NUCLEAR SAFEGUARDS IMPLEMENTATIONS IN TAIWAN

Rong-Huei Hou, Chien-Kuo Chang, Chang-Rong Lin, Jec-Kong Gone and Wei-Li Chen
Atomic Energy Council, Yung-Ho City, Taipei County, Taiwan, R.O.C.

1. Background of nuclear safeguards developments in Taiwan

With six nuclear power units in operation, two advanced boiling water reactor units under construction, and other peaceful applications of nuclear and radiation technology expanding in great pace, the Atomic Energy Council (AEC) has been focused on reactor safety regulation, radiation protection, radioactive waste administration, environmental monitoring and Research and Development (R&D) for nuclear technologies and other civilian nuclear applications.

As included in nuclear safety regulation, nuclear safeguards inspection in Taiwan was first conducted based on the bilateral ROC-USA agreement on peaceful uses of atomic energy in 1955. After the international safeguards inspection mechanism was established within IAEA, Taiwan signed the safeguards agreement INFCIRC/158 at Vienna in 1971, thereby transferring the responsibility of safeguarding nuclear materials from the U.S. to IAEA. Despite Taiwan's departure from the United Nations and therefore its family member IAEA in 1971, Taiwan remains its commitment to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and committed to the INFCIRC/540 (Additional Protocol) through letters exchanged with IAEA and ROC on September 14, 1998. Taiwan was one of the earliest countries to support IAEA's policy on the peaceful use of atomic energy and our attitude of openness and transparency towards nuclear safeguards. IAEA inspectors conduct safeguards activities in Taiwan according to INFCIRC/158 and INFCIRC/540.

Starting from 1995, AEC has assigned a nuclear expert to the diplomatic office in Austria as a liaison to assist nuclear safeguards activities. The regular safeguards activities include, among others, technical exchange of information, coordinated efforts in carrying out routine and unannounced inspections, transparency visits and control of strategic high-tech commodities. These activities provide the base line of our commitments to the world and therefore protect Taiwan's rights and interests.

2. Legal framework and regulatory authority of nuclear safeguards in Taiwan

AEC, directly under the Executive Yuan, is the sole administrative authority overseeing atomic energy related affairs. In order to promote R&D of nuclear science and technology, the exploitation of nuclear sources and peaceful utilization of nuclear energy, the Atomic Energy Law of Republic of China came into force in 1970. Furthermore, the “Nuclear Materials and Radioactive Waste Management Act” (hereinafter referred to as “Act”) based on the Atomic Energy Law has been enacted to administer radioactive material, prevent radioactive hazard and secure public safety.

Article 7 of the Act states that the regulations for the nuclear safeguards operation shall be prescribed by the competent authorities, and hereby “Operational Regulations Governing Nuclear Safeguards” (hereinafter referred to as “Regulations”) based largely on INFCIRC/158 and INFCIRC/540 has been enacted. The main points of the Regulations are:

- The competent authorities may execute various inspections and monitoring according to the relevant nuclear safeguards treaties or agreements, and may ask nuclear facilities to submit designated materials.
- Facilities should be in charge of handling nuclear safeguards materials and material accounting, establish accounting and reporting systems, ensure reconciliation of the material accounting records.
- Facilities should take an inventory on their nuclear safeguards materials every 12 to 18 months and submit the results to the competent authorities.
- Facilities should submit to the competent authorities the initial design information and
questionnaire when applying for the facility construction license and final design information and questionnaire 8 months before commencement of the facility operation.

Four standard operation procedures based on the Regulations have been drawn up: operation procedures of unannounced inspections, transparency visits, dispatching ICR (Inventory Change Report), and paying safeguards expenses. A series of safeguards-related operation procedures will be set up in the near future. Figure 1 shows the legal framework of nuclear safeguards developments in Taiwan.

AEC has established and maintained a national system for nuclear material control and accounting to ensure that nuclear materials subject to NPT and Additional Protocol are used only for peaceful purposes. The Nuclear Safeguards Section (NSS) of Department of Planning in AEC is designated to be in charge of nuclear safeguards related issues. Figure 2 shows the organization structure of AEC and its nuclear safeguards section.

Figure 1  Legal framework of nuclear safeguards developments in Taiwan

Figure 2  Organization structure of AEC and its nuclear safeguards section
The NSS reviews the reports regularly provided by nuclear facilities, such as ICR, Physical Inventory Listing (PIL), Material Balance Report (MBR), declarations pursuant to Additional Protocol, and facility design information, to verify whether there are any inconsistencies with IAEA’s requirements, and then submit them to IAEA. In addition, NSS may perform domestic safeguards inspections to nuclear facilities if necessary. For example, NSS may count and identify the items of nuclear materials recorded and reported by facilities. IAEA uses various mechanisms for reporting to Taiwan on the implementation of safeguards activities pursuant to safeguards agreements and Addition Protocol. Figure 3 shows the regulatory structure between AEC, IAEA, and nuclear facilities for nuclear safeguards implementation in Taiwan.

![Image](Image)

**Figure 3 Regulatory structure between IAEA, AEC, and nuclear facilities for safeguards implementation**

3. **Highlights of safeguards implementation in Taiwan**

AEC has taken some measures to enhance transparency of nuclear activities and safety information. For example, several types of information are available to the general public at AEC’s Web site: first, real-time environmental radiation monitoring data, such as HPIC (High-Pressure Ion Chamber) readings updated every hour at site boundaries of all nuclear power plants; secondly, area exposure rates of gamma radiation at more than 20 sampling stations in the entire Taiwan area; and constantly updated IAEA safeguards activities in Taiwan.

In this section, we will describe some highlights of nuclear safeguards implementation in recent years for comprehensive safeguards (e.g. routine inspections), strengthened safeguards (e.g. declarations pursuant to Additional Protocol, complementary accesses, environmental sampling), integrated safeguards (e.g. transparency visits, remote monitoring approaches, unannounced inspections), and some other issues (e.g. annual safeguards implementation meeting and personnel training).

3.1 **Routine inspections**

IAEA carries out different types of on-site inspections, and routine inspection is the type most frequently used. IAEA may perform routine inspections at a nuclear facility or a location outside facilities (LOF) in order to verify that the location, identity, quantity and composition of all nuclear material subject to safeguards under agreement. The routine inspections may include examination of the nuclear material accounting records, PIV (Physical Inventory Verification), DIV (Design Information Verification), item counting, reattaching the seals on surveillance instruments, etc. The results of all routine inspections in Taiwan fulfill IAEA’s requirements.
3.2 Declarations pursuant to Additional Protocol

According to the Article 2 and 3 of Additional Protocol, AEC should provide a declaration of Taiwan’s nuclear programme and related activities to IAEA within 180 days of the entry into force of this Protocol. An initial declaration was accordingly submitted to IAEA on March 15, 1999. By May 2005, 198 declarations containing updates, clarifications and amplifications have been submitted by AEC to IAEA. In the past two years, safeguards on 3 facilities were approved by IAEA to be terminated.

3.3 Complementary accesses

Pursuant to Article 4 and 5 of Additional Protocol, IAEA could “carry out complementary access to assure the absence of undeclared nuclear material or to resolve questions or inconsistencies in the information that a State has provide about its nuclear activities”. Advance notice of complementary access to a designated facility is provided by IAEA 24 hours before implementing inspection. IAEA keeps the right of getting into any location on the designated facility within 2 hours after inspectors arrive. The most common activities IAEA inspectors may perform for complementary access including visual observation, utilization of radiation detector, collection of environmental sample, etc.

Complementary access continues to be implemented with a good spirit of cooperation between IAEA and AEC. The IAEA started the first complementary access in November 1999, and the accesses cover nuclear power plants, governmental institutes, military sites, universities, and private enterprises, and so on.

3.4 Environmental sampling

Since 1996, IAEA has been implementing environmental sampling for Safeguards as a strengthening measure designed to detected undeclared nuclear activities in countries. Environmental sampling has proven to be a potent tool for radiological analysis of materials. Inspectors survey areas and collect samples that are later analyzed in specifically-equipped laboratories.

According to the Additional Protocol, IAEA may carry out environment sampling at any site in Taiwan, through arrangement with AEC. In fact, IAEA perform environmental sampling in any kind of inspections, such as routine inspection, complementary access, transparency visits, etc. IAEA has completed more than 30 environmental samples by June 2006.

3.5 Remote monitoring approach at LWRS

IAEA uses remote monitoring to reduce its routine inspections. Remote monitoring of surveillance data from facilities, as an effectiveness and efficiency measure, continues to expand in other States. Installation of Server Digital Image Surveillance (SDIS) and Virtual Private Network (VPN) with remote data transfer capability was completed in all 6 Light Water Reactors (LWRs) in Taiwan by September 2003. A test of transfer remotely declared data was conducted in October 2003, and implementation of remote monitoring regime at LWRs was completed in October 2004.

3.6 Unannounced inspections

Unannounced inspections not only enhance IAEA’s ability to detect the diversion and misuse of nuclear material, but also help to deter such actions. The increases use of unannounced inspections should permit cost savings. The first rehearsal of unannounced inspections at LWRs was carried out in August 2003 at a nuclear power plant in Taiwan.

Unannounced inspections at all LWRs, in connection with remote monitoring systems, formally began from January 2005 and resulted in considerable savings of routine inspection efforts. Besides, in order to help IAEA schedule unannounced inspections at LWRs appropriately, AEC regularly sends the monthly reports of all LWRs through encrypted email to IAEA.
3.7 Transparency visits

IAEA performs transparency visits to non-nuclear facilities with a view to providing assurances regarding the absence of undeclared nuclear material and activities. Transparency visits generally include environmental sampling, on-site interviewing, making a visit to facilities, etc.

Since 1993, AEC has agreed with IAEA for arranging the transparency visits. The first transparency visit was conducted in 2002. As of the end of 2005, all transparency visits have been performed on close cooperation with IAEA’s inspectors.

3.8 Annual safeguards implementation meeting and personnel training

AEC has held annual safeguards implementation meeting in Taipei with IAEA since 1995. The annual meeting discusses the current issues concerning safeguards, the safeguards inspection results during the previous year, safeguards implementation matters, additional protocol implementation issues, and other issues such as training and cooperation with IAEA.

In the past 10 years, AEC has held 2 safeguards training courses with the assistance of IAEA. To learn the design, implementation, and operation of systems for nuclear materials accounting and control, Taiwan has dispatched one or two observers to join the biannual International Training Course on Implementation of State Systems of Accounting for and Control of Nuclear Materials (SSAC) since 1983. IAEA is scheduling to have a two-day training course with AEC on safeguards implementation in 2006.

4. Conclusion

Taiwan, as one of the first signatory state parties to NPT in 1970 and to the Additional Protocol in 1998, has been faithfully implementing the associated provisions of both agreements for years. Assuming full obligations under the NPT and Additional Protocol, Taiwan has been making every effort to prevent nuclear proliferation, abide by IAEA’s nuclear safeguards, and enhance the peaceful use of atomic energy.

According to the above agreements, IAEA sends inspectors to conduct safeguard activities in Taiwan. Inspection reports demonstrated that the safeguard measures operating in Taiwan meet all IAEA requirements. AEC has always been cooperative with IAEA on safeguard activities, and will continue to cooperate with the Agency in the future.

5. References