

# Refreezing Yongbyon: Developing an Effective Approach

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# Refreezing Plutonium Activities in North Korea

- Solving the current crisis with North Korea is likely to require re-establishing some type of “freeze” over all plutonium production and separation activities at Yongbyon.
- Refreezing should be framed as part of a broader verified dismantlement approach, which should include removing remaining spent fuel or separated plutonium from North Korea.
- Refreezing will likely require confirmation of North Korea’s statements about its recent actions.

# Critical Questions in Refreezing

- What has been the fate of the spent fuel?
- How much spent fuel has been reprocessed?
- How much plutonium has been separated?
- How much transparency is necessary to confirm North Korean answers to the above questions?

# Observations

- Whatever happens, refreezing will require more than just re-establishing IAEA monitoring at the site.
- Demanding too much, however, could trigger difficult, and perhaps unnecessary, efforts to verify the correctness and completeness of any North Korean statements about its activities at Yongbyon and elsewhere.

# Facilities and Items Requiring Refreezing at Yongbyon

- 5 MW(e) reactor
- Spent fuel discharged in 1994
- Radiochemical Laboratory
- Fuel fabrication complex
- 50 MW(e) reactor
- Two controversial suspect waste sites were not included under the 1994 freeze, but perhaps they should be now.

# Refreezing the 5 Megawatt Reactor

- IAEA witnesses shutdown.
- Cooperative (US/DPRK) determination of best way to store spent fuel to delay corrosion of fuel cladding and ease its verification.
- IAEA verifies unloading and storage of about 50 tonnes of fuel and any other fuel unloaded since early 2003.
- IAEA conducts on-going monitoring of reactor and spent fuel.

# The 5 MW Reactor: Additional Measures

- North Korea should provide the IAEA with sufficient access and information so that it can estimate the plutonium content of the discharged fuel. Specific measures could include providing operating records and allowing the IAEA to take measurements of the spent fuel.
- Depending of irradiation level of fuel, i.e. its plutonium content, spent fuel should be removed from North Korea after sufficient cooling has occurred.

# Spent Fuel Unloaded in 1994

- DPRK freezes this spent fuel in place and IAEA verifies locations of spent fuel
- DPRK provides records of movement of spent fuel
- Spent fuel is consolidated under IAEA supervision
- IAEA confirms amount of spent fuel and determines if any spent fuel is missing.
- IAEA determines fate of any missing spent fuel.
- IAEA conducts on-going monitoring of spent fuel



# Spent Fuel Unloaded in 1994: Additional Considerations

- IAEA may not receive sufficient records or be allowed to conduct activities in order to determine plutonium content of this spent fuel or answer questions about pre-1994 plutonium production.
- Agreement should be sought to remove any of the remaining spent fuel from North Korea.

# Radiochemical Laboratory: Plutonium Separated in 2003

- DPRK halts operations with IAEA present.
- The IAEA applies seals and conducts other measures to ensure that plant is shutdown.
- DPRK empties process lines and tanks with IAEA present, preparing for permanent shutdown.
- IAEA conducts on-going monitoring.

# Radiochemical Laboratory: Additional Measures

- Depending on the extent of operations at the plant, North Korea will likely need to provide information about its plutonium separation activities, including recent operating and accountability records.
- IAEA will need to verify this information, which may require access to plant personnel and the right to take samples for assessment.
- Agreement should be sought to remove any newly separated plutonium from North Korea.

# Other Sites Subject to Refreezing

- Fuel Fabrication Complex--IAEA reestablishes monitoring and North Korea provides fresh fuel inventories.
- The 50 and 200 MW(e) Reactor—North Korea halts any construction activities and IAEA resumes monitoring.

# Conclusions

- Any effort to reestablish the freeze at Yongbyon should be part of a broader verified dismantlement approach.
- Verification arrangements should be central to any agreements to refreeze activities or facilities.
- IAEA should participate fully in any negotiations.
- Refreezing activities should be designed so as to facilitate verification and build confidence that North Korea intends to comply.