



# International Confidence to Japanese Nuclear Activities

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## What is “international confidence to nuclear activities”? ①

### <Nuclear Non-proliferation Treaty>

- Into force in 1970. 189 member states.
- Prevention of proliferation of nuclear weapons to outside of 5 Nuclear Weapon States.
- Non-Nuclear Weapon States should conclude agreement with IAEA and accept safeguard by IAEA.
- The original main purpose of this Treaty has been said to **prevent Japan** and West Germany **from acquiring nuclear weapons.**

## What is “international confidence to nuclear activities”? ②

### <Japan Overview>

#### by ”Nuclear Threat Initiative (NTI)”

- Japan **has the technical capability** to produce nuclear weapons.
- Several neighboring countries have expressed **concerns about possible Japanese nuclear ambitions**.
- Recent tension in the Korean peninsula has led to **discussions in Japan about nuclear weapons development**.

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## What is “Safeguards”? ①

- **Safeguard:**
  - Timely detection of diversion of nuclear materials from peaceful nuclear activities to the manufacture of nuclear weapons,
  - Deterrence of such diversion by the risk of early detection.
- **Safeguards Measures:**
  - **Nuclear Material Accountancy:**  
To grasp and report to IAEA the locations, sorts, quantities and transfers of all nuclear materials.
  - **Containment and Surveillance:**
    - Seals for verification of no transfer of nuclear materials.
    - Surveillance of transfers of nuclear materials with cameras.
  - **Inspection:**
    - Comparison of records and reports.
    - Verification of existence of nuclear materials as recorded.

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## What is “Safeguards”? ②

### <Strengthening of Safeguards>

- **Background:** Nuclear development suspicion of Iraq and North Korea
- **Purpose:** **Detection of undeclared** activities and facilities
- **Safeguards measures strengthen under Additional Protocol**
  - **Complementary Access:**  
Access with 2 hours or 24 hours advanced notice
  - **Environmental sampling**

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## Broader Conclusion on Japan by IAEA(June 2004)

- **The first conclusion** among states with large nuclear programs.
- **Summary of this conclusion:**
  - **All declared nuclear material** in Japan has remained **in peaceful** nuclear activities.  
(led by the comprehensive safeguards)
  - **No indication of undeclared nuclear material or activities** for Japan as a whole.  
(led by the strengthened safeguards under Additional Protocol)

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## 5 Factors of the International Confidence

- **5 Factors, based on which Japan has achieved the international confidence in its nuclear fuel cycle activities :**
  - ① **Manifesto for peaceful use of nuclear energy,**  
(eg:Atomic Energy Basic Law, Three Non-Nuclear Principles)
  - ② **Obvious needs for nuclear fuel cycle program,**  
(eg:Energy-scarce island country, Large scale nuclear power program)
  - ③ **Transparency of national nuclear energy program,**  
(eg:Open process for revise every 5 years)
  - ④ **Excellent Records of compliance with nonproliferation norms,**  
(eg:NPT, Comprehensive Safeguards, Additional Protocol, Export control)
  - ⑤ **Active contribution to nonproliferation.**
- **This research focuses on Japanese efforts in safeguards.**

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## Evaluation of Japanese Cooperation to Safeguards Implementation as One of Best Practices ①

### Backgrounds

- **The importance of transparency and openness in safeguards**
  - Iran
    - **Breaches** of IAEA Safeguards Agreements by **undeclared nuclear activities** for a long time.
    - IAEA requests Iran to provide more **transparency, cooperation** to IAEA, and **confidence building measures**.
  - Brazil
    - **Denials to IAEA inspections** at its uranium enrichment facility.
  - International **discussion on the transparency and openness** in safeguards
    - **Needs concrete examples** to discuss further.
- **Consideration of strengthening of safeguards by IAEA**

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## Evaluation of Japanese Cooperation to Safeguards Implementation as One of Best Practices ②

### Objectives :

- To facilitate the international discussion on transparency and openness by evaluating Japanese cooperation to safeguards implementation in terms of transparency and openness,
- To identify and disseminate best practices of cooperation to safeguards implementation in terms of transparency and openness,
- To facilitate international understanding to Japanese peaceful nuclear activities.

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## Evaluation of Japanese Cooperation to Safeguards Implementation as One of Best Practices ③

### Research Organization :

- **Advice from the Nuclear Nonproliferation Policy Study Group**
  - Experts in the fields of International laws, International relations, nuclear engineering, safeguards, and from related organizations, mass media, etc..
- **Research Team**
  - Members voluntarily from,
    - Japan Institute of International Affairs (JIIA),
    - Japan Nuclear Fuel Limited (JNFL),
    - Federation of Electric Power Companies of Japan (FEPCO),
    - Nuclear Material Control Center (NMCC),
    - Japan Atomic Industrial Forum (JAIF), etc.,as well as NPSTC/JAEA

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# Features of Japanese Cooperation to Safeguards Implementation

1. Active contribution to the concreting and strengthening of safeguards methods
2. Close cooperation with IAEA from early phase
3. Close cooperation with US based on the Japan-US Nuclear Cooperation Agreement
4. Development and Adoption of advanced safeguards technologies
5. Active provision of enough information
6. Active acceptance of various random inspection methods whose dates are hard to anticipate
7. Sincere cooperation to IAEA inspections
8. Sincere responses in case of questions raised by IAEA

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## Japanese Concrete Cooperation to Safeguards Implementation (1) Active Contribution to the Concreting and Strengthening of Safeguards Methods

### <Additional Protocol>

- Active contribution to its establishment, although AP imposes more safeguards burden on Japan.
- Japan is the first ratification state among states with large nuclear programs.

### <Hexapartite Safeguards Project> (1980.11~1983.2)

- Active contribution to the consideration on concrete safeguards method at commercial centrifuge enrichment plants.
- Adoption of “Limited Frequency Unannounced Access (LFUA)” in the cascade area.

### <Large Scale Reprocessing Plant Safeguards (LASCAR)> (1988~1992)

- Japanese donation to IAEA
- Effective safeguards can be implemented by appropriate mixture of related technologies.

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Japanese Concrete Cooperation to Safeguards Implementation (2)  
**Close Cooperation with IAEA from Early Phase ①**

**<Tokai Reprocessing Plant>**

- **Provision of design information and acceptance of IAEA inspections, even before the ratification to NPT and the conclusion of SG agreement.**

1970.2 Signature to NPT (1976.6 Ratification).  
1971.6 Start of construction.  
1973.11 Provision of design information to IAEA.  
1974.9 Preliminary inspection by IAEA.  
1974.10 Completion of construction  
(74.10~75.3 Chemical test, 75.9~77.3 Uranium test.)  
1977.9 Start of formal IAEA inspection.  
1977.12 Conclusion of comprehensive SG agreement with IAEA.

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Japanese Concrete Cooperation to Safeguards Implementation (2)  
**Close Cooperation with IAEA from Early Phase ②**

**<Tokai Plutonium Fuel Production Facility>**

- **Negotiation with IAEA on Safeguards**
  - 27 times, 66 days between 1985.6~1988.7.
- **1986.12, Submission of Design Information Questionnaire to IAEA. 4 times, 8 days of Design Information Verification.**
- **1988.7, Facility Attachment into force, describing specific safeguards.**

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## Japanese Concrete Cooperation to Safeguards Implementation (2) Close Cooperation with IAEA from Early Phase ③

### <Rokkasho Reprocessing Plant>

- 1989.3, Upon concrete planning, start of **informal meeting with IAEA** to exchange information.
- 1992.12, Licensed for reprocessing.
- 1993.1, **Submission of preliminary design information** of Spent Fuel Storage Building and Main Reprocessing Facilities to IAEA. Establishment of **Working Group with IAEA** to negotiate specific safeguards.
- Spent Fuel Storage Building
  - 1994.8, **Submission of Design Information Questionnaire** to IAEA. **Design Information Verification**, one after another.
  - 1996.12, Facility Attachment into force, describing specific safeguards.
  - 1998.10, Start of reception of spent fuels.
- Main Reprocessing Facilities
  - 2000.1, **Submission of Design Information Questionnaire** to IAEA. More than **50 times Design Information Verification** between 2000.1~2005.12.
  - 2004.1, Facility Attachment into force, describing specific safeguards.
  - 2004.12, Uranium test started.
  - 2006 Spring, Active test will start.

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## Japanese Concrete Cooperation to Safeguards Implementation (3) Close cooperation with US based on the Japan-US Nuclear cooperation Agreement ①

### <Japan-US Nuclear Cooperation Agreement>

- **1955 Into force**
- **1968 Revised**
  - Japan is allowed reprocessing **only when** Japan-US **codetermine** that effective safeguards can be applied.
- **Current Agreement (1988 into force)**
  - Comprehensive advance approval for reprocessing, etc.
  - To add planned facility into the frame of comprehensive approval, **notification to US of its compliance with the agreed safeguards concept.**
  - The agreed safeguards concept provide that **Japan and IAEA shall cooperate in timely resolution of any problems** arising during the implementation of safeguards.

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## Japanese Concrete Cooperation to Safeguards Implementation (3) **Close cooperation with US based on the Japan-US Nuclear cooperation Agreement ②**

### <Tokai Reprocessing Plant>

1971. 6 Start of construction (Designed to extract Pu solely)  
1974.10 Completion of construction (Chemical test: 1974.10 – 1975.3)  
(Uranium test: 1975.9 – 1977.3)
1977. 4 US announced its new nuclear policy  
(**Demanded** not to extract Pu solely but **Pu-U mixed**)
1977. 9 **Codetermination** under Japan-US Nuclear Cooperation Agreement.  
(To allow two years operation with confirmed effective safeguards. To conduct **mixed extraction experiment** and report the result to “INFCE: International Nuclear Fuel Cycle Evaluation”).
- 1977.10 – 1980. 3 **Conduct of “INFCE”**  
(Improvement of safeguards technologies enables **peaceful nuclear activities compatible with nuclear non-proliferation.** )
- 1978 – 1981 **Tokai advanced safeguards technology exercise (TASTEX)**  
(Japan, US, France and IAEA cooperated in **developing effective safeguards technologies**, and demonstrated them at Tokai Reprocessing Facility)
- 1983.10 **Start of hot operation.**  
(Conversion facility was **remodeled** to denitrate and convert Uranium and Plutonium solution after mixing them.)

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## Japanese Concrete Cooperation to Safeguards Implementation (3) **Close cooperation with US based on the Japan-US Nuclear cooperation Agreement ③**

### <Tokai Plutonium Fuel Production Facility>

- **Negotiation with US on safeguards**  
— 3 times, 16 days, between June and July, 1988

### <Rokkasho Reprocessing Plant>

- **Unofficial Japan-US safeguards meeting**
  - Informed the progress of safeguards system design/production and the situation of negotiation with IAEA.
  - Informed and negotiated with US in earnest since 1993. Provided other opportunities of information exchange including operator.
- **3 parties meeting among Japan, US and IAEA**
  - Discussed safeguards approach, key elements, etc. between 2002 and 2004 for 4 times
- **Accomplishment of the procedure of US's comprehensive approval in March, 2004**

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Japanese Concrete Cooperation to Safeguards Implementation (4)  
**Development and Adoption of  
advanced safeguards technologies ①**

**< Tokai Plutonium Fuel Production Facility >**

● **Purpose**

- To establish safeguards system **compatible with automated facility operation.**
- To **reduce exposure** and to **improve safety** during inspection.

● **Developed Safeguards Technologies**

- Non Destructive Assay system (NDA)  
(Automatic measurement of Pu amount in the nuclear material in all forms and shapes. )
- Non inspector attendant verification system  
(All necessary inspection data can be obtained by camera and embedded NDA system on transfer trolley during transfer. )
- Near Real Time Material Balance Management System (NRTA)  
(Verification of no diversion of nuclear material by frequently confirming MUF within measurement error. )
- Inspection data remote monitoring system  
(Regularly transmission of inspection related information gathered and stored in the facility to inspectors office. )

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Japanese Concrete Cooperation to Safeguards Implementation (4)  
**Development and Adoption of  
advanced safeguards technologies ②**

**<Rokkasho Reprocessing Plant>**

● **Based on the LASCAR project, the following advanced technologies were developed and adopted.**

- Solution Monitoring (in Pu solution handling area)
  - To confirm no extraction of solution by continuously monitoring the level and density of solution in tanks.
- Pu Inventory Measurement System (in Pu powder handling area)
  - Continuous Pu amount determination by Neutron radiation measurement.
- Near Real Time Accountancy (in Pu solution/powder handling area)
  - To confirm no diversion of nuclear material by verification every 10 days in addition to the monthly inventory verification.
- Safeguards Analytical Laboratory (On-site Laboratory)
  - State owned analytical laboratory, where IAEA also conducts various nuclear material analysis such as Isotopic ratios with high accuracy and quickly.

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Japanese Concrete Cooperation to Safeguards Implementation (5)  
**Active provision of enough information ①**

**<Provision of necessary information for Inspection >**

- **Inspection data remote monitoring system at Tokai Pu Fuel Production Facility.**
  - Accumulated inspection related information is regularly transmitted to inspectors office.
- **Remote data transmission system at uranium fuel fabrication facilities.**
  - Data on the receipt and shipment of uranium are transmitted daily to enable IAEA to carry out short notice random inspections timely.
- **Number of Accounting records (Year 2004)**
  - Uranium Enrichment Facilities : 6,920 records
  - Uranium Fuel Fabrication Facilities : 23,138 records
  - Reactor Facilities :167,169 records
  - Reprocessing Facilities : 42,919 records
  - Plutonium Fuel Production Facilities : 32,700 records

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Japanese Concrete Cooperation to Safeguards Implementation (5)  
**Active provision of enough information ②**

**<Initial Report (June, 2000) and Annual Report (every May) under Additional Protocol>**

- **Declared Information (End of 2004)**
  - Buildings at site (136 sites, Approx. 5000 bldgs.) .
  - Governmental nuclear fuel cycle related researches without using nuclear material (93 themes).
  - Activities mentioned in Appendix I of AP, such as production of centrifuge rotor (39 activities).

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## Japanese Concrete Cooperation to Safeguards Implementation (6) **Active acceptance of various random inspection methods whose dates are hard to anticipate**

- **Uranium enrichment facility**
  - Limited Frequency **Unannounced** Access (LFUA)
    - To confirm the connection of centrifuge tubes and to measure uranium enrichment in the cascade area **to prevent production of highly enriched Uranium.**
  - To confirm no production of highly enriched Uranium by **continuous** Gamma-ray **monitoring** at the tail tube.
- **Uranium fuel fabrication facility**
  - **Short Notice Random** Inspection (**2 hours advance notice**)
  - **Borrowing Verification** (**24 hours advance notice**)
    - Simultaneously verification of process inventory at other fabrication facility, to confirm no similar nuclear material borrowed.
- **Nuclear Power Plant**
  - **Random Interim** Inspection (**24 hours advance notice**)
    - To confirm records of fuel inventory and operation and to verify fuel inventory.
- **Reprocessing Plant**
  - **Continuous presence of Inspector** during operation.
- **Complementary access (2 hours or 24 hours advance notice)**
  - Accepted **139 accesses** between Nov. 2000 and Aug. 2005.

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## Japanese Concrete Cooperation to Safeguards Implementation (7) **Sincere cooperation to IAEA inspections**

- **Related laws provide that operators shall record, store and report the necessary information for accounting and safeguards**
- **Provision of necessary information to IAEA in advance**
- **Careful preparations by operators to enable efficient inspection**
  - (In advance)
    - Preparation of **manual** to deal with inspection
  - (At inspection)
    - Preparation of all necessary **data**
    - Preparation of enough **materials** for inspection
    - Preparation of all necessary **instruments**
    - **Attendance** to inspectors
    - Some **staff supporting** inspection in every area, etc.
- **Sincere and quick responses, when questions arise.**

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## < Improvement of Shipper Receiver Difference at Tokai Reprocessing Plant >

- **Cumulated Pu amount difference between Shipper and Receiver reached 206kg since 1977 to Sept. 2002.**
  - Shipper (Power plant) uses **calculated** amount in the fuel assembly.
  - Receiver (Reprocessing Plant) uses **measured** amount after dissolution.
- **Response**
  - Information sharing and cause investigation by the **Working Group among Japanese government, IAEA and operator** since 1995.
  - The **causes** of the difference **were identified** at the end of 2002.
    - Ex, Some Pu in the waste had not been accounted correctly. This was found from the difference of analytical results between IAEA and operator.
  - Improvement of the accuracy of analysis by **improved analytical method** of waste and **developed new measurement technology**.

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## < Pu holdup in the process area at Tokai Pu Fuel Production Facility >

- **“Missing 70kg of Pu”** U.S Paper reported in May 1994
- **Consultation with IAEA and improvement in two years.**
  - Pu recovery by disassembling of the equipments.
  - Development of high precision holdup measurement system.
  - Development of improved fuel fabrication equipments.

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# Summary of Japanese Cooperation to Safeguards Implementation

1. Active contribution to the concreting and strengthening of safeguards methods
2. Close cooperation with IAEA from early phase
3. Close cooperation with US based on the Japan-US Nuclear Cooperation Agreement
4. Development and Adoption of advanced safeguards technologies
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8. Sincere responses in case of questions raised by IAEA

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## Future Research

- Follow-up of international discussion on the strengthening of safeguards, transparency and openness.
- Identification of examples that are useful for confidence building, beyond the safeguards criteria.
- Consideration of what are the best or desirable practices of cooperation to safeguards implementation in terms of transparency and openness.
- Contribution to the international discussion on the strengthening of safeguards, transparency and openness.

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