EVOLUTION OF IAEA SAFEGUARDS

Development of IAEA safeguards against diversion to military purposes of materials and equipment supplied for peaceful use, entered a new phase on 25 February 1965, when the Board of Governors provisionally approved (with slight modifications) the text of a revised Safeguards System recommended to it by a Working Group it had established a year earlier to review the entire system in the light of experience and technological developments. This review was initiated at the same time as the Board extended the Agency's safeguards to reactors of more than 100 MW(t) power.

This marks a stage in the steady development of safeguards which has been taking place since the inception of the Agency. Safeguards are fundamental to the purpose of IAEA, which is required by its Statute "to ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose." The Statute also authorises the Agency to apply safeguards:

- Where it grants assistance at the request of a State;
- Where the parties to a bilateral or multilateral agreement request it to do so;
- At the request of the State itself, in respect of any of its atomic energy activities.

The Statute also prescribes in broad terms that safeguards procedures shall consist of the following:

- The Agency may review the design of a nuclear installation to ensure that it will not further any military purpose and will lend itself to the exercise of safeguards;
- The State must maintain records to which the Agency must have full access;
- The State must make reports;
- The Agency has the right to approve the means of chemical processing of irradiated material. It may also require the deposit of produced fissile material that is not immediately needed for other peaceful projects to be carried out under Agency safeguards;
- The Agency may send inspectors into the State with the right of "access at all times to all places and data and to any person" as may be necessary to account for safeguarded materials and to ensure compliance with the undertaking against military use. "In the event of non-compliance by a State party to a safeguards agreement, the Board is empowered by the Statute*) to take any of the following steps: call upon the State to remedy forthwith such non-compliance; report the

* *Articles XII.A.7 and XII.C.*

matter to the UN Security Council and General Assembly; curtail or suspend Agency assistance, and require return of material supplied; suspend the membership privileges of the offending State."

To work out practical methods of doing all this, however, has been complicated. It has meant pioneering in an entirely new field, involving the establishment of some broad general principles to provide reliable guidance on future development, followed by the formulation of detailed procedures. It has been necessary to find at least tentative answers to such questions as – What kinds of materials and equipment should be safeguarded – only those which play the most direct and important role in the production of fissile material, or those which are capable of making a significant contribution to such production, or those capable of making a slight contribution? How small a quantity of nuclear material is it worth safeguarding, and how large need a reactor be before it needs to be controlled? In particular circumstances what methods of control should be adopted – material accounting, reports by the recipient State, inspection? How intensive should the control be?

It has been necessary to avoid a cumbersome system, while ensuring that it will provide an effective check. In this field of particularly rapid technological development, too, it must remain sufficiently flexible to permit it to be adapted to changing atomic energy techniques.

THE EARLY STAGES

The approach was to begin with the smaller and less complicated matters – such as the safeguarding of research reactors – and work up by stages.

In 1958, Japan became the first country to seek nuclear material through the Agency, with Agency safeguards; three tons of natural uranium were supplied to Japan for a research reactor. Pending the formulation of standing arrangements, IAEA applied interim safeguards provisions in respect of this transaction, specifying the reports and inspections which would have to be made. At this time, too, on the request of Japan and Austria, the Agency advised these States on setting up systems for accounting, stocktaking, measurement and storage of nuclear materials.

Meanwhile the Secretariat drafted some general principles dealing with various types of assistance and a set of detailed regulations for their practical applications.

The Board considered them at a number of meetings, and in 1960 set up a Working Group of expert representatives to assist it in formulating a safeguards system. After the Board had provisionally approved a system, it submitted the text to the General Conference at its fourth regular session. The Conference discussed it at length and by a two-to-one majority adopted a resolution in favour. After some further amendment the Board adopted it by a majority vote, in January 1961.

These safeguards related only to research, test and power reactors of less than 100 MW(t), to source and special fissionable material used and

Where Safeguards Apply

In March 1965, eighteen Member States had signed one or more agreements providing for IAEA safeguards in their territories.

Seven of these countries had IAEA safeguards agreements in respect of Agency projects:

Argentina, Congo Democratic Republic, Finland, Mexico, Norway, Pakistan, Yugoslavia.

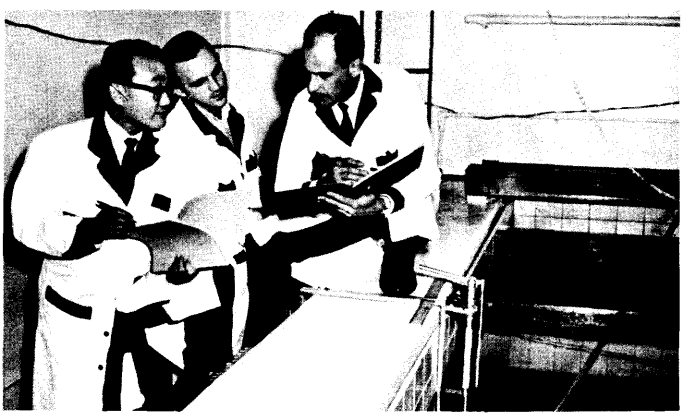
Thirteen countries were parties to agreements transferring to IAEA safeguards responsibilities under previous bilateral arrangements:

Argentina, Austria, China, Greece, Iran, Japan, Norway, Philippines, Portugal, South Africa, Thailand, U.S.A., Vietnam.

One country – U.S.A. – concluded an agreement whereby it unilaterally submitted four reactors to IAEA safeguards.

produced in these reactors, and to small research and development facilities. The safeguards procedures foreseen included (a) examination and approval of designs by the Agency, (b) maintenance by the State concerned of an agreed system of records, (c) submission to the Agency of routine and special reports, (d) inspections by the Agency.

IAEA reactor inspection team checking spent fuel elements in the fuel canal of the graphite research reactor at Brookhaven, USA. Y. Moteda (Japan), N. Roberts (Brookhaven) and C.L.A. Buechler (Argentina). (Photo: Brookhaven National Laboratory)



The first applications of this system were in Finland, which received from the United States through IAEA a research reactor and fuel, and Norway, where Agency safeguards applied to the NORA reactor and used with fuel leased from the United States in a joint international research programme.

The Board also adopted detailed provisions relating to inspectors. In June 1961 it further decided that the Inspector General and officers of the Division of Inspection should be appointed by the Director General after he had submitted their names to the Board for approval.

Before designating an Agency inspector for a State, the Director General informs the State of the name, nationality and grade, and qualifications of the officer proposed. The Government may request consultations but must inform the Director General within 30 days whether or not it accepts the nomination. If it objects, the Director General proposes an alternative designation. Should repeated refusals to accept nominations impede the inspections provided for in the safeguards agreement, the Director General may refer the matter to the Board for appropriate action. When a designation has been accepted the Government must grant the necessary visas promptly.

Except in the case of large power reactors, the Government is normally given a week's notice of an inspection. Inspection visits are to be so arranged as to ensure the minimum possible inconvenience to the State and disturbance to the plants inspected.

The Government is to arrange for the inspectors to be informed of the location of all safeguarded materials and facilities, and is to instruct its own personnel to co-operate fully. After an inspection the Agency informs the State of its results; should the State disagree, it may submit its own report to the Board of Governors.

The first Agency safeguards inspection was made of the NORA reactor in February 1962.

EXTENSION AND IMPROVEMENT

In February 1963, the Board requested the Director General to prepare suggestions for the extension of the safeguards system to reactors of more than 100 MW(t). It also re-established the Special Working Group of expert representatives on Safeguards to assist in this. The resulting draft provisions were provisionally approved by the Board in June 1963 and submitted to the General Conference; at the same time the Board also decided to undertake a general review of the safeguards system during 1964. The General Conference noted these decisions with approval, by 57 votes to 4, with 6 abstentions. In February 1964 the Board finally approved the extension provisions and established a new Working Group (on which all Board members might be represented) under the chairmanship of Mr. Gunnar Randers, of Norway. The task of the group was to review the safeguards system in the light of experience and of technological developments, paying particular attention to the question of applying safeguards to equipment. After thirty-two meetings, the Working Group presented its proposals for revision to the Board in

Exemption Limits

Exemption limits are prescribed for nuclear materials held in small quantities or produced at low rates. Thus a State may have the following quantities of exempt materials :

(a) One kilogramme in total of special fissionable material (plutonium and/or the "equivalent" quantity of enriched uranium, calculated in accordance with a formula taking account of the degree of enrichment);

(b) Ten tons of natural and/or depleted uranium with an enrichment of more than 0.5 per cent;

(c) Twenty tons of depleted uranium with an enrichment of not more than 0.5 per cent;

(d) Twenty tons of thorium.

In addition, nuclear material produced in a reactor whose annual rate of production does not exceed 100 grammes or whose thermal power is less than 3 MW may be exempted.

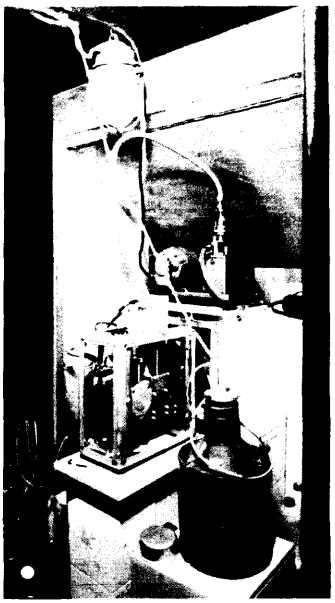
February 1965. After making minor changes, the Board, by 21 votes to nil with two abstentions, approved the new system provisionally and decided to submit it to the General Conference in September 1965 " for consideration and appropriate action ".

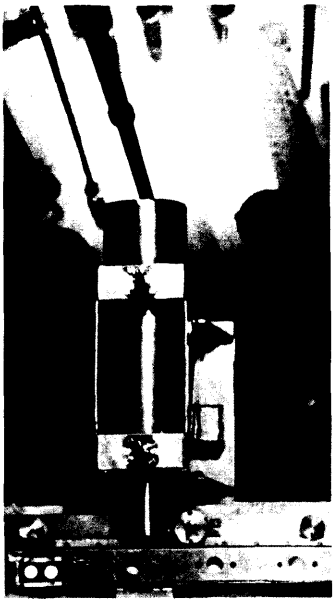
The new safeguards document makes a number of improvements in the Agency's Safeguards System, and in particular the presentation has become clearer. The principal provisions are summarized below.

The first part describes the purposes of the document. It sets forth the statutory background and indicates that the provisions of the document, which at present relate mostly to reactor facilities, might later be supplemented to cover other types of principal nuclear facilities.*)

The ensuing paragraphs 9 to 14 set out the Agency's obligations in administering safeguards. These include assurances that the Agency will avoid hampering a State's economic or technological development, that safeguards will be implemented in a manner consistent with prudent management practices, that the Agency shall not request a State to stop construction or operation of a principal nuclear facility except by decision of the Board, and that a State in which safeguards are being applied may consult the Director General on any questions that might arise. In addition Agency

* *"Principal nuclear facility" means a reactor, a plant for processing nuclear material irradiated in a reactor, a plant for separating the isotopes of a nuclear material, a plant for processing or fabricating nuclear material (excepting a mine or ore-processing plant) or a facility or plant of such other type as may be designated by the Board from time to time, including associated storage facilities.*





● Part of the experimental set-up for developing a non-destructive method of analysing physical properties of fuel elements. The work is in the hands of the Oesterreichische Studiengesellschaft für Atomenergie with its ASTRA research reactor at Seibersdorf near Vienna, under an IAEA research contract. The irradiated fuel element to be analysed is on the right, inside the reactor tank behind a 30 cm lead shield.

●● Experiment with a scanning apparatus mounted on top of the ASTRA reactor wall. This equipment is designed to take measurements of fuel elements without interrupting reactor operations.

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inspectors must not reveal confidential information acquired in the course of their duties, and the Agency itself may only publish a limited amount of information which it acquires from its Member States in the course of applying safeguards.

Further, it is specified that the Agency will only apply safeguards in a Member State pursuant to a safeguards agreement to which that State is a party, and under one of the three circumstances described at the beginning of this Article.

Subsequent sections indicate the type of nuclear materials to which safeguards might be applied under specified circumstances, and provide for certain exemptions from safeguards (both of a general nature and as specifi-

cally related to reactors – in each case because of the minor quantities of materials involved), for suspensions from, and for terminations of, safeguards. The circumstances under which materials may be transferred out of the State in which they are being safeguarded are also laid down.

THE PROCEDURES LAID DOWN

Inspections

One of the initial inspections of a *reactor* shall if possible be made just before the reactor first reaches criticality.

The maximum frequency of routine inspections of a *reactor* and of the safeguarded *nuclear material* in it shall be determined from the following table:

Whichever is the largest of: (a) Facility inventory (including loading); (b) Annual *throughput*; (c) Maximum potential annual production of special fissionable material *(Effective kilograms of nuclear material)*	Maximum number of routine inspections annually
Up to 1	0
More than 1 and up to 5	1
" " 5 " " " 10	2
" " 10 " " " 15	3
" " 15 " " " 20	4
" " 20 " " " 25	5
" " 25 " " " 30	6
" " 30 " " " 35	7
" " 35 " " " 40	8
" " 40 " " " 45	9
" " 45 " " " 50	10
" " 50 " " " 55	11
" " 55 " " " 60	12
" " 60	Right of access at all times

The actual frequency of inspection of a *reactor* shall take account of:

(a) Whether the State possesses irradiated-fuel reprocessing facilities;

(b) The nature of the *reactor*; and

(c) The nature and amount of the *nuclear material* produced or used in the *reactor*.

The document then specifies the safeguards procedures, first of all as applied generally to all safeguarded materials and to facilities containing them, and also specifically for reactors and for other locations outside of principal nuclear facilities, such as material in sealed storage.

The general procedures first indicate under what circumstances and to what purpose the Agency can review the design of facilities. Then, with respect to records, it is provided that the Agency and the State concerned shall agree on a system of stock and operating records, with respect to each facility, and certain provisions are indicated as to their language, contents and period of retention. With respect to stock and operating reports certain general requirements are established, followed by specific provisions for routine reports, for reports on the construction of facilities and for the circumstances under which special reports or amplification of existing reports might be required. Concerning inspections, the general provisions indicate the purpose of inspections, state that their number, duration and intensity, shall be kept to the minimum consistent with the effective implementation of safeguards and that inspectors may under no condition operate any inspected facilities ; additional provisions are made concerning routine inspections, concerning initial inspections of principal nuclear facilities under or at the completion of construction, and concerning the carrying out of special inspections.

The special procedures for reactors provide first of all that the frequency of routine reports shall vary between two and twelve, taking into account the frequency established for routine inspections. The maximum frequency of routine inspections is to be established from a table set forth in the document, which relates inspection frequency to the stock (including loading), throughput or plutonium production of the reactor ; other factors are also specified which are to be taken into account in establishing the frequency of inspections actually to be carried out. This scale ranges from "Nil" up to "right of inspection at all times."

The special procedures concerning nuclear materials outside principal nuclear facilities indicate the routine reports and inspections and other special rules to be applied to those materials : in research and development facilities, in sealed storage, or in other locations.

Finally, the terms used in the safeguards document are defined.

A TECHNOLOGY OF SAFEGUARDS

Along with the development of these principles and procedures, it is necessary to develop continuously the technology of safeguards. This has been assisted by the award of research contracts on such topics as :

- Methods of determining the power output of a reactor ;
- Positive identification of fuel elements by photographic identification and other means, in order to reduce the possibility of clandestine use of fuel ;

- Non-destructive analysis of irradiated fuel, as a means of quickly checking whether it contains the amount of fissile material which corresponds ot the power produced;
- Monitoring charge/discharge machines in continuous refuelling type reactors.

Another approach has been the organization of expert panels and symposia on topics closely related to the applications of safeguards, such as the panel on Non-destructive Testing in Nuclear Technology (May 1965) and the symposium on Nuclear Materials Management (August-September 1965).

A lengthy process of development still lies ahead, as the system comes to be applied to more reactors of different kinds and to other types of nuclear activities. But a firm foundation has now been laid – not least in the growing confidence of Member States, some of which questioned the feasibility of such a system during the initial stages.

This confidence has been demonstrated not only by the increasing support in successive meetings of the Board of Governors and General Conference, but by the number of IAEA safeguards agreements now coming into force. At the end of March, twelve such agreements had been signed providing for the transfer to the Agency of the administration of safeguards under bilateral agreements and one unilateral, and the Agency has been notified of half a dozen other bilateral agreements whose safeguards are also to be transferred, including the Japan-United Kingdom agreement in respect to the Tokai Mura power station. In addition, Agency safeguards are applied under arrangements of a different kind (such as Agency projects) in seven countries.*)

Thus the Agency is now in a fair way to carry out fully one of the most important functions envisaged at its foundation.

* *The 1965 safeguards document is available from the IAEA Division of Public Information on request. The Proceedings of the symposium on Nuclear Materials Management are published in the IAEA Proceedings Series.*