Reducing the Enrichment Level of Uranium Fuel
(Japan's Experience)

Yukiya Amano
Ambassador
Permanent Mission of Japan
to the International Organisations
in Vienna

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1. Introduction

(i) As a country with few natural resources, Japan has given special priority to the development of science and technology as a means of ensuring its national prosperity and stability. Nuclear technology, in particular, has been of prime importance to Japan. Radioactive resources are widely used in the field of healthcare, in the treatment of cancer, for example; in industry, such as in non-destructive testing; and in the area of nutrition, such as in the improvement of breeding techniques.

Nuclear technology is also widely used in power generation in Japan. 55 nuclear power plants are currently in operation, as of June 2006, supplying about 30% of all electricity produced in the country. Japan has carried out uranium enrichment and plutonium reprocessing as a means of increasing the self-sufficiency of its energy supply. As regards radioactive waste generated by power reactors, Japan has adopted a policy of geological disposal which is implemented once the volume of such waste has been reduced as much as possible by reprocessing. It means that Japan has an advanced nuclear fuel cycle, covering both front end and back end.

(ii) As the only nation in the world to have endured a nuclear bombing, Japan is vehemently opposed to the development of nuclear weapons and restricts the use of its nuclear power to peaceful activities only.

Japan has consistently maintained a high level of transparency with regards to its nuclear activities and enjoys the full confidence of the international community in this respect. It has adhered to almost all international agreements concerning nuclear power including the NPT, the Additional Protocol, and the CTBT, and has kept an excellent record of its compliance with these agreements. Japan has enacted stringent domestic laws and regulations regarding nuclear activities. It maintains a high level of transparency vis-à-vis its own nationals and the international community by taking measures such as announcing its long-term strategy on nuclear power development and publishing a white paper on this issue.

(iii) Regarding the highly enriched uranium, Japan used enriched uranium fuel at

a level of 90% or 93%, when research institutes and universities constructed research reactors in the late 1960s. However, using highly enriched uranium is a matter of concern from the security point of view, is not a necessity, and is not helpful to ensure the confidence of the international community, as far as Japan is concerned. Therefore, Japan decided and has been reducing the enrichment level since the end of 1970s.

2. Japan's approach to reducing the enrichment level of uranium fuel in research reactors

There is no need for me to go into detail about the history of reducing the enrichment level of uranium fuel because this subject has, and will be, broached by the appropriate moderator.

Let me just mention the basic elements:

Reducing the enrichment level of uranium fuel is part of the non-proliferation policy that former US President Carter devised in April 1977.

The INFCE (International Nuclear Fuel Cycle Evaluation), which was carried out by the IAEA between 1977 and 1980, concluded that it was possible to reduce the enrichment level of uranium fuel for research reactors without decreasing safety and performance, or increasing operating costs, and with minimum changes to the core structure and fuel shape.

The Reduced Enrichment for Research and Test Reactors (RERTR) program, which was advocated by the United States as a follow-up to INFCE, was carried out on 25 occasions between 1978 and 2003. The program agreed by consensus that (a) it is essential to reduce the enrichment level of uranium fuel for research reactors from the viewpoint of non-proliferation, and (b) it is necessary to develop an enriched uranium fuel of a level of less than 45% for the short term and enriched uranium fuel of less than 20% for the long term. Each country is required to base the development of its technology on this policy.

Japan declared its support for this policy at an early stage and has taken appropriate measures, in line with the efforts of the international community.
The 5th "Long Term Plan regarding the Research, Development and Usage of

Nuclear Power" announced in 1978 stated that "Japan has already positively participated in the International Nuclear Fuel Cycle Evaluation (INFCE) and wishes to make a positive contribution to establishing a new international order for promoting the peaceful use of nuclear energy in the future."

In May 1978, Kyoto University commenced a joint research project with the ANL (Argonne National Laboratory), aimed at reducing the uranium enrichment level to less than 20% at the Kyoto University Reactor (KUR).

At a government level, the "Committee on the Highly Enriched Uranium Problem" (composed of the Science and Technology Agency, the Ministry of Foreign Affairs, the Ministry of Education, Kyoto University, and JAERI) was established in June 1978 and 89 meetings had been held by January 2000.

The Japanese Atomic Energy Research Institute (JAERI) has also begun to address the issue of reducing the enrichment level of fuel in each of its reactors in 1979. It established "the project team for mid-level enrichment uranium" and engaged in a joint research project with the ANL between 1980 and April 1994.

3. Reducing the uranium enrichment level – the current status

(1) Converting a research reactor's fuel from highly enriched uranium to low enriched uranium

Japan has constructed and operated 28 research reactors (currently 17 are in operation) for promoting research on safety and use of nuclear power for peaceful purpose. The first research reactor in Japan, JRR-1, was constructed and reached the critical phase in 1957.

By way of example, let me explain briefly the current status of some of Japan's research reactors:

(i) The Japan Material Testing Reactor (JMTR) used enriched uranium fuel at a level of 93% in the late 1960s, but is now fuelled exclusively by low enriched uranium. As regards spent fuel, both high and low enriched uranium, will continue to remain in Japan for some time.

(ii) The Japan Material Testing Reactor Critical assembly (JMTRC) has already been dismantled. Highly enriched uranium will remain as spent fuel for some time.

(iii) Kyoto University Reactor (KUR)
The operation of KUR using highly enriched uranium ended on February 23 this year. Preparation for the application procedure for using low enriched uranium is currently under way and KUR is expected to be fully operational by 2009.

(2) Schedule of transportation of spent fuel to the United States of America

(i) Spent fuel from JMTR
Spent fuel generated at JMTR will be 747 by the end of the 2006 fiscal year. A breakdown of this figure is as follows: highly enriched uranium fuel assembly (20% or more) is 35 (all 45%), and low enriched uranium fuel assembly (less than 20%) is 712. 120 fuel assemblies will be transported each year from FY2006 to FY2011, and in FY2012 the last remaining 27 spent fuel assemblies will be despatched.

(ii) Spent fuel from JMTRC
JMTRC has 72 highly enriched spent fuel assemblies in total (41 spent fuels with an enrichment ratio of over 90% and 31 spent fuel assemblies with an enrichment ratio of 45%).
20 spent fuel assemblies are scheduled to be transported annually in FY2006 and FY2007, and 16 spent fuel assemblies annually in FY2008 and FY2009.

(iii) Spent fuel from JRR-3
In total, 80 spent fuel assemblies are scheduled to be transported each year in FY2006, FY2007, FY2012 and FY2016 and 72 spent fuel assemblies in FY2018.

(iv) Kyoto University Reactor (KUR)
All spent fuel assemblies are scheduled to be transported to the United States in FY2007.

4. Conclusion

Japan supports the peaceful use of nuclear power, has an advanced nuclear fuel

cycle with the full confidence of the international community, and advocates non-proliferation, safety, security and transparency.

It has used highly enriched uranium at research reactors in the past, but since the end of 1970s, it has reduced the uranium enriched level from HEU to LEU. By now, Japan has almost completed the conversion.

A remaining issue is that of the transportation of highly enriched spent fuel to the United States. A considerable amount of this fuel has already been transported, with the remainder due for transportation at a later date.

Reducing the use of highly enriched uranium fuel is an important issue in preventing nuclear terrorism. I hope the process of replacing it with low enriched uranium fuel will be accelerated worldwide.