

International Nuclear Fuel Cycle and Nuclear Non-Proliferation

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A Proposal by Nuclear Nonproliferation Study Committee

1. The non-proliferation study committee at Tokyo University proposes a **cooperative framework in Asia Pacific** to meet the goals of 1) **assurance of fresh fuel supply**, 2) **spent fuel management** and 3) **nuclear non-proliferation**.
2. The goal of the regional network of nuclear fuel cycle facilities in Asia Pacific is to **promote trust, confidence-building measures, and transparency of peaceful nuclear fuel-cycle programs in Asia Pacific**.

Members of the Nuclear Non-proliferation Study Committee

Leader Satoru Tanaka * The University of Tokyo (G-COE)
Sub-Leader Yusuke Kuno *The University of Tokyo (G-COE)

Japan's nuclear industrial companies,
utilities, laboratories, NGOs, and Tokyo
University members

[in Alphabetical Order]

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Hirohisa Miyakoshi The Kansai Electric Power Co., Inc.
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Yukio TomitaThe federation of Electric Power Companies of Japan
Coordinator: Yoshinori Izumi * Japan Atomic Energy Agency

Note: “*” Member of the Working Group on an international (regional) nuclear fuel cycle framework.

The study committee aims to foster free-discussion on the future direction of nuclear energy from nuclear non-proliferation viewpoints among the members. Therefore, the opinions given in this paper does not represent the individual companies/organizations, but the majority of the opinions shown during the discussions of the committee.

Nuclear Non-proliferation Study Committee

2008年(平成20年)9月20日(土曜日)

September 20, 2008

夕刊 読者 新聞 新聞



核不拡散専門家を養成

来月 東大と産業界で機関設立

東京大学は、電力会社など産業界と共同で、核拡散問題の専門家を養成する教育研究機関を10月上旬に設立する。

唯一の被爆国で、原子力の平和利用を進める日本は、核拡散防止への貢献が期待されているが、専門家は少ない。国際原子力機関（IAEA）などの核拡散防止活動の即戦力となる人材を育て、実践的な政策提案を行うのがねらい。

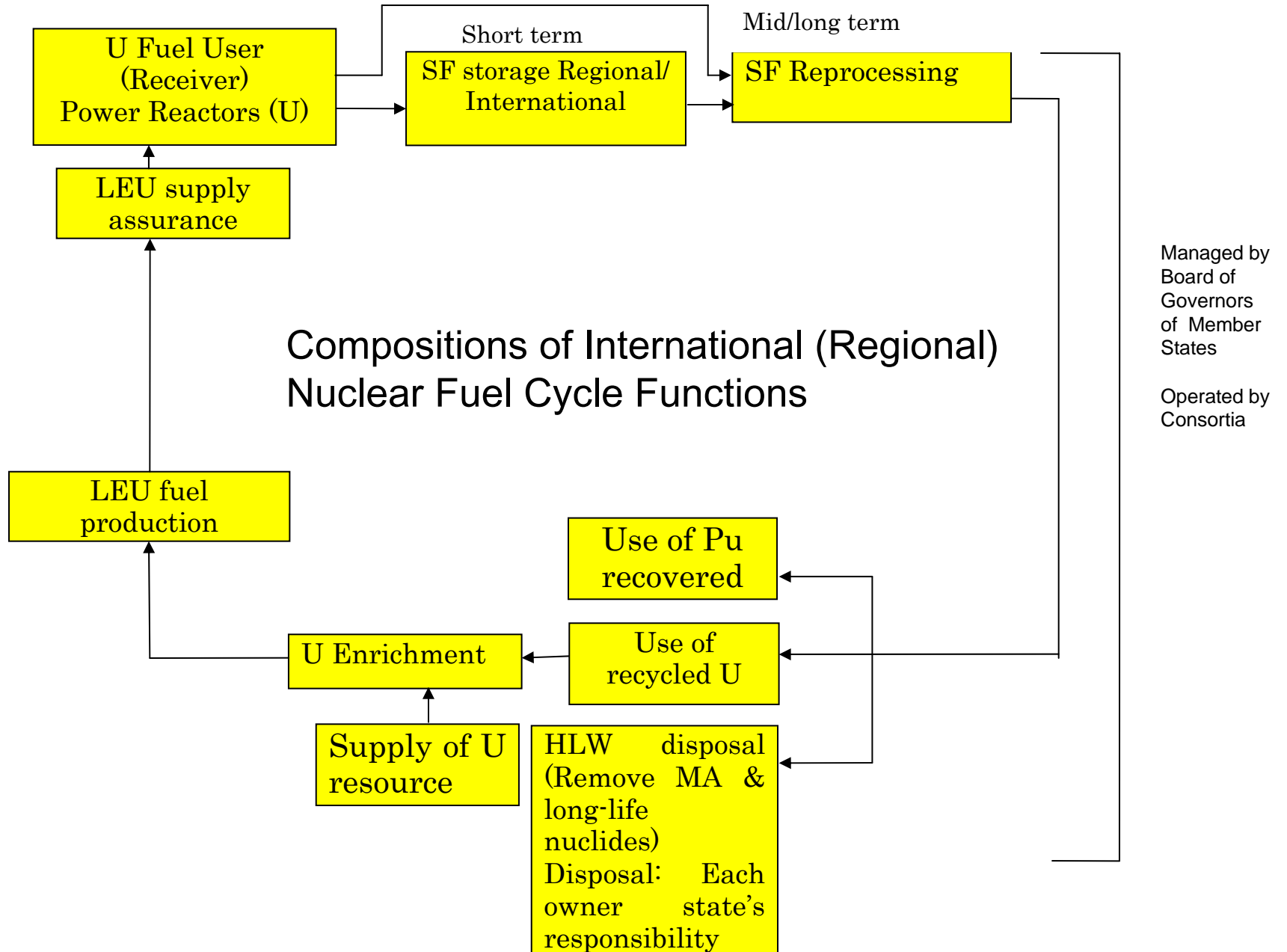
久野祐輔・原子力国際専攻専員教授ら、原子力技術などを担当する東大教授9人が発起人となり、電力会社や核燃料製造会社、原子炉メーカーなど約20の企業や組織が参加する。「国際保障学研究会」などの名称が検討されている。

産業界が協力するのは、今後、アジアを中心に原子力のビジネス展開を図るうえで、核不拡散技術や政策に精通した人材が必要になるためだ。新しい機関では、原子力発電所の使用済み核燃料から核兵器の材料となるプルトニウム、ウランを抽出しにくくする最新技術

や、核不拡散を巡る各国間の協力態勢、査察の在り方などを研究する。

Conditions Necessary for Cooperative Framework

1. Universality/equality
2. Transparency under international regime,
bilateral and/or multilateral agreements
3. Economic viability, market mechanism
4. Voluntary but willing participation
5. Stability, e. g., abrogation due to
country's own demand / aspiration
should not be readily happened



Specific framework proposed

1. All the participants are divided into 2 categories, Nuclear Fuel Cycle (NFC) country and non-NFC country.
2. Any country has a right on its own nuclear fuel cycle options including reprocessing, if it meets specific conditions (prerequisite)*. The board of governors judges the qualification for new country's entry to NFC in consultation with IAEA. (Country which starts participation as non-NFC country can become NFC even on its demands afterwards when it comes to fulfill the conditions));
3. Participants (non-NFC countries) should take-away SF soon after taking SF out (basic taken back to the owner countries of materials. If it is not possible, SF can be stored at participants' own sites preliminarily.)

* Conditions/Prerequisite to Become a Nuclear Fuel Cycle Country (Box 1*)

- a. There is obvious quantitative accordance between in nuclear energy/Pu-resource (needs/seeds).
- b. To be transparent enough on plan and activities on nuclear fuel cycle to be recognized by international communities.
- c. To be under key international institutional systems/norms including Comprehensive Safeguards, Additional Protocol.
- d. To possess technology level that international communities can recognize.
- e. To possess long-term record of excellent performance in compliance with the above norms.
- f. Measures for physical protection are at international level.
(Ratification of PP Treaty, Treaty against Nuclear Terrorism)

Specific framework proposed (Cont'd)

4. It is prudent for the nuclear-weapons states (NWS) to consider take-back /take-away of spent fuel produced in countries in regions of political instability: compensation of NWSs for dissolution of inequality in NPT. It should not imply to restrict the contribution in nuclear fuel cycle services by non-nuclear weapon countries, where the contribution should be confined to voluntary cooperation since it relates to Pu-accumulation issue, that positions differently from the NWS.
5. In parallel with the effort towards the establishment of back-end services in the international system, the spent fuel taken-back /taken-away can be stored and managed by the international (or regional) system of nuclear fuel cycle under multi-national control for an interim period (possibly Max~50 years).
6. Direct disposal of spent fuels is out of scope in this study from the viewpoints of effective utilization of nuclear fuels (recovered U and Pu), proliferation concerns on spent fuels (Pu), and environmental burden.

Specific framework proposed (Cont'd)

7. Fuel cycle services provided by the international (or regional) framework should be commercially competitive; e.g. at least 2 enrichment consortia / 2 reprocessing consortia.
8. Accountancy of nuclear materials in fuel cycle facilities including sensitive technology facilities should be made by the multilateral countries with host country (RSAC) under IAEA Safeguards for transparency of the host country's operations. Nuclear weapon country as well as nuclear non-weapon country, when it participates in the fuel cycle services for the international framework, must be under the same high level of Safeguards.
9. Partner countries are not allowed to get into details of sensitive technologies. Those should be under the strict control of the fuel-cycle countries. Operations of facilities are made by consortia whose personnel are mainly employed from host country.

Specific framework proposed (Cont'd)

10. Nuclear fuel facilities, in particular, the sensitive technology should have high proliferation resistance to reduce the incentive for abrogation of a fuel-cycle supplier's country.
11. The international (or regional) system of nuclear fuel cycle would promote the peaceful utilization of separated Pu in thermal reactors, FBRs to prevent unnecessary Pu accumulation, and to promote effective / efficient use of nuclear energy. Any surplus of plutonium should be sent / provided to the NWS (stored or sold).
12. The values of plutonium produced by participating countries, and reprocessed and recovered by the fuel-cycled suppliers countries (taken-away mainly by NWS) would be properly compensated for by alternative energy resources or economic support. Transferred Pu should be utilized only for the peaceful purpose of nuclear energy under strict control of IAEA Safeguards.

Specific framework proposed (Cont'd)

13. Each participating country should responsibly seek solutions for disposal of its HLW depending upon country's feature although it does not exclude the case of disposal by the other countries in other countries' land.
14. Disposal of HLW will be a critical challenge to facilitate realization of the proposed international nuclear fuel cycle. This study committee will study specific ideas towards the reduction of quantity and risk of HLW for its repository (e.g. reduction nuclides to be disposed)
15. Costs for infrastructure (enrichment and reprocessing facilities and operations) should be shared by fuel-cycle countries & supplied countries.
16. Fundamental principle of energy security policy: individual country should ensure to fulfill its own energy demand.

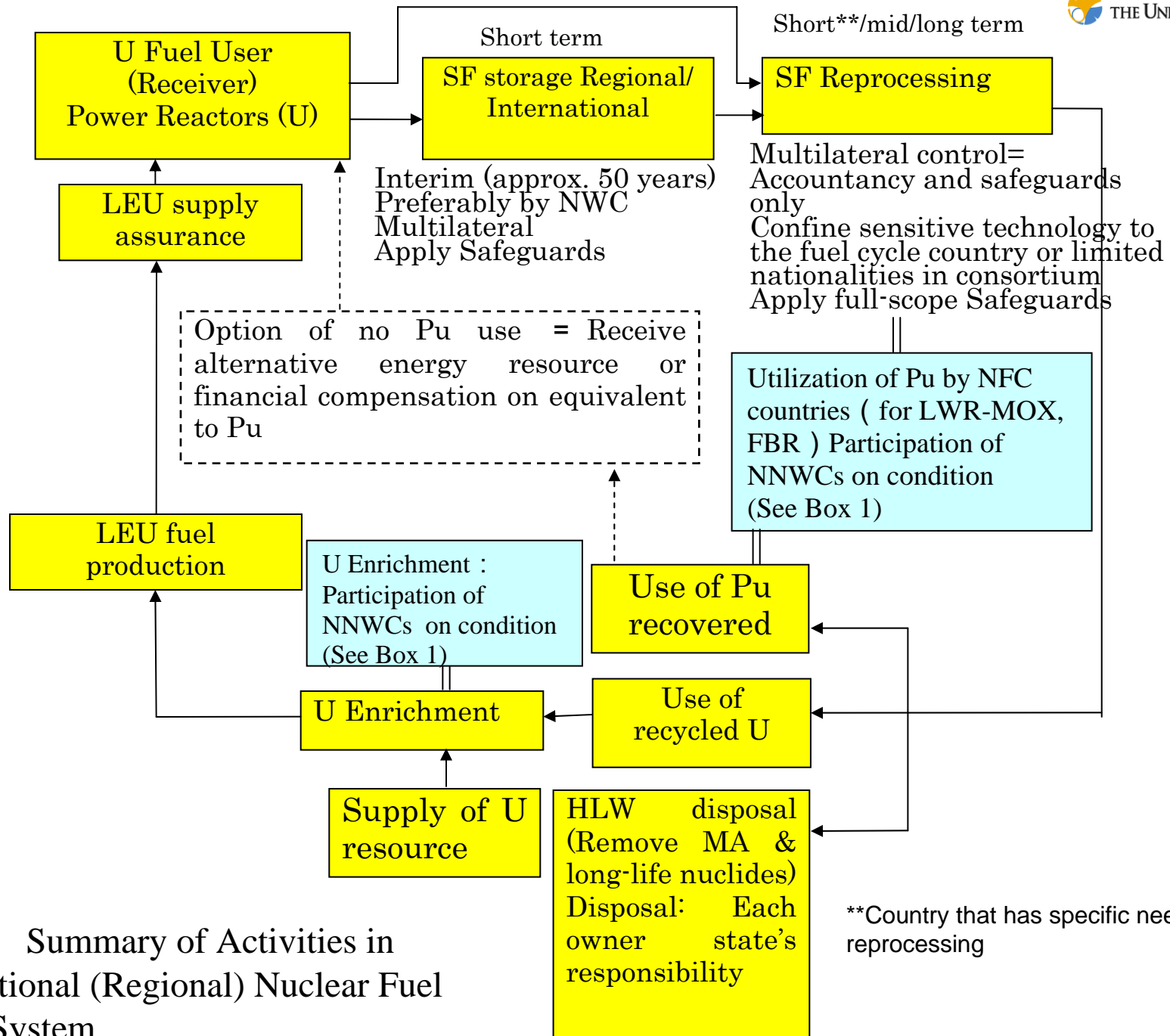


Figure Summary of Activities in International (Regional) Nuclear Fuel Cycle System

Expected effect from the international fuel cycle concept (I)

1. Stable supply system of LEU fuels
2. Solution on accumulation of spent fuels individual countries
3. Cost saving for treatment of SFs by SF take-back system (e.g. cost for building reprocessing, implementation of Safeguards etc for unnecessary small scale countries)

Expected effect from the international fuel cycle concept (II)

4. Develop/keep 3S in peaceful use of nuclear energy
 - **Safeguards** (nuclear non-proliferation) - elimination of incentive to possess sensitive technologies, enrichment (EU) and reprocessing (Pu): 1) increase in transparency among participants, 2) prevent proliferation of SF, 3) prevent proliferation of sensitive technologies (enrichment and reprocessing) 4) reduction of diversion risk in nuclear fuel cycle states, 5) eliminate Safeguards for HLW, since not spent fuels.
 - **Security**: Improvement of total security through 1) central control of SFs (by multi-lateral control), 2) limiting the number of nuclear fuel cycle states, and 3) reduction in security level by change from spent fuels to HLW in long-term.
 - **Safety**: Safe storage of SF in mid-to-long term, maintain safety in nuclear fuel cycle technologies by limiting the number of NFC states.

Expected effect from the international fuel cycle concept (III)

5. Lessen the burden of Safeguards, and contribute to universalization of AP.
6. Effective utilization of resources; utilization of U and reprocessed U from the viewpoints of mid-to-long term.
7. Promote solution of high level waste issue through international cooperation
8. Solve problem of inequality in NPT
9. Aim for an ultimate goal of a world completely absence of nuclear weapon.

Weak-points / Challenges

- ◆ Difficult to expect the participation of states having strong aspirations of independence of their own fuel cycle policy; the cooperative framework cannot be an absolute non-proliferation measure.
- ◆ Although a state which fulfills the conditions/prerequisite* can be a nuclear fuel cycle state, it may still be realistically difficult to equate situations of possessing sensitive technologies among different fuel-cycle states.
- ◆ New issues on security and cost for spent fuel transportation occur.

*Thank you for
your attention*

Our Paper is open Tokyo University
GCOE (GoNERI) HP (in Japanese), -
English version will show up soon. It will
be presented at Conferences of INMM
2009 (July 2009) and GLOBAL 2009
(September 2009).