards system. The main articles of the treaty manifest that "The Contracting Parties hereby undertake to use exclusively for peaceful purposes the nuclear materials and facilities which are under their jurisdiction, and to prohibit and prevent in their respective territories: the testing, use, manufacture, production or acquisition by any means whatsoever of any nuclear weapons, by the Parties themselves, directly or indirectly, on behalf of anyone else or in any other way."[36] Argentina, Brazil and Chile signed the treaty to join Mexico among others in 1992. This was a significant event due to the fact that rival military governments in Argentina and Brazil were engaged in an incipient nuclear arms race up to the mid-1980s. The nuclear programs of Argentina and Brazil were of grave proliferation concern to each other and to states outside of the region. When the civilian governments took power in 1983 and 1985, Argentina and Brazil had a series of high level talks which eventually led to the Argentine-Brazilian Agency for accounting and Control of Nuclear Materials in 1991 diffusing an incipient nuclear arms race between them. The main characteristics of Latin American nuclear safeguards system include: (1) incorporation of technicians and scientists in the nuclear monitoring process to complement political efforts in nuclear energy; (2) verification activities taking place in a context of technical cooperation, leading to transparency as well as mutually beneficial energy process; (3) external, internationally trusted technical training; (4) mutual inspections; and (5) localized autonomy.[37]

Both the treaty and bilateral agency work closely with IAEA and represent a regional nonproliferation success story. Latin American states have terminated unsafeguarded nuclear programs and devised their own regional program of confidence building and transparency

35. International Atomic Energy Agency, *Information Circular,* INFCIRC/193, September 14, 1973, pp. 2-20, available on line at <http://www.iaea.or.at/worldatom/glance/legal/inf193.html>.
36. International Atomic Energy Agency, *Treaty for the Prohibition of Nuclear Weapons* in Latin America, 1997, pp. 2-3, available on line at <http://www.iaea.or.at/worldatom/glance/legal/bginf179.html>.
37. Edward T. Fei, "Nuclear Energy and Nuclear Fuel Cycle Issues in East Asia," Paper presented at the Northeast Asia Cooperation Dialogue, Beijing, China, January 1996, p. 35.

through site visits and inspections.

Another successful example of regional nuclear safeguards can be found in the South Pacific. The states of the South Pacific, including Australia, New Zealand and various islands of the Pacific, forged the South Pacific Nuclear Free Zone Treaty in 1985. The treaty denounces nuclear explosive devices, pledges for peaceful nuclear activities, agrees to prevent stationing of nuclear explosive devices, and prevents testing and dumping in the region.[38]

Nuclear Safeguards Systems on the Korean Peninsula and Asia Pacific

In East Asia, nuclear energy is a vital part of energy production. Japan has 53 nuclear plants in operation with 2 under construction, South Korea has 12 plants operational with 4 under construction, North Korea has 2 plants under construction under the KEDO guidance, China has 3 plants and 2 being built and Taiwan has 6 operational plants.[39] Nuclear power already constitutes some 30 percent of total power generation both in Japan and Taiwan, and South Korea depends on nuclear energy for 40 percent of its requirements. China, although depends on nuclear power for less than 2 percent of its energy needs, has a plan to expand its use of nuclear power substantially by year 2020.[40] Table 1 provides the information on nuclear reactors and fuel cycle facilities in Asia-Pacific region, while Table 2 show installed nuclear electric capacities and its share in the region.

In recent years, especially heightened by the North Korean nuclear crisis, there has been an increasing focus on "EURATOM-like" regional cooperation in the field of peaceful nuclear energy in Asia Pacific region. With the trend toward regional integration as evidenced by the NAFTA, APEC and European Union, along with mutual concern about future energy supply with heavy dependency to OPEC oil and with heightened concern about regional nuclear proliferation issue in

38. International Atomic Energy Agency, *Information Circular*, INFCIRC/331, February 1986, available on line at <http://www.iaea.or.at/worldatom/glance/legal/inf67a15.html>.

39. According to IAEA, there are a total of 444 nuclear power plants are operating around the world, as of May 1997. During 1996, five nuclear power plants representing 5717 MW(e) were connected to the grid in France, Japan (2), Romania and the United States. The U.S. is the largest consumer of nuclear power with 109 operational plants, followed by France (56), Japan (53) and Russia (29).

40. Robert Manning, "PACATOM: Nuclear Cooperation in Asia," *The Washington Quarterly*, 20, 2 (1997), p. 220.

Table 1. Nuclear Reactors and Fuel Cycle Facilities in Asia-Pacific Region, 1997

Country	Power reactor*	Research reactor*	Reproces sing plant	Uranium enrich. plant	Fuel fabrica. Plant
China	3/2	12	2	2	1
Japan	53/2	18/1	1	4	7
South Korea	12/4	3/2	0	0	1
Nouth Korea	0/2	1	1	1	1
United States	109	88	0	0	6
Russia	29/4	77	5	5	6

* operating reactors/under construction

*Table 2. Installed Nuclear Electric Capacities and Percent Share, 1993-2010**

	1993		2000		2010	
Country	capacity	% share	capacity	% share	capacity	% share
China	1.2	0.7	7.0	2.3	25.0	4.7
Japan	37.1	19.5	50.6	21.0	83.0	25.5
South Korea	7.6	27.5	13.7	32.5	24.5	37.7
Nouth Korea	-	-	-	-	-	-
United States	99.0	21.0	102.5	21.0	90.7	18.4
Russia	19.8	12.0	18.9	-	17.4	-

* Capacity is in gigawatts. % share takes into account electricity produced by coal, oil, hydro and other sources.
Sources of data drawn from *World Nuclear Industry Handbook,* 1994 and International Atomic Energy Agency, *IAEA Newsbrief,* 12, 2 (April/May 1997), available on line at <http://www.iaea.or.at/worldatom/inforesource/newsbriefs/newsv12n2.html#ab.1>.

particular due to the North Korean nuclear fiasco, there is a definite need and likelihood of regional cooperation in nuclear energy in East Asia and Pacific. The present study propose three models of regional cooperation in the field of peaceful nuclear energy in the Korean peninsula and Asia Pacific region. The first is the KEDO based model that focuses mostly on the Korean peninsula. The second is East Asian

atomic energy model that consists of East Asian states, namely two Koreas, China, Taiwan and Japan. The third model is Asia-Pacific model that would included the United States, and perhaps Russia and Canada, in addition to East Asian states. Although all three would have EURATOM-like characteristics, the latter two models would be most similar to EURATOM and yet may be more difficult to implement.

The first model of regional cooperation for peaceful use of nuclear energy will be based on the "Agreed Framework" signed by the U.S. and North Korea, which has produced the KEDO as the organizing body, and will also be based on *Joint Declaration of the Denuclearization of the Korean Peninsula* singed by South and North Korea in 1992. Although the "Agreed Framework" was intended to freeze and terminate the North Korean nuclear program, it has several attributes which may transform KEDO into a regional nuclear energy safeguards system. First, KEDO has multinational membership. The U.S. serves as the main actor along with South Korea and Japan, and it seeks assistance from other states, including China, Russia, European and other Asian. Increased interdependency in economic spheres, the end of the Cold War, and the rise of globalism in communication and information, have transformed traditional bilateral relationship into truly multilateral one. Second, as the signed members of the NPT, KEDO states and North Korea are obligated to the fundamental issues of nuclear safeguards as prescribed by the IAEA, including inspections and record system. The IAEA would be an essential part of any regional system of nuclear safeguard whether the system would be based on the Korean peninsula, East Asia, or Asia-Pacific. Third, the "Agreed Framework" provides an avenue of economic interaction between North Korea and the rest of the world, most notably with the U.S. and South Korea: "...both sides *(the U.S. and North Korea)* will reduce barriers to trade and investment, including restrictions on telecommunications services and financial transactions."[41] This can be viewed as a policy of engagement that best serves U.S. interests. And in this vein, the U.S. can contribute to this diplomacy in much the same way that it contributes to engagement broadly defined by offering military initiates, by holding direct bilateral talks with Pyongyang, and by holding out the hope of U.S. trade and investment if the issue is resolved.[42] Fourth, the "Agreed Framework" makes it clear that North Korea will (would) take steps to implement the North-South *Joint*

41. Council on Foreign Relations, *op. cit.*, p. 20.
42. William J. Taylor and Michael J. Mazarr, *op. cit.*, p. 366.

Declaration of the Denuclearization of the Korean Peninsula.[43] The Joint Declaration spells out all the necessary clauses for nonproliferation in the Korean peninsula.

1. The South and the North shall not test, manufacture, produce, receive, possess, store, deploy or use nuclear weapons.

2. The South and the North shall use nuclear energy solely for peaceful purposes.

3. The South and North shall not possess nuclear reprocessing and uranium enrichment facilities.

4. The South and North, in order to verify the denuclearization of the Korean Peninsula, shall conduct inspection on the objects selected by the other side and agreed upon between the two sides, in accordance with procedures and methods to be determined by the South-North Joint Nuclear Control Commission.[44]

Subsequently, KEDO-based model of regional cooperation for nuclear energy would consist of the U.S., South and North Korea, Japan, as the main actors, and would combine the accords of the "Agreed Framework" and the Joint Declaration.

The second model is Asian cooperation of nuclear (atomic) energy, referred to as ASIATOM. It is suggested that ASIATOM would serve the following functions:

1. Regional cooperation and coordination of peaceful nuclear R&D.

2. Regional enrichment and reprocessing, such as a regional fuel cycle center.

3. Coordination, information, clearing, and enhanced transparency for regional nuclear activities.

4. Upgraded nuclear safety, radiological protection, nuclear material control and physical protection in Asia.

5. A EURATOM-type regional safeguards system to reduce the burden of the IAEA.

6. Upgraded collective security in Asia.

7. Possibly, involvement with the concept of a nuclear-free zone.[45]

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43. Council on Foreign Relations, *op. cit.*, p. 20.

44. Young Whan Kihl, ed., *Korea and the World: Beyond the Cold War* (Boulder, CO: Westview Press, 1994), pp. 347-348.

In this model, Japan, South and North Korea, and China would play a crucial role. Taiwan which has 6 operating plants will be a hidden force in this arrangement. China-Taiwan relationship would make this model extremely complicated and delicate. Although Taiwan is accepting full-scope safeguards as if it was a member of the NPT, uncertain and often hostile relationship between the PRC and Taiwan makes this model more difficult to predict.[46] Japan should play a leadership role as the largest nuclear energy producer in the region and can built on its experiences with Japan's Nuclear Material Control Center. However, due to Japan's unwillingness to play the leadership role in global economic sphere and the regional neighbors' (especially Korea and China) deep rooted suspicion on Japanese militarism of the past provide a potential concern for this regional safeguards system of ASIATOM.

The third and most ambitious model is PACATOM. This is the Asia-Pacific coalition for the nuclear safeguard across the region. The membership will be expanded to the U.S. and perhaps, Russia and Canada. Similar to ASIATOM this broader arrangement would serve the following functions:

1. Setting standards for measurement and accounting of nuclear materials,

2. Setting standards for nuclear safety,

3. Studies on Plant ageing and dismantlement and disposition,

4. Studies on the public acceptance of nuclear power,

5. Agreement on nuclear liability issues,

6. A clearing house for standards and information on nuclear materials transport,

7. Studies on the back end of the nuclear fuel cycle,

8. Regional safeguards both to increase regional confidence and to reduce the burden of the IAEA,

9. Nuclear emergency response information sharing and possible cooperation, and

10. Studies and implementation of plans for regional repositories for spent nuclear fuel.[47]

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45. Edward T. Fei, *op. cit.*, p. 6.

46. Tatsujiko Suzuki, "Regional Nuclear Cooperation Regime in Asia Pacific (ASIATOM)," Paper presented at the Northeast Asia Cooperation Dialogue, Beijing,China, January 1996, p. 4.

PACATOM necessitates a system and agreement for regional nuclear safeguards, regional nuclear fuel cycle, nuclear power safety and organization for cooperation on research and development. All the considerations, concerns and requirement for the previous two models would apply to PACATOM. There are certain amount of dissimilarities between EURATOM and Asia-Pacific region. Certainly there is a geographical differences, there is a difference in established nuclear industries across the region and surplus of special fissile materials from nuclear disarmaments and civilian programs, and the post-Cold War security environment. In addition, the Asia-Pacific have two divided countries—PRC vs. Taiwan and North vs. South Korea—which makes this regional integration for peaceful uses of nuclear energy more complicated and yet crucial.

Institutionally, PACATOM could take shape through various measures. For instance, Japan could propose the creation of nuclear cooperation regime, beginning with the four major powers (the U.S., Japan, China and Russia) and the tow Koreas. A formula could worked out with China to include Taiwan at some point. PACATOM would need China as an active member and since PACATOM would be largely a technical agency rather than a political or overtly security-oriented one, it is likely that China would be an active member. However, initially, Beijing would be unlikely to participate if Taiwan were also included, unless a major improvement in cross-strait relations took place.[48]

Tactically, PACATOM could be established in modular form, with the various components of it, such as nuclear safety cooperation or a regional safeguards regime, proceeding at their own pace based on a larger conception of what the full system would entail. Alternatively, particular components could be put forward as discrete and independent elements of regional cooperation. Japan has already embarked on a modest initiative, holding a conference in November 1996 on Nuclear Safety in Asia that officials of nine Asian states attended, with G-7 countries as observers.[49] In addition, PACATOM would be adhesive and open to other Pacific Basin states as relevant—that is, when Indonesia, Thailand, the Philippines, Vietnam, and other countries actually begin civil nuclear power programs.[50]

How might the experience of EURATOM benefit East Asia's

47. Edward T. Fei, *op. cit.*, p. 12.
48. Robert Manning, *op. cit.*, p. 223.
49. *Ibid.*, pp. 223-224.
50. *Ibid.*, p. 223.

peaceful uses of nuclear energy or regional security programs? For one thing, EURATOM's system of nuclear safeguards and inspection show that a nuclear cooperation can serve as a confidence-building measure. Beyond IAEA inspections, each member of EURATOM assigns inspectors to EURATOM safeguards agency. Inspectors can be dispatched at any time and to any member state. Similarly, PACATOM inspectors from China could tour Japanese facilities at any time, just as Japanese inspectors working for PACATOM could review Chinese reactors. Moreover, North and South Korean inspectors could inspect each other's nuclear facilities under PACATOM auspices. Such development would be useful reassurance and confidence-building measures.[51]

One obvious benefit of nuclear energy system regardless of the type is the creation of a pattern of consultation and cooperation in Northeast Asia. This would be a useful addition to the regional security nexus which is still consider to be highly volatile, despite the fact that the rest of the globe has entered the post-Cold War security environment. Among the three models discussed above, PACATOM clearly has the highest payoff for the regional security, while KEDO-based model would be least difficult to implement. Japan, by taking a leadership role, could show that it is serious about nonproliferation and this would demonstrate Japan's global leadership in ways welcomed by its neighbors. Likewise, Russia, China, two Koreas and U.S. have mutual gains from regional nuclear regime and there is a likelihood that Asian initiative may serve as a catalyst for a larger global nonproliferation measure.

Conclusion

It is clear that there is a need for regional nuclear safeguard arrangement in East Asia. Also it is clear that East Asia would need to develop its own unique regional approaches to nuclear safeguards and fuel cycle management. Regardless of the type of regional safeguards system, preconditions for successful integration would include: (1) promotion of better understanding of nuclear activities in the region; (2) joint technical and economic nuclear research between the states; and (3) joint nuclear activities and regional organizational building. The first step is for states in the region to gain better understanding of each

51. *Ibid.*

others nuclear program, including the underlying nuclear and related technologies, economic analysis and nuclear safety cultures. Bilateral visits and discussions as well as regional meetings and conference can be essential. The annual meeting of Japan Atomic Industry Industrial Forum (JAIF) could serve as the cornerstone for gaining better understanding based on open discussion and by sharing information. To promote better understanding, Japan has promoted transparency as a way of building international and regional confidence, and can be a standard against which other states in the region can measure themselves.[52]

Second, better understanding and confidence can be reinforced further through such activities as joint technical and economic research. According to the guideline of Reduced Enrichment for Research and Test Reactors (RERTR) Program which was initiated by the U.S. in 1978, a successful reduction in the used of highly enriched uranium by promoting the conversion to low enriched uranium fuel to reduce the danger of nuclear weapon proliferation.[53] Currently, the U.S., Japan, Russia, and South Korea participate in the program and more joint research is strongly encouraged–environmental effects of fuel cycle choices, regional cooperation in nuclear emergency response, nuclear material measurement, protection and control, and regional spent fuel management.[54] China who has pledge to participate in the future could bring about an enhanced multilateral cooperation.

Thirdly, joint activities and joint ownership of nuclear-related projects are recommended for regional stability. Joint activities should begin with lower level of technology. For instance, to study and share information on the medical and agricultural use of nuclear energy and should graduate transfer to higher level. In addition, the development of multinational ownership of sensitive fuel cycle facilities such as for enrichment and reprocessing for the regional would be instrumental in multilateral nuclear cooperation.

In the final analysis, multilateral nuclear safeguards system on the Korean Peninsula and Asia-Pacific can be viewed as part of a larger process of forging regional institutions and a still elusive sense of community in the Asia-Pacific. In near future, it is possible but somewhat unlikely to expect multilateral cooperation in nuclear energy in the region. First of all, there is a collective lack of any vision about the direction of the post-Cold War order–hostilities between Koreas and

52. Edward T. Fei, *op. cit.*, p. 11.
53. *Ibid.*
54. *Ibid.*

between Beijing and Taiwan persist. Another problematic point is the presence of intellectual disconnection between Asia specialists and nuclear specialists. They would have to bridge the gap between policy and technology for peaceful uses of nuclear energy in the region.

Appendix 1. Agreed Framework Time Line

1994: Agreed Framework Signed (B),
Freeze Existing Nuclear Facilities (DPRK),
Freeze Construction of 200MW and 50MW reactors (DPRK),
IAEA Monitoring of frozen facilities commences (DPRK),
Efforts begin on safe storage of "old" spend fuel (B).

1995: Delivery of heavy fuel oil begins (U.S.),
Trade and investment barriers reduced (B),
KEDO established (U.S.),
Liaison offices to open in Washington and Pyongyang (B),
Sign supply contract for LWR project (B),
Resume ad hoc and routine IAEA inspections of "non-frozen"
Facilities (DPRK),
Site survey for LWR project to begin (U.S.).

1996: Construction of LWR-1 begins (U.S.).

1999: DPRK to comply fully with IAEA safeguards*** (DPRK),
U.S.-DPRK nuclear cooperation agreement** (B),
Nuclear components of LWR-1 to be delivered (U.S.),
Shipments of "old" spent fuel to begin*** (DPRK).

2001*: Shipments of "old" spent fuel to be completed (DPRK),
Dismantling of existing nuclear facilities to begin (DPRK),
LWR-1 to be completed (U.S.),
Shipments of heavy fuel oil to cease (U.S.).

2003*: Dismantling of existing nuclear facilities to be completed (DPRK),
LWR-2 to be completed (U.S.).

* estimated
** if necessary
*** could occur sooner
(B) = shared obligation
(DPRK) = DPRK obligation
(U.S.) = U.S. obligation
Source: Council on Foreign Relations, *op. cit.*, p. 23.

Appendix 2. IAEA Safeguards Implementation System

1. **Inspectors:** The most visible components of the IAEA's safeguards systems are the designated inspectors. Under agreed rights of access, they regularly visit nuclear installations to verify records, check instruments and surveillance equipment and confirm physical inventories of nuclear materials; they later prepare detailed reports to the State concerned and to the IAEA. In Member States of the European Union, IAEA inspectors work with those of the European Atomic Energy Commission (EURATOM).

2. **Containment and surveillance**: At many nuclear installations the IAEA uses surveillance cameras and other electronic techniques to continuously and automatically record activities in key places. Also used are specially designed small metal seals which are fixed on the camera housings and other IAEA equipment to prevent undetected tampering, or at nuclear material storage areas or containers to safeguard the contents. Films and seals are regularly analyzed.

3. **Verification of nuclear material**: On a regular basis, the IAEA receives and analyzes reports from State authorities on the whereabouts of nuclear material under their control. Reports cover stocks of nuclear fuel and the export/import of safeguarded materials and equipment.

4. **Field and laboratory testing**: The fact that nuclear materials have distinctive radioactive characteristics makes it possible to detect and measure them; consequently, they can be accounted for with a high degree of accuracy. During inspections, IAEA inspectors conduct independent measurements for on-the-spot confirmation of the enrichment level and content of nuclear material. They also collect samples of certain types of safeguarded nuclear materials that are later tested and measured at the IAEA's Safeguard Analytical Laboratory near Vienna, Austria, or at some national analytical laboratories.

5. **Agreements**: Legal agreements are the basis of IAEA safeguards. Many are popularly known as full-scope agreements because they extend to all peaceful nuclear activities and materials in the State. They mainly relate to the Treaty of the Non-Proliferation of Nuclear Weapons (NPT) and also to the Treaty for the Prohibition of Nuclear Weapons in Latin America (the Treaty of Tlatelolco) and to the South Pacific Nuclear-Free Zone Treaty (the Rarotoga Treaty). Other safeguards agreements cover individual nuclear installations or individual quantities of nuclear materials.

6. **Other safeguards**: There are a number States not party to the NPT or the Treaty of Tlatelolco which have nuclear facilities in operation or under construction. In some of these States only some installations are under safeguards and there are unsafeguarded nuclear facilities known to be in operation or under construction.

Source: International Atomic Energy Agency, *International Safeguards*, *op. cit.*, pp. 3-4.