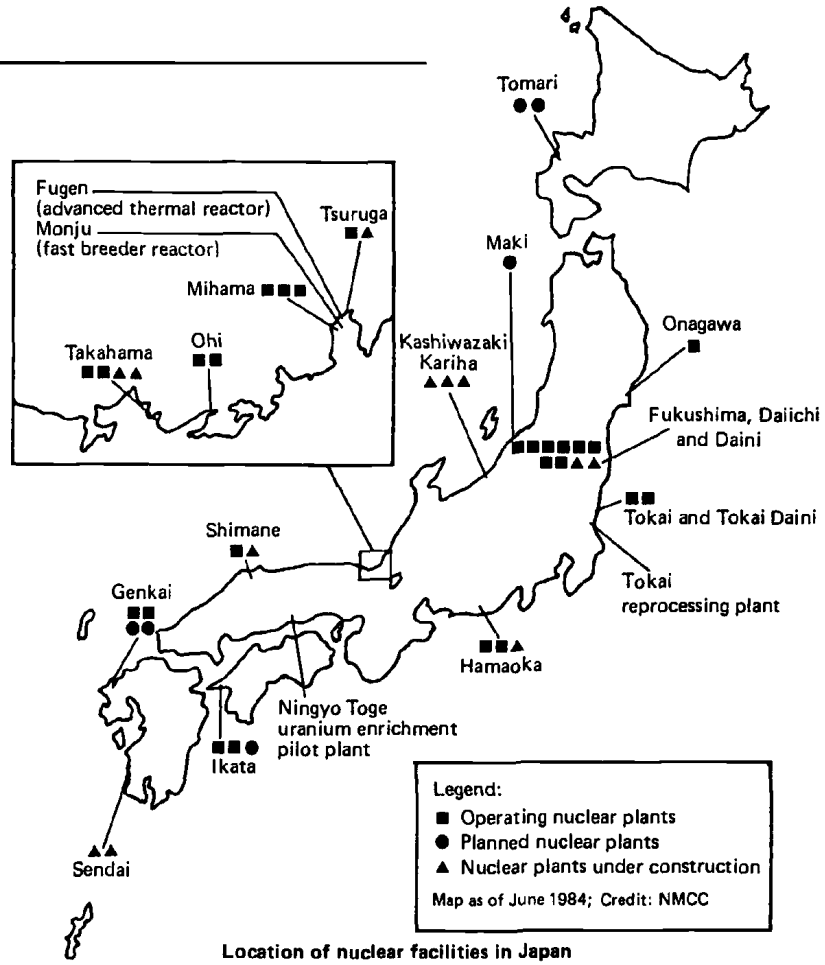
# The national system of safeguards: Experience in Japan




Location of nuclear facilities in Japan

by T. Haginoya

Long before concluding its safeguards agreement, Japan established a national system of safeguards. This system includes examination of design information, maintenance of records, and submission of reports to permit nuclear material accounting for Japan, inspection by Japan's inspectors, and a system of sanctions. Moreover, there are associated activities, such as research and development (R&D) of safeguards techniques and an advisory group on safeguards matters.

### Brief history of safeguards in Japan

"Atoms for Peace" is the fundamental nuclear policy of Japan. It not only is the strong desire of all Japanese people, but also is embodied in the "Atomic Energy Basic Law" promulgated in 1955.

Based on this Law, the "Law for Regulations of Nuclear Source Materials, Nuclear Fuel Materials and Nuclear Reactors" (Nuclear Regulation Law) was enacted. It sets forth specific regulations for management and control of nuclear materials and nuclear reactors to limit their uses only for peaceful purposes and for securing nuclear safety, and also for enforcing undertakings committed under international agreements.

Those who wish to use nuclear materials for the purposes of refining, enrichment, fabrication, reprocessing, reactor operation, research, and others should obtain licenses from the Science and Technology Agency (STA) or other competent Government authority. These licenses shall only be granted if the authority ascertains that such use of nuclear material is limited to peaceful purposes and nuclear safety is secured. (There is no exemption from this procedure. Therefore, even quasi-governmental organizations such as the Japan Atomic Energy Research Institute (JAERI) or the Power Reactor and Nuclear Fuel Development Corporation (PNC) should obtain licenses just as private organizations do.)

Japan has concluded atomic energy co-operation agreements bilaterally with Australia, Canada, France, the United Kingdom, and the United States. In these agreements, Japan has undertaken that nuclear material, equipment, and facilities supplied by these countries, and special fissionable materials produced by the use of them, shall be used solely for peaceful purposes. To that end, parties to the agreements have requested the IAEA to apply safeguards to such materials, equipment, and facilities as are covered by these agreements. Accordingly, safeguards agreements have been concluded between the IAEA, Japan, and parties concerned.

On the other hand, Japan ratified the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) on June 8, 1976. According to the NPT, a safeguards agreement was concluded between Japan and the IAEA and entered into force in December 1977. (The IAEA safeguards application based on the bilateral agreements was suspended accordingly.)

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**Nuclear facilities in Japan**

| | Number | Capacity |
|---|---|---|
| Nuclear power plants | | |
| in operation | 26 | 18 801 MWe |
| under construction | 12 | 12 100 MWe |
| in planning | 6 | 5 233 MWe |
| LEU fuel fabrication plants | 5 | 1 275 tU/a |
| Enrichment pilot plant | 1 | 75 tSWU/a |
| Reprocessing plant | 1 | 210 tU/a |
| Pu conversion pilot plant | 1 | 1 tPu/a, 1 tU/a |
| Pu fuel fabrication pilot plant | 1 | 1 tPu/a |
| Fast breeder reactor | 1 | 100 MWth |
| Advanced thermal reactor | 1 | 165 MWe |
| Research reactors, critical assemblies | 21 | |

LEU = low-enriched-uranium
MWe = megawatts-electric
MWth = megawatts-thermal
tU/a = tonnes of uranium annually
tSWU/a = tonnes of separative work units annually
tPu/a = tonnes of plutonium annually

Source: NMCC

In parallel with the implementation of the 1977 safeguards agreement, Japan promotes work in R&D in order to make the application of safeguards more effective and efficient. In addition, Japan contributes to international co-operative activities for safeguards technology development, such as the Japan Support Programme for the IAEA Safeguards (JASPAS).

#### Legal aspects of safeguards in Japan

To realize "Atoms for Peace" as provided for in the "Atomic Energy Basic Law" and also to implement undertakings made under the Japan/IAEA safeguards agreement, the Nuclear Regulation Law has specific provisions ensuring the application of national and international safeguards to all nuclear material.

The Law requires that the facility operator should maintain and implement an adequate system of accounting and control of nuclear material in the facility. The Law provides that facility operators shall prepare their own rules and methods for accounting and control of nuclear material and obtain approval from the Minister of Science and Technology prior to utilizing nuclear material. The rules and methods should include the definition of material balance areas (MBAs), key measurement points (KMPs), procedures of accounting and control of nuclear material received, shipped or removed from or to the inventory in each MBA, maintenance of equipment for measurement, and so on.

The facility operator is required to submit inventory change reports (ICRs) to the Government (Safeguards Division, STA) by the 15th of the month following whenever the inventory change occurs. The operator shall also submit the physical inventory listings (PILs) and material balance reports (MBRs) within 15 days after the confirmation of the physical inventory. The forms of these reports are designed to correspond not only with national accountancy requirements, but also with IAEA reporting requirements. As a matter of fact, some facility operators submit accounting reports in the form of magnetic tape or disk.

The Law provides that national inspectors may enter into facilities for the purpose of inspection. The inspection activities may include but are not limited to:

- Auditing nuclear material accountancy documents
- Measurement of nuclear material
- Application of containment and surveillance devices

The IAEA inspectors may inspect nuclear material in the presence of a national inspector, and their inspection activities shall be in accordance with the safeguards agreement.

#### Safeguards organization

The STA is the principal responsible organization in Japan for the implementation of safeguards. In April 1977, the Safeguards Division was set up in the Nuclear Safety Bureau, STA, as the central organization responsible for maintaining the national safeguards system and facilitating application of IAEA safeguards.

The Inspector General, who is responsible for managing national inspection activities and for the co-operative arrangement with the IAEA Safeguards Department, was appointed to the Nuclear Safety Bureau in April 1981. The Minister for Science and Technology has designated 17 national inspectors who conduct safeguards inspections at all nuclear facilities and also has designated 87 safety inspectors who belong to the Ministry of International Trade and Industry as national inspectors. These inspectors may conduct safeguards inspection only at commercial nuclear power plants.

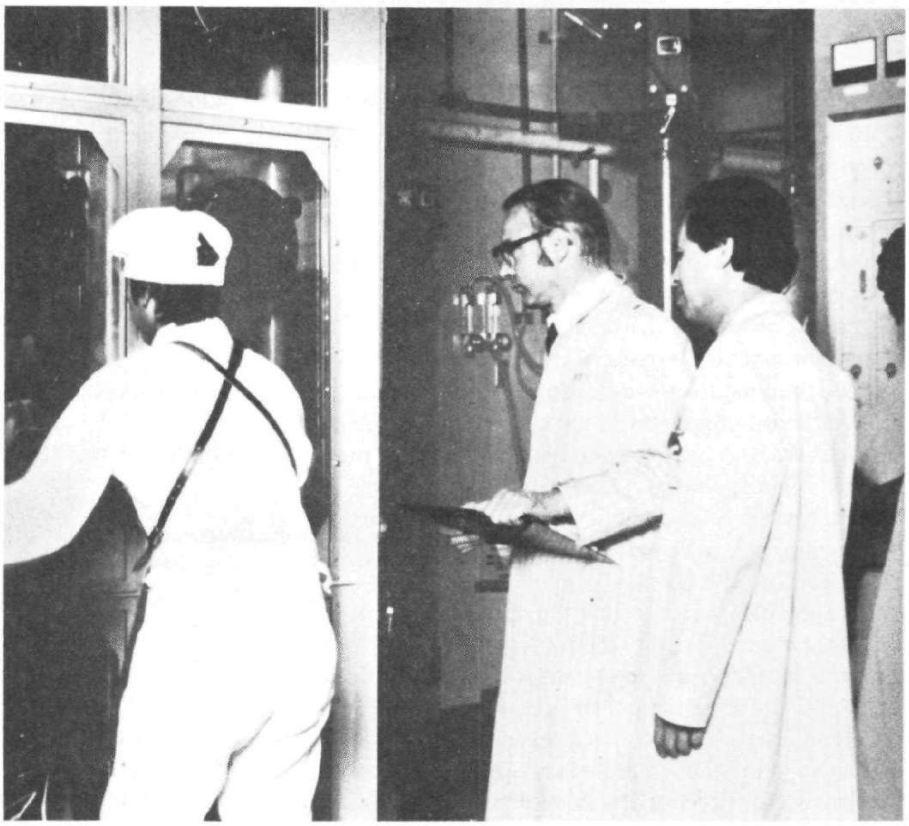
The Nuclear Material Control Centre (NMCC) was established in April 1972, and was authorized as the designated organization for treatment of safeguards information by the STA in 1977. The NMCC carries out, under the contract with the STA, the following tasks:

- Treatment of information on nuclear material accountancy
- Analysis of samples taken by national inspectors
- Calibration and adjustment of inspection instruments

Research and development work in the field of safeguards techniques are mainly conducted by the Nuclear Safety Bureau, STA, JAERI, PNC, and NMCC. Concerning physical protection, the Safeguards Division of the STA is the responsible body.

#### Technical criteria of national safeguards

Japan's national system of safeguards is intended chiefly to verify that there has been no diversion. It is not designed to protect nuclear material against theft or acts of terrorism, and therefore the technical criteria have been considered from that point of view.



**Inspectors from Japan and the IAEA at the plutonium handling area of the Power Reactor and Nuclear Fuel Development Corporation (PNC). (Credit: PNC)**

It is well known that INFCIRC/153 (the model for safeguards agreements under the NPT) provides for the technical objective of safeguards as the "timely detection of diversion of significant quantities of nuclear material...". These have been quantified after consultation with SAGSI (Standing Advisory Group on Safeguards Implementation), and the values are being used by the IAEA as the technical criteria for planning its safeguards approaches.

Many countries have their own technical criteria, different from those of IAEA, and some of them are more stringent and some others are more relaxed than those of the IAEA. The Japanese criteria are more or less the same as the IAEA's. Therefore, IAEA inspectors can conduct safeguards activities through observation of the national inspectors' activities, and thus they can avoid unnecessary duplication. (INFCIRC/255, which is the safeguards agreement between the IAEA and Japan, states that "whenever the Agency can achieve the purpose of its routine inspections set out in the Agreement, the Agency inspectors shall implement the provisions of Articles 74 and 75 of the Agreement through the observation of the inspection activities carried out by Japan's inspectors...".

**Nuclear material inventory in Japan**

| Facility | Material | | | | | |
|---|---|---|---|---|---|---|
| | Enriched uranium (tonnes) | Fissile enriched uranium (tonnes) | Plutonium (kilograms) | Natural uranium (tonnes) | Depleted uranium (tonnes) | Thorium (tonnes) |
| Power reactor | 4 147 | 94 | 10 546 | 319 | 10 | – |
| Research reactor | 32 | 1 | 416 | 24 | 43 | 0 |
| Fabrication plant | 1 079 | 31 | – | 9 | 25 | – |
| PFFP* | 2 | 0 | 521 | 42 | 0 | – |
| Reprocessing plant | 231 | 3 | 825 | 4 | 14 | 0 |
| Enrichment plant | 24 | 1 | – | 113 | 144 | – |
| R&D other plant | 9 | 0 | 44 | 300 | 31 | 3 |
| Total | 5 525 | 130 | 12 353 | 810 | 268 | 3 |

* Plutonium Fuel Fabrication Plant

Data as of end of June, 1984. Totals may reflect rounding.

Source: NMCC

### Problems encountered in implementation

In implementing its national safeguards, Japan has encountered many problems. Following are some technical problems identified in the past, but this should not be considered an exhaustive account.

Every facility is now using more and more sophisticated equipment and systems that include fully automated processes. This makes access by inspectors to nuclear material in question more and more difficult, and naturally verification activities become more difficult. Moreover, in the case of plutonium, frequent access is hazardous to humans due to its radioactivity. On the contrary, however, when the capacity of a facility increases, the physical accessibility must be increased to permit adequate inventory verification by the Inspectorate.

Japanese safeguards require the operator's report of material unaccounted for (MUF), together with a derived estimate of random and systematic errors, just as does the IAEA. Information on the operator's measurement uncertainties are needed to determine the error limits associated with MUF. Yet there are technical arguments that say it is difficult to obtain random and systematic errors separately.

Some bilateral agreements require that information be kept on the nuclear material inventory supplied by the country (not required by IAEA safeguards). Therefore, each facility must keep records of supply origin, in particular if the material has multiple supply origins (e.g. one State supplying yellow-cake, another supplying enrichment services). Record-keeping of supply origins thus becomes more and more complicated.

### International considerations

Japan today is developing the essential elements of the nuclear fuel cycle – namely, reprocessing of spent fuel, enrichment, and fabrication of mixed oxide fuel, which draws particular attention to safeguardability. Further, Japan is fully dependent in its nuclear activities upon the foreign supply of nuclear material. In this connection, the bilateral agreements between Japan and other States provide for additional controls of nuclear activities to ensure the non-proliferation commitment of Japan. Information required under these agreements, and exercises of those controls, are mainly supported by the national safeguards implementation system, which tracks the supply origin through nuclear fuel-cycle stages, and covers issues such as the supplying country's prior consent for reprocessing or international transfer of nuclear material, physical protection, and so on.

In the light of the above, it is essential that national and international safeguards continue to work effectively and efficiently. The high credibility of international safeguards reflects upon the development of the nuclear activities in Japan. In other words, the national system of safeguards will be intensified so that it is able to obtain credibility at the international level. It will continue to be the basis for co-operation with IAEA to enable the Agency to discharge its safeguards responsibility.

### Advisory committee on national safeguards

The Japanese Government has established an advisory committee for the improvement of national safeguards that has several working groups. Major activities of this committee and its working groups cover various areas:

- Research and development projects for the safeguards approach for future large-scale reprocessing facilities are being reviewed.
- Current safeguards implementation at the existing enrichment pilot plant is being reviewed. Also being considered is the safeguards approach for future larger scale centrifuge enrichment facilities.
- The practical method of MUF analysis for bulk-handling facilities has been discussed and continues to be examined.
- An appropriate system that could track the origin of supplies of nuclear material, consistent with existing material accounting procedures, has been recommended.
- Safeguards policies are being developed by an advisory group. Its major tasks are to establish guidelines for both operators and the Inspectorate in a safeguards-oriented facility design, and to advise on multilateral and bilateral co-operation in the safeguards field.

### R&D in safeguards techniques

As previously mentioned, safeguards R&D regarding techniques are mainly conducted at PNC, JAERI, and NMCC under the financial support of the STA. Further extensive R&D efforts are being concentrated on areas that take into account the increase in the quantity of nuclear material handled and of the number of nuclear facilities in the future.

In November 1981, Japan started the Japan Support Programme for the IAEA Safeguards (called JASPAS). JASPAS covers wide areas of safeguards technology, including system study and developments in measurement equipment and surveillance devices.