

Study on Sustainable Regional Nuclear Fuel Cycle Framework from Viewpoint of 3S

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**Peaceful Use of
Nuclear Energy**



Nonproliferation, Security, Safety

Basic Concept on Our MNA Study (I)

Regional Nuclear Fuel Cycle (Front/Back End)



1. Compatibility of “inalienable right (equality)” and “nuclear non-proliferation” in peaceful use of nuclear.
2. Hold equal level of nuclear non-proliferation (NNP) function to the existing NNP measures (e.g., substitute for existing bilateral nuclear agreement)
3. Possess function to comply with International standard or requirement of Safety, Security and Safeguards (3S)
4. Establish Regional control system for 3S and sensitive technologies.

Basic Concept on Our MNA Study (II)

Regional Nuclear Fuel Cycle (Front/Back End)



5. Pursue Closed Fuel Cycle with long-term storage for regional energy security : open cycle is out of our scope from the viewpoints of 1) NNP (to avoid worldwide proliferation of Pu-contained spent fuels; Pu-mine) and 2) reduction of Environmental burden and 3) saving of repository space.
6. Economical, functional, industrially viable
7. Enhance reliability of international / regional community

INFCIRC/640

**“Multilateral approaches
to the nuclear fuel cycle”**

Type I: Assurances of services not involving ownership of facilities

- a) Suppliers provide additional assurances of supply
- b) International consortium of governments
- c) IAEA-related arrangement

Type II: Conversion of existing national facilities (ownership) to multinational ones

Type III: Construction of new joint facilities

Our Project

Type A:

No involvement of services (assured) of fuel supply , Spent Fuel (SF) storage & reprocessing, but regional framework for 3S

Type B:

Provision of services (assured) of fuel supply, SF storage & reprocessing; existing & new facilities; without transfer of ownership, regional framework for 3S (IAEA - arrangement)

Type C:

Provision of services (assured) of fuel supply , SF storage & reprocessing existing and new joint facilities; with owner-ship transfer of facilities to MNA, regional framework for 3S (IAEA - arrangement)

Service Recipient States (Possess Reactors) enjoy services ,involve regional 3S framework, not involve ownership change

MNA Options for INFCIRC/640 and Our Study

Prerequisite items for formulation of NMA

Label A: Nonproliferation (restriction of NPT Article IV, safeguards, nuclear security and export control)

Label B: Assurance of supply

Label C: Siting – choice of host country

Label D: Access to technology

Label E: Multilateral involvement

Label F: Economics

Label G: Transportation

Label H: Safety

Label I: Nuclear liability

Label J: Political and public acceptance

Label K: Geopolitics

Label L: Legal aspects (relations with international agreement, bilateral agreements, nuclear free zone, etc.)

New

Table Prerequisites for Formulation of MNA (I)

| Label A: Nonproliferation | | | | |
|---|---|--|--|---|
| | NPT Article IV (Right of Peaceful Use) | Safeguards | Nuclear Security | Export Control within MNA |
| Type B <u>Host State :</u> Provision of services of fuel supply, SF/MOX storage, reprocessing existing/ new joint facilities <u>Without transfer of ownership (Only MOX storage is controlled by MNA)</u> | Operator: <u>MemberState-consortium</u> Member states: Host states: Criteria-based, <u>any Member State,</u> though mainly already technology-introduced states Partners: <u>any member state,</u> not possess facilities | <u>Regional (MNA+IAEA)</u> <u>Safeguards / RSAC Accountancy: by utility and MNA</u> | <u>International Standards</u> By utility (national police) <u>Security audit by MNA</u> | <u>MNA members: to be Members of NSG</u> <u>NSG Criteria* :Guidelines' "objective"/ (excluding "subjective") of INFCIRC 254/Part1 - 6,7 (revised in June 2011): CAS+AP (equivalent), Nuclear Security, Nuclear Safety Treaty, NSG Guideline.</u> |
| Type C <u>Site Provision State:</u> Provision of services of fuel supply, SF/MOX storage & reprocessing existing/ new joint facilities <u>With ownership transfer to MNA</u> | Operator: MNA-consortium Member states: Site-provision states : <u>Criteria-based,</u> any member state, not regarded technology holder. Partners: <u>any member state</u> not possess facilities | <u>Inspections: by MNA in cooperation with IAEA</u> | <u>International Standards</u> By MNA <u>Security audit by MNA</u> | |
| MNA Member Stats Operation (with only Reactor partner) For Type A,B,C <u>-without transfer of ownership</u> | National (or utility's) facility Enjoy services of fuel supply & reprocessing including with safeguards, meet nuclear safety, security standards and NSG criteria* | | <u>International Standards</u> By utility (national police) <u>Security audit by MNA</u> | |

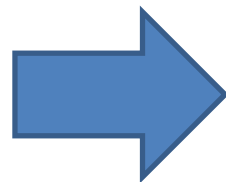
Table Prerequisites for Formulation of MNA (II)

| | Label B: Assurance of Supply/ Services | Label C: Selection of Host States | Label D: Access to technology | Label E: Multilateral involvement | Label F: Economics |
|----------------|---|---|--|--|--|
| <u>Type B</u> | Host states to provide services to partner states of LEU fuel supply, SF storage , reprocessing and MOX-MNA stock-pile storage | State with political stability | Access should be permitted only to technology holder | Provision of AOS without transfer of ownership . Technology holder (host state) for ownership, control, and operation; MNA for development, mainly SF treatment | Increase economy compared with the case by individual states <small>(Incentive to MNA on competitive-ness of economy vs individual states' investment)</small> |
| <u>Type C</u> | MNA to provide services to partner states of LEU fuel supply, SF storage and reprocessing | Extra territorial status for MNA siting State with political stability | | Provision of AOS with ownership transfer of facilities to MNA. MNA for ownership; Technology holder, committed by MNA, for control and operation. MNA for development, mainly SF treatment | |
| <u>Reactor</u> | Partner states: ENS and states with small nuclear programs | State with political stability | - | Reactor Operation Only for Type A,B,C -Enjoy AOS without transfer of ownership | - |

Table Prerequisites for Formulation of MNA (III)

| | Label G: Transportation | Label H: Safety | Label I: Nuclear Liability | Label J: Political and public acceptance | Label K: Geo- politics | Label L: Legal Aspect |
|----------------|--|---|--|--|--|--|
| <u>Type B</u> | International standards on the transportation of nuclear material | International nuclear safety standards | States to individually join international nuclear liability convention | Significance and social acceptability | Host state with political stability | Agreement on MNA Need to mutually adjust variances among related laws/ agreements |
| <u>Type C</u> | Mutual Cooperation within MNA Member States | | MNA (among Member States) to cover certain level liability | | | |
| <u>Reactor</u> | - | | States to individually join international nuclear liability convention | | | |

Above Prerequisites



“Fundamental Regional Agreement” was drafted.

Regional Framework



Near Future goal

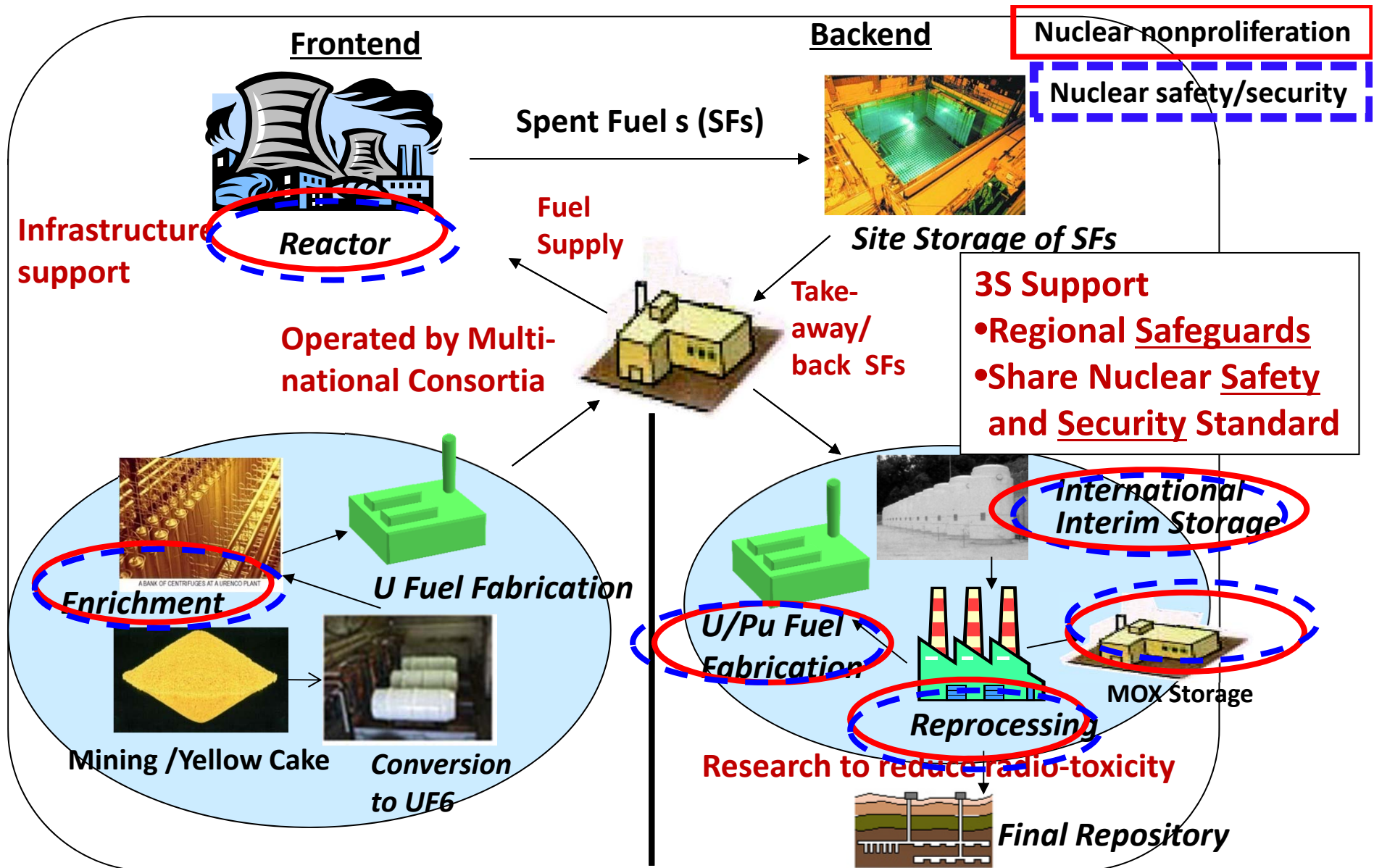
- Targeted to **type B**
- Establish MNA SF storage
- Use of existing (ready for use) Reprocessing
- Return HLW to owner states
- MOX after reprocessing : options: ① MNA storage for stockpile of MOX, ② Return MOX as LWR MOX at high level safeguards/security, ③ Sellout to Nuclear Weapon states (mainly ①)

Long-term future goal

- Targeted to **type C**
- Establish MNA SF storage and Reprocessing with advanced technology
- MOX after reprocessing : options: ① MNA storage for stockpile of MOX, ② Return MOX as LWR MOX or FBR/FR at high level safeguards/security, ③ Sellout to Nuclear Weapon states (mainly ①②)

Example: Potential Members on: Asian (Pacific?) region





Any country has a right on its own nuclear fuel cycle options, if it meets specific prerequisites, as discussed in NSG.

Possible Regional Framework of Future Nuclear Fuel Cycle