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NPT SAFEGUARDS - PROGRESS AND PRACTICE

SUMMARY

J.H.F. JENNEKENS,
DIRECTOR OF LICENSING,
ATOMIC ENERGY CONTROL BOARD

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"NPT SAFEGUARDS - PROGRESS AND PRACTICE"
J.H.F. JENNEKENS
ATOMIC ENERGY CONTROL BOARD
OTTAWA, CANADA

INTRODUCTION

The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) was opened for signature on July 1, 1968. Canada was one of the first nations to ratify the NPT and the Canada/IAEA safeguards agreement was the first concluded by the Agency with a Member State conducting an extensive nuclear program and processing large quantities of nuclear material. At present, 107 Member States of the IAEA have signed and ratified the Treaty. It is evident that a significant number of nations have not elected to ratify the Treaty and without universal acceptance it will not be possible to achieve the maximum optimization of international safeguards called for by the Treaty.

More than thirty years ago, world-wide optimism about the early establishment of an effective system of international control of nuclear energy was aroused when, in January, 1946, the United Nations General Assembly approved without a dissenting vote a proposal to set up a United Nations Atomic Energy Commission. However, in the difficult months that followed, the United States and the Union of Soviet Socialist Republics were unable to reach accord on the measures to be taken and the proposal disappeared into the pages of history until revived again in the early 1950's. With the approval on October 23, 1956 of the Statute of the International Atomic Energy Agency (IAEA) a series of international safeguards developments began which has continued to this day. However, the objective of establishing a fully effective, comprehensive system of international safeguards is still some distance away.

Paralleling these multi-lateral events, individual states instituted domestic safeguards arrangements as an integral part of their nuclear programs to ensure that adequate controls were maintained to protect against sub-national diversion of nuclear materials. Immediately following the announcement of the Atoms for Peace program by the United States negotiations were initiated between a number of states which led to the conclusion of "cooperation agreements" under which states such as Canada, the United Kingdom and the United States agreed to share with other states the benefits of their nuclear research and development programs. Supplier states insisted upon the incorporation into these cooperation agreements of provisions for independent verification of the commitments
by recipient states to use supplied materials, equipment, facilities and technology for peaceful purposes only. In retrospect these provisions have been shown to be inadequate.

During the late 1950's and early 1960's efforts were underway by the IAEA to develop a set of criteria, principles and procedures for the application of safeguards by the Agency's inspectorate. These efforts led to the publication of the Agency's Safeguards Document INFCIRC/66 and to subsequent revisions thereof. Gradually, safeguards transfer agreements were negotiated on a trilateral basis which enabled supplier states to transfer the task of applying safeguards in recipient states to the IAEA. However, these trilateral agreements were of limited scope since they did not provide for the application of safeguards to the entire nuclear program in recipient states. By limiting the application of safeguards to specific projects a recipient state retained the possibility of constructing unsafeguarded nuclear facilities which could be used for non-peaceful purposes.

Thus, in 1968 a new dimension was added to the safeguards work of the IAEA with the opening for signature of the NPT. The Treaty entered into force in 1970 and committed all parties which had not detonated a nuclear explosive device prior to January 1, 1967 to forego acquisition of such devices and to accept the application of IAEA safeguards on their entire nuclear programs.

In the light of experience with the Agency's Safeguards Document INFCIRC/66, it was recognized that a revised set of criteria, principles and procedures was required to facilitate the implementation of the Treaty. During 1970 and 1971 a special "Safeguards Committee" established by the IAEA's Board of Governors drafted a set of recommendations which was subsequently approved by the Board and issued in the form of an "information circular" entitled "The Structure and Content of Agreements Between the Agency and States Required In Connection With the Treaty on the Non-Proliferation of Nuclear Weapons". INFCIRC/153 or the "Blue Book" as it is commonly referred to, stipulates the requirements to be placed upon the Agency and Member States. It obliges the state to establish a system of accounting for and control of all nuclear materials subject to safeguards. The Agency applies its safeguards system in such a manner as to enable it to verify the "findings" of the state's system.

THE IMPLEMENTATION OF NPT SAFEGUARDS IN CANADA

The Agreement between Canada and the International Atomic Energy Agency for the application of safeguards under the Treaty on the Non-proliferation of Nuclear Weapons entered into force on 21 February, 1972. The subsidiary arrangements and facility attachments required by the Agreement entered into force on 15 May, 1972, that is within the 90 day period specified in Article 39 of the Agreement.
In anticipation of these events, Canada had initiated a major revision of its national system of accounting for and control of nuclear material in July of 1970. The implementation of this revised system was underway by February 21,1972, the day on which the Canada/IAEA agreement became operationally effective but much remained to be done. For example, the provision of design information relative to the major nuclear facilities in Canada was not as complete as it should have been but the then available information was submitted to the Agency in an attempt to meet the 90 day deadline stipulated in the Agreement. The Agency for its part was not yet sufficiently experienced in drawing up the facility attachments required under the Agreement and being equally subject to the 90 day deadline, produced a set of facility attachments which left much to be desired. In the light of experience, it is evident that 90 days is not sufficient time for a state with a substantial nuclear program to negotiate with the Agency the subsidiary arrangements and facility attachments which are essential to the implementation of safeguards unless extensive effort is expended prior to entry into force of the safeguards agreement.

There followed a period of about 6 months during which great difficulty was encountered in meeting Agency requirements for reports and in establishing verification procedures. The facility attachments gave Agency inspectors very little guidance in the detailed performance of their verification activities. Facility operators and regulatory staff were also in a state of uncertainty as to precisely what the verification activities should consist of. It became evident at the end of the first 6 month period that the initial inventory of nuclear material in Canada which had been submitted to the Agency as of February 21,1972 was incomplete even though the omissions from the inventory involved only small quantities of materials. The Agency had not foreseen this eventuality and considerable difficulty was experienced in revising its accounts. At one point it was decided to close the books and essentially start over again with a revised initial inventory statement. Even this did not eliminate all the problems but at least provided a more secure basis on which to carry on the Agency's verification activities. It should be understood that all of these difficulties occurred in spite of the best efforts of the Agency and of the Canadian officials working in an atmosphere of complete cooperation. This experience served to indicate that the implementation of NPT safeguards in a state with a substantial nuclear program is not as simple a matter as it might appear on the surface.

In subsequent years, several modifications were made to the Canadian accounting and control system. Changes were also made in the safeguards verification activities of the Agency however further improvements are required. Achievement of these improvements will require the continued effort of all parties concerned.

As a consequence of almost six years of experience with NPT safeguards, Canada and the IAEA have learned several lessons. The most positive benefit is an awareness of the requirement for a viable national system of accounting for and control of nuclear materials and of having it in place before the Agency is required to implement its safeguards system. The advent of NPT safeguards necessitated a more stringent
control on inventories of materials at licensed facilities. At the outset, such inventories were maintained primarily for financial accounting and radiological protection reasons. As mentioned previously, the requirement for submission of a detailed inventory revealed that a more comprehensive system of accounting and control was required.

A further lesson resulting from the implementation of NPT safeguards in Canada arose because of the on-load refuelling of CANDU nuclear power stations. Although the employment of resident nuclear safety engineers at such stations for licensing and compliance purposes is completely adequate for national purposes, it became apparent that instrumental surveillance of fuel transfers was necessary to satisfy Agency inspectors. As a consequence of a long established research and development program considerable progress has been made in the development of an acceptable safeguards equipment package for this purpose.

Notwithstanding the benefits accrued, the past 6 years have been fraught with problems which appear to be only marginally closer to solution now than at the outset. These can be attributed to two major difficulties: the Agency concept of audit and its reluctance to pursue independently conceived and developed surveillance and containment measures.

The accepted concept of audit is to inspect for conformance, to ensure that the prescribed rules and procedures of a system are complied with and to pursue the investigation of any significant deviation from such rules and procedures. The Agency's inspectorate appears to use audits almost exclusively for finding accounting errors with inadequate consideration of the overall picture. By apparently ignoring the concept of materiality, Agency inspectors dwell excessively upon details of minor significance thus straining their relationships with national regulatory officials and facility operators. Similarly, the inability of the Agency's system to handle with ease nuclear material transfers not previously identified in facility attachments and its rigid adherence to coded reporting procedures have led to unnecessarily protracted debate on matters which are of little importance to the achievement of the technical objectives of safeguards.

A further problem area has arisen in the verification of physical inventories by the use of statistical sampling plans based upon a material description code, inventory stratification procedures and a random selection process for attribute measurement which do not take adequate account of the actual physical condition or containment of the material to be inspected. It is essential therefore that the Agency, the national regulatory agency and facility operators expend considerable effort in drafting facility attachments and inspection procedures which will enable the Agency to achieve its safeguards objectives without unnecessary cost to all three parties.

Quite apart from the need to ensure the further development and improvement of inspection procedures is the equally important need to optimize the overall technical effectiveness of safeguards by the application of technological developments in the field of instrumentation and
control generally and of containment and surveillance measures in particular. For many years, Canada and the United States have been co-operating with the IAEA in the development of instrumental techniques for the safeguarding of nuclear facilities. As evidenced by the experience over the last six years and by the conclusions set out in the Director-General's Special Safeguards Implementation Report to the IAEA Board of Governors of June 1977 renewed effort is required.

The Canada/USA/IAEA cooperative program has resulted in several valuable lessons insofar as instrumental safeguards techniques are concerned. These lessons include the following:-

(a) the development of safeguards instruments should at all times include consideration of the practical problems encountered by the safeguards inspector, e.g. the sophistication of the instrument including its tamper-proofing and tamper indicating characteristics, the use of instruments in hostile radiation environments where access may be difficult to obtain and the amount of analysis required to interpret information received; and

(b) the development of an instrument may satisfactorily demonstrate the feasibility of a particular device e.g. detecting the passage of an irradiated fuel bundle, but the adaptation of that instrument to individual nuclear power reactors may require a much larger engineering effort.

To profit from this experience and to accelerate the implementation of instrumented safeguards, Canada has offered a support program to the IAEA for the development and procurement of instruments and techniques that could be applied to Canadian designed reactors both in Canada and in other countries. The program is flexible to allow for different circumstances at each reactor but basically follows a concept described in IAEA-CN 36/185 presented at the International Conference on Nuclear Power and its Fuel Cycle at Salzburg this spring. Areas where the fuel bundles are discharged from the reactor would be under camera surveillance, the passage of fuel bundles in transit to the spent fuel bay would be detected, fuel bundles would be subject to gamma interrogation in the spent fuel bay and would finally be sealed in cages or baskets. The spent fuel bay would also be under camera surveillance. In order to ensure that this equipment could be installed in a particular reactor, appropriate modifications to the reactor would be designed in parallel with the program of development and procurement.

The job of coordinating this support program, absorbing the new technology it presents and of eventually applying it, places an additional burden on the small staff of the IAEA Department of Safeguards and Inspection and Canada intends to provide cost-free experts to the IAEA to assist in this program.
EVOLUTION OF CANADIAN NUCLEAR EXPORT POLICY SUBSEQUENT TO RATIFICATION OF THE NPT

Canada's long standing commitment to the principle of non-proliferation is evidenced by a number of Government Policy Statements made prior to the advent of the Non-Proliferation Treaty. Canadian ratification of the NPT was yet a further indication of this commitment.

It was May of 1974, however, that led to a serious reappraisal of the effectiveness of Canadian policy and the degree to which Canada and other Member States of the United Nations were prepared to act in order to give substance to these altruistic objectives. In May 1974, the Government of India detonated a nuclear explosive device. The fact that this nuclear explosion followed the provision of substantial nuclear assistance by Canada and by other nuclear suppliers, brought into question the effectiveness of the measures taken by all supplier states. It was clear that action was required.

The intensive review of Canadian Export Policy which took place during the remainder of 1974 resulted in a new comprehensive policy which was elaborated in some detail in a statement made in the House of Commons on December 20, 1974. The revised policy required the renegotiation of all existing bilateral nuclear cooperation agreements such that recipients of Canadian nuclear material, equipment and technology would be under binding obligation to refrain from the use of these items in any nuclear explosive program. The new bilateral agreements would also provide for prior consultation and agreement on the enrichment or reprocessing of material subject to Canadian control. Although the agreements would rely heavily on IAEA safeguards inspection of materials, a provision was to be incorporated whereby Canadian verification would take place in the event that IAEA safeguards could not be adequately implemented. The undertakings were to be enforceable for the entire life of the facilities, the material concerned and any material produced thereby or therefrom.

Recognizing the difficulties which might be encountered in renegotiating the existing bilateral agreements, the policy statement provided for a 1 year period for this to be accomplished and for supplies which had been committed prior to the policy announcement, to continue during that period. The year expired in December of 1975 and was subsequently twice extended for six months because it was felt that outstanding problems with each trading partner were near resolution. These problems were not resolved, however, and since January 1, 1977 the Canadian Government has not permitted the export of material, equipment or technology to states which have been unable to conclude an agreement fully consistent with the Export Policy.

During this period, the Export Policy underwent constant review. In December of 1976, the Government amended the earlier statement by reaffirming not only the 1974 requirements, but in addition, insisting that recipients of Canadian nuclear exports ratify the Non-Proliferation Treaty or accept equivalent IAEA safeguards on their entire nuclear program. This additional requirement applies to any sales agreement entered into after December 31, 1976.
A price has of course been paid for Canada's determination to act in the interest of reducing the possibility of weapons proliferation. The uranium producing industry, an important sector of Canada's economy, has been unable to export uranium to its major customers throughout the current year. This embargo has resulted in significant strain on Canada. It is, however, an acceptable price to pay if the desired results can be achieved.

Canada has continued to explore means for strengthening the non-proliferation objective and has been active in all fora where this objective might be realized. As a major nuclear supplier, Canada participated actively in the suppliers meetings held in London in recent years and worked hard to convince many other supplier nations that the spread of technologies, essential to a weapons program should be carried out only under the strictest safeguards controls. This endeavour has been only partially successful because reactors and reactor technology supplied by some states still remain exempt from these controls.

Canada is also participating actively in the international nuclear fuel cycle evaluation program which has recently begun. It is our hope that the proliferation problem will be recognized to be more important than many issues of self-interest and that all nations will be prepared to make reasonable sacrifices to attain the objectives.

**CONCLUSION**

It is evident therefore that much remains to be done both technically and politically before a fully effective system of international safeguards is achieved. The technical difficulties can be resolved with the cooperation of all concerned. However, there remains a significant number of nations which have not elected to ratify the NPT and without their adherence to the Treaty it will not be possible to achieve the full potential of international safeguards. Efforts to extend the Treaty to all states currently involved in nuclear energy developments or planning such involvement must take into account the many and varied reasons for not acceding to the Treaty some of which are as follows:-

1) the alleged inequity of the undertakings required of nuclear weapon states and of non-nuclear weapon states;

2) concern over possible infringements on national sovereignty;

3) concern about the alleged futility of controlling horizontal proliferation when inadequate progress is being achieved in limiting vertical proliferation;

4) concern about the apparent differentiation in the application of safeguards to single nations as compared to groups of nations;

5) the increasing costs of the IAEA's safeguards program (e.g. $7,951,000 in 1977 or 18.2% of the Agency's Regular Budget);
6) inadequate allocation of resources by developed nations (directly or indirectly via the IAEA) to the provision of technical assistance in the nuclear field to lesser developed nations;

7) difficulties encountered in the legal interpretation of governing documents including the NPT itself, the Statute of the IAEA and the safeguards agreements entered into between the IAEA and Member States;

8) concern about commercial espionage by IAEA inspectors.