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A background paper on nuclear  
safeguards and Canadian safeguards  
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A Background Paper on Nuclear Safeguards and  
Canadian Safeguards Policy

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## I. Introduction

This paper is a brief discussion of some of the implications of the worldwide expansion of nuclear power generation programmes, and the methods of control, or safeguards, developed over the years by the international community to ensure the applications of nuclear power are directed towards peaceful purposes only. The paper attempts to deal specifically with the evolution of Canadian safeguards policy.<sup>1</sup>

## II. The Context

### The Growth of Nuclear Power

By the year 2000 the world's total energy requirements may be more than five times present levels. This anticipated expansion in energy demand would be the direct result of worldwide population increases (expected to double in the next twenty-five years) and projected increases in the standard of living, with a correspondingly higher per capita energy consumption level. It is quite possible that present projections of energy use will be mitigated by economic constraints and energy conservation practices. Nonetheless, it has been estimated that as much energy will be consumed in the world between 1970 and 2000 as has been consumed in the last twenty centuries.

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<sup>1</sup> This paper has been prepared by the Department of External Affairs in consultation with other government departments and agencies concerned, including Atomic Energy of Canada Limited, the Atomic Energy Control Board, the Department of Industry, Trade and Commerce, and the Department of Energy, Mines and Resources.

The demand for electricity, the most versatile form of energy, is increasing faster than that for other forms of energy. This demand is expected to double every ten years for several decades to come. At the present time, the demand for electrical energy, met partly by hydro-electric sources, is largely supplied by fossil fuels. As hydro-electric resources in many countries are becoming fully developed, and fossil fuel resources are diminishing while becoming increasingly expensive, other sources of power generation and more rational use of existing resources will be required if this anticipated rate of demand is to be met. In addition to conservation measures, alternatives such as solar, wind, tidal, geothermal and fusion power are being developed but require much more research and development before their commercial viability can be proven.

A major alternative energy technology now available is nuclear fission. At the end of 1974, according to estimates published by the Stockholm International Peace Research Institute, 170 nuclear power reactors in some 19 countries were capable of producing a total of 73,000 MWe (million watts) of electricity. By 1980, if present projections hold, some 28 countries will have a total nuclear electrical generating capacity of about 185,000 MWe.

Nuclear power generation may not be a viable option for all countries because nuclear power programmes require very large capital investment and a sizeable technical and industrial infrastructure, which many countries lack. Nor is there now available internationally the capital and technological base to support a significantly accelerated worldwide expansion of nuclear power; in addition, many countries at

present lack the level of energy consumption which would justify the necessary large capital investment. Possible limitations such as those expected on uranium production, and the fact that a significant number of countries have alternative power sources available, may also curtail the rate of nuclear power expansion. Accordingly, it is expected that in the next decade or two at least, nuclear power generation will be confined largely to the industrialized countries, and to the more advanced countries of the developing world.

#### Nuclear Power

Nuclear power plants are more capital intensive than conventional power plants, but they do possess some unique attractions. They have proven reliable to operate, and the cost of electricity produced is relatively insensitive to changes in fuel prices. The major advantage of nuclear power plants over conventional ones, however, is that, in spite of rising capital and operating costs, they may result in significantly lower total unit energy costs than fossil-fires plants in some countries without alternative indigenous supplies of energy. Uranium fuel has a tremendous energy producing capacity: the fission of one pound of natural uranium fuel, of the kind used in the Pickering CANDU Station, produces as much electricity as 15 tons of coal or 70 barrels of oil.

Further fuel economies are offered, for instance, in that plutonium, a by-product of the irradiation of U-238 in reactors, can now feasibly be mixed with uranium fuel to greatly expand the energy yield of the material, intensive research and development efforts towards commercial application of such "mixed oxide" fuels are now underway in a number of centres. Advances in technology may make

commercially viable a type of reactor, the breeder, which by using recycled depleted uranium and plutonium, could increase the efficiency of uranium usage by a factor of ten. There is further fuel potential in the combination of plutonium and thorium. World reserves of thorium, though highly dispersed, are several times those of uranium; CANDU reactors have the potential of using this element with high efficiency, assuring a significant extension of known fuel supplies.

Nuclear power generation does pose a set of serious concerns distinct from other forms of power generation, because of the particular nature of nuclear materials. For instance, complex protective systems are required to reduce the risk of accidentally releasing radioactive contaminants. Waste products from reactors require complex long term management. Protection must be provided against sabotage (and theft) which would result in radioactive release. Countries may attempt to develop nuclear explosives building upon know-how acquired in their peaceful nuclear power programmes. Despite the risks involved, however, there is no indication that the growing international trend toward increased reliance on nuclear power as an energy source will be reversed in the years ahead or that countries with potential energy shortfalls will reject nuclear power as an energy option at the risk of facing an energy shortage.

#### The Nuclear Export Dilema

Within the limitations noted above nuclear technology can make a substantial and essential contribution to the energy needs of countries unable to rely for their development solely on other sources of energy. In cases where there is a demonstrated need for additional power sources and where nuclear power is cost-effective, it would seem only just that countries advanced in nuclear technology be prepared to share that

technology with other countries, both developed and developing. States like Canada, that are party to the Treaty on the Non-Proliferation of Nuclear Weapons have undertaken to facilitate the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy.

Nuclear technology, however, also has destructive potential. The science and technology developed for peaceful purposes can serve military purposes. Certain nuclear fuels and derivatives which could be used to generate electricity could also be used as the source of uncontrolled fission for nuclear explosives.

The international community and particularly countries advanced in nuclear technology, must confront this dilemma. Means must be found to meet the world's demonstrated needs for power, including nuclear energy, but it is as vital to ensure that increased access to nuclear technology does not produce an increased threat to the international community. The problem of how to prevent the spread of nuclear weapons to more states is in large part a political one, influenced by international conflict and insecurity. The first objective is, therefore, to promote conditions which will encourage a more stable and peaceful world. As part of the effort to remove incentives to the further spread of nuclear weapons, it is vital that the international community promote a system of intergovernmental controls on the peaceful uses of nuclear energy in order to inhibit the ability and the desire of more countries to acquire nuclear weapons.

As a major supplier of uranium and the producer of an effective system of nuclear power generation, Canada can play an important role in the international exchange of nuclear materials, equipment and technology

to the benefit of Canada and of other countries. In large part by virtue of its position as a supplier, Canada is able to further measures to ensure that international nuclear cooperation does not contribute to the danger of nuclear proliferation.

#### The Nuclear Fuel Cycle

An understanding of the nature of the dilemma might be aided by a brief description of the materials which constitute the hazard. Conventional power stations use the combustion of oil, gas or coal to produce electricity; nuclear power reactors produce electricity using the fission of uranium 235. Natural uranium as mined, consists essentially of two kinds of uranium atoms, 99.3% is uranium 238, and .7% is uranium 235. Fission occurs when the nucleus of a U-235 atom is split by a neutron; heat is produced and additional neutrons are emitted from this reaction which will, in turn, when slowed by a moderator (such as heavy water), split the nuclei of other U-235 atoms. This process will continue indefinitely provided the conditions are exactly right.

A nuclear power reactor is essentially a furnace where this self-sustaining chain reaction can be controlled, and the massive amounts of heat produced put to useful work. In a typical case the heat produced by the fissioning of U-235 is removed from the fuel elements in the reactor core by the coolant, which flows over them. The coolant is then piped through a heat exchanger where it turns water in a secondary circuit into steam. From this point on a nuclear power station is the same as a conventional power plant, for in both cases the steam produced is used to drive a turbine generator which produces electricity.

The major types of power reactors currently in commercial use are either heavy water moderated, natural uranium fueled systems (HWR's), like the Canadian CANDU reactor, or light water moderated, enriched uranium fueled systems (LWR's). Most nuclear supplier nations, in particular the USA, have developed LWR Systems, which use light (ordinary) water both as a moderator and a coolant, contained in a single large pressure vessel. Also integral to the LWR and HWR cycles are such facilities as fuel fabrication or conversion plants, enrichment facilities, and in some instances, reprocessing plants.

#### Enriched Uranium

Unlike heavy water, light water is a relatively inefficient moderator, absorbing many more neutrons than heavy water. Because of this it is necessary to increase the concentration of U-235 in the fuel for LWR's to about 2-4%. Uranium enriched to levels of commercial utilization for use in LWR's present no weapons proliferation risks. However, highly enriched uranium 235 may be used to produce nuclear explosive devices. At present, fissile material used by the nuclear weapons states contains over 90% of U-235. Commercial enrichment plants can be converted from the production of low-level enrichment LWR fuel to highly enriched material suitable for weapons purposes. As of this time enrichment technology is restricted to the nuclear weapons states and to a few industrialized countries, but this situation cannot be expected to last, for advances in technology may well put enrichment plants within the reach of more countries.

### Plutonium

Except in minute amounts, plutonium does not exist in nature. It is an inevitable by-product of the irradiation of uranium 238, as occurs in a nuclear reactor. Some of the plutonium that is created as the uranium fuel is irradiated is itself consumed as fuel, the rest leaves the reactor mixed with the spent fuel. Chemical separation or "reprocessing" facilities are required to separate the plutonium from the unused uranium and waste products also contained in the spent fuel.

Research into the development of "mixed oxide" fuels containing plutonium requires reprocessing facilities, and as more countries are investigating this alternative, their construction is becoming more widespread. The possession of such facilities is the critical element in a nuclear weapons programme, however, since plutonium separated in such a facility can also be used in the fabrication of a nuclear explosive device. It takes only a few kilograms of the plutonium (PU) isotope 239 to fabricate a nuclear explosive device. To be most efficient, power reactors "burn" their fuel for two or more years. The plutonium produced in the irradiated fuel becomes increasingly "contaminated" the longer it is in the reactor by the presence of other isotopes of plutonium. The PU-239 contained in most spent fuel from a normally-operated power reactor is heavily "contaminated", even after reprocessing, which reduces its suitability for use in explosive devices. Less costly large research reactors or reactors especially built for weapons production, from which spent fuel is removed before the build-up of contaminants, are more likely means to be employed for producing plutonium 239 for use in explosive devices.

### Nuclear Safeguards: IAEA and NPT

It is to limit the risks posed to the international community by the fact that certain nuclear facilities and materials used or produced in the peaceful nuclear cycle may, under the circumstances described in the

previous section, be diverted to military purposes, that an international safeguards regime has evolved since the 1950's. As commonly applied to nuclear commerce the term "safeguards" incorporates two elements. The first element is that of "legal safeguards" or treaty obligation undertaken by a state to use nuclear materials only for peaceful, non-military or non-explosive purposes. The second basic element of safeguards is the "technical safeguards" which are implemented on the basis of the treaty obligations assumed and are designed to verify by means of reports, records, inspections, and technical instrumentation that the state concerned is complying with its commitments. Usually the legal commitment and the consequent safeguards verification regime are established at the same time by a single treaty or "safeguards agreement" which is binding in international law.

Initially these undertakings by recipient states to a specific use of transferred nuclear material were made bilaterally to the supplying country. These early bilateral safeguards arrangements by and large proved unsatisfactory, partly because they did not always contain effective inspection provisions to verify compliance. Furthermore, control over fissile material is a matter of security concern to many countries, not just the two involved in a particular nuclear transaction. It became evident that a more effective and politically acceptable way of regulating nuclear traffic would be for the international community to set up an impartial, autonomous body, to provide both the services of a broker in transfers of nuclear material and at the request of states carrying out nuclear cooperation, to apply internationally agreed safeguards to satisfy all states that the nuclear transfers among states served only peaceful purposes.

In 1957 the International Atomic Energy Agency (IAEA) was created as an autonomous body closely associated with the United Nations. The declared mission of the IAEA is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world" (Article II of the IAEA Statute). The Agency, which today has 109 Member States, facilitates international research and development programmes in the nuclear field, and provides technical assistance services to many member states.

One of the most important functions of the Agency, however, has been its safeguards work. In its Statute the Agency was charged with the responsibility of administering "safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities and information made available by the Agency or at its request or under its supervision or control, are not used in such a way as to further any military purpose" (Article III of the Statute). In order to permit it to comply with this statutory obligation the Agency over the years developed a "technical safeguards" system, which in its present form is outlined in IAEA document INFCIRC 66/Rev.2 (attached), originally drawn up in 1965 and modified several times since.

As the IAEA established its "technical safeguards" procedures supplier states in many cases transferred their bilateral safeguards verification rights to the IAEA, and most agreements concluded since 1965 have provided for IAEA rather than bilateral safeguards. INFCIRC 66/Rev.2 is an open-ended system of safeguards. Its intention is not to lay down rigid rules for safeguards implementation, but rather to define the principles and procedures for safeguards application, that must be

further elaborated in particular safeguards agreements or in the Subsidiary Arrangements, which set out the technical and administrative details of safeguards implementation.

Safeguards pursuant to INFCIRC 66/Rev.2 are applied at the request of a particular state (Unilateral Submission), as a result of Agency project assistance (Project Agreement), or by the agreement of parties to a bilateral or multilateral nuclear cooperation arrangement, who have agreed to transfer safeguards rights to the IAEA (Safeguards Transfer Agreements). The content and scope of these three types of agreements will vary, though for political as well as operational and technical reasons the Agency makes every attempt to apply uniform procedures. But it is up to the Agency and the State to determine, within fairly wide limits, the safeguards procedures to be used with respect to record-keeping, inventory, reporting, notification of transfers of nuclear material and other points that determine the scope of application of safeguards.

INFCIRC 66/Rev.2 in combination with other subsequent decisions of the IAEA has proven to be useful safeguards base, and continues to be the framework for the safeguards of the IAEA, with the major exception of Non-Nuclear Weapons States (NNWS) party to the NPT which assumed more comprehensive safeguards régimes. The major weakness of the INFCIRC 66/Rev.2 system as a non-proliferation mechanism is its limited scope. It is primarily facility oriented, designed to be the basis by which single facilities or transfers of material, are subject to safeguards. It does not require that all civil nuclear activities in a given country be subject to the safeguards verification regime, nor does it stipulate any obligation on the part of nuclear suppliers to invoke safeguards as a condition of supply.

The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) concluded in 1968, and entered into force in 1970, added a new dimension to the safeguards work of the Agency, for it confirmed a new and more comprehensive obligation by a number of states to a specific use of nuclear materials. Instead of being constrained only to the generally defined "non-military" uses of nuclear energy as under INFCIRC 66/Rev.2, which is subject to interpretation, with the entry into force of the Non-Proliferation Treaty, all NNWS (i.e., those states which had not detonated a nuclear device before January 1, 1967), party to the Treaty undertook specifically not to develop or manufacture or acquire any nuclear weapons or other nuclear explosive devices, and were required to accept safeguards to be administered by the IAEA to verify this undertaking.

Because the obligation assumed by NPT NNWS was more comprehensive than before, a new and more comprehensive system of "technical safeguards" was required by the Agency for its verification activities in those states. The NPT Safeguards System was developed by a special IAEA Safeguards Committee between 1970 and 1971, and was adopted by the IAEA Board of Governors in April 1971 in document INFCIRC 153 (attached). The objective of safeguards under the NPT was defined by the Safeguards Committee as "the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and the deterrence of such diversion by the risk of early detection." The safeguards system developed was designed to take advantage of the fact that all nuclear material in the civil nuclear programme of an

NPT NNWS is under safeguards.<sup>2</sup> Rather than being geared to a particular facility, the inspection effort under the NPT régime is concentrated at those stages in the entire fuel cycle where there is nuclear material in such a form as to lend itself most easily to the manufacture of nuclear explosives. Document INFCIRC 153 does not constitute guidelines only; rather it specifies the "structure and content of agreements" between the Agency and States required in connection with the NPT. It sets out detailed provisions on the frequency and scope of IAEA inspections; it requires states to establish and maintain systems of accounting and control for safeguarded nuclear material in such a way as to facilitate Agency verification of states' compliance with NPT undertakings.

The system pursuant to INFCIRC 153 is an improvement over previous safeguards systems in that it provides an international mechanism to verify non-explosive use of nuclear materials for those states that have demonstrated their non-proliferation commitment by adherence to the NPT. The fact that not all states are party to the NPT is, of course, one of the weaknesses of the Treaty, and because there are non-NPT states engaged in nuclear activities, safeguards pursuant to INFCIRC 66/Rev.2 continue to be applied in those countries. Among the non-parties are France, a major supplier nation, and India, Brazil, Pakistan and Argentina. One of the main reasons why some states do not subscribe to the NPT is that they believe the Treaty discriminates in favour of the nuclear weapon states (NWS). NPT NNWS are required to place their entire nuclear activities under safeguards, while NWS are under no obligation to apply

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NNWS party to the NPT are allowed to use nuclear power for certain defined military uses such as power plants for submarines.

safeguards on any of their nuclear activities, nor are they constrained, other than in general hortatory terms, from developing their nuclear weapons programmes.<sup>3</sup>

### Safeguards Application

Within the IAEA, the Division of Safeguards and Inspection, (which has a total staff of 136 people, 74 of whom are professional staff members) is responsible for the implementation of safeguards procedures pursuant to a safeguards agreement or subsidiary arrangement involving the IAEA. The Safeguards Operation subdivision is responsible for the evaluation of design information on nuclear facilities to ensure that safeguards can be applied effectively to facilities, for the evaluation of accounting data on the flow and inventory of nuclear material, and for the performance of inspections as well as the monitoring of on-site surveillance and containment measures to verify the reported presence of nuclear materials.

The Safeguards Development subdivision carries out extensive research and development programmes on safeguards application, developing optimum verification strategies for facilities under inspection and improved techniques for the automatic and continuous collection of information on the identification, containment and flow of nuclear material and items, and on the automatic processing of information obtained through inspections

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<sup>3</sup> The three NWS which are party to the NPT (the USA, USSR and the UK) have undertaken to inform the IAEA of their anticipated export and imports of nuclear materials, and the USA and the UK have offered to place their peaceful nuclear activities under safeguards. This offer has chiefly a symbolic value, of course, since NWS are not prevented by the NPT from continuing non-peaceful nuclear activities and a number of developing countries have complained that implementation of the offers will sharply increase safeguards costs without having any real arms control value.

and provided by States. In this way the Agency endeavours to ensure the maximum effectiveness of safeguards and the most efficient use of available resources.

Although the technical verification measures applied by the IAEA, pursuant to either the Agency's safeguards system under INFCIRC 66/Rev.2 or the NPT safeguards system pursuant to INFCIRC 153, cannot prevent clandestine diversion of safeguarded nuclear material to military or explosive purposes, they can inhibit a state from such action by posing a high risk of detection. The Secretariat of the IAEA has fixed on the advice of technical panels, the probability of detecting the significant quantity of nuclear material, if missing, at 95% and the probability that this quantity is correctly established (the confidence level) also at 95%.

In the event of such unauthorized diversion of nuclear materials or facilities to proscribed purposes by a state, international sanctions may be applied to that state. Article XII.A.7 and C of the IAEA Statute provides, inter alia, that when there is non-compliance with any provision of a safeguards agreement with the Agency, and the state concerned fails to remedy this non-compliance forthwith upon being requested to do so by the Agency Board of Governors, this shall be reported by the Board of Governors to the Agency members and to the United Nations Security Council and General Assembly; assistance provided by the IAEA or by its members may be curtailed or suspended; the recipient member may be asked to return the materials and equipment made available to it; and membership of the non-complying state in the Agency may be suspended. If it is judged by the IAEA Board of Governors that diversion has occurred, the U.N. Security Council can then take the measures provided for in the U.N. Charter.

Canadian Safeguards Policy

Canada's nuclear export policy has evolved considerably since the first large scale uranium exports in the latter years of the Second World War. Exports of material and equipment, during the war years and the decade following, supported the military nuclear programmes of both the U.S. and the U.K. Cooperation in the peaceful applications of nuclear energy with a non-weapons state first began with India under the Colombo plan. The nuclear cooperation agreement with India concluded in 1956, reflected Canada's concern with the weapons potential inherent in transferred nuclear materials by requiring that only peaceful purposes be served.

The formation of the IAEA resulted in the development of safeguards systems which could be applied at the request of the parties to any bilateral or multilateral arrangements. Canada first took advantage of this position in 1966 when a Japan-Canada-IAEA agreement was concluded. IAEA safeguards were subsequently brought into effect on specific transfers to Pakistan (1969) and India (1971).

Canada was among one of the first nations to ratify the NPT which came into force in 1970. Non-nuclear weapon states party to the NPT undertook not to transfer nuclear materials or equipment to any non-nuclear weapon state except under the provisions of IAEA safeguards. Shipments of nuclear material continued to several European countries where IAEA safeguards were not in effect because of prior contractual and cooperation commitments in anticipation of their ratification of the

NPT which finally took place in 1975. This material was subject to safeguards administered by Canada under bilateral agreement, while safeguards in line with Canadian requirements were negotiated.

The Canadian government during 1974 carried out an examination of the present international safeguards standard and concluded that Canada should make urgent efforts for the standard to be improved. It was also concluded that as a matter of national policy, Canada would move ahead of the international norm as it then existed. While it was recognized that the safeguards policy of any one supplier country could not change the entire system, it was considered essential for Canada, as a major nuclear exporter, to take a leading role.

#### Nuclear Explosions

Following extensive study, the Minister of Energy, Mines and Resources informed the House of Commons on December 20, 1974 of the Government's decision to require more stringent safeguards on the export of Canadian nuclear equipment, material and technology. The new policy requires a binding assurance that Canadian supplied nuclear material, equipment and technology will not be used to produce a nuclear explosive device whether the development of such a device be stated to be for peaceful purposes or not. It is the view of the Canadian Government that no distinction can be made between the technology for a nuclear explosive device for military purposes, and one for other purposes, and that a state cannot develop a nuclear explosive device for peaceful purposes without acquiring a capability to develop nuclear weapons.

In particular, the new policy stipulates that safeguards will now cover:

- 1) all nuclear facilities and equipment supplied by Canada for the life of those facilities and equipment;
- 2) all nuclear facilities and equipment using Canadian supplied technology;
- 3) all nuclear material - uranium, thorium, plutonium, heavy water - supplied by Canada, and future generations of fissile material produced from or with these materials;
- 4) all nuclear materials, whatever their origin, produced or processed in facilities supplied by Canada.

#### Items Under Safeguards

It is impossible to regulate the flow of much of the equipment in a nuclear facility which is of standard industrial design. The problem has been to identify a list of items which are specially designed for nuclear facilities, and to reach agreement among nuclear suppliers that safeguards be a precondition for the export of all items on such a "trigger list" in all cases. If such a control mechanism is not to be abused all suppliers must be involved.

Following the coming into force of the NPT, which requires inter alia that parties undertake not to provide any non-nuclear weapon state with "(a) source or special fissionable material or (b) equipment and material especially designed for the processing, use or production of special fissionable material" unless that material shall

be subject to the safeguards required by the Treaty, a group of supplying countries parties or signatories of the NPT agreed on a list of equipment and materials which should trigger the application of safeguards in the recipient country. Although the agreed list does not contain all of the components necessary for the construction of a nuclear facility, it does nevertheless contain the most significant items including those that do not have an application in other fields, e.g. reactor fuelling machines. This so called "trigger list" (INFCIRC 209) has become generally accepted as a minimum definition of items, shipment of which would call for the application of safeguards to facilities in which they are used.

Canada for its part has relied since 1968 on its "export import control list" to maintain safeguards control on nuclear exports. Items on this list must receive export permits issued by the Department of Industry, Trade and Commerce, which does so in the case of nuclear items only upon the advice of the Atomic Energy Control Board (AECB), Canada's nuclear regulatory agency. The AECB examines applications for such exports and gives its concurrence only if the safeguards which apply are acceptable. Canada's own "trigger list" is significantly in advance of that drawn up in INFCIRC 209, in that export of major components of "trigger list" items and related technology also triggers safeguards. The triggering of safeguards to cover facilities, equipment and material by the transfer of technology was a major international advance, which has been subsequently adopted by other supplying countries. In addition, Canada has included heavy water plants as a trigger list item. As technology evolves and recipients develop greater sophistication in nuclear matters, the trigger list requires regular review to retain its value.

Duration and Scope

Until later 1974 when the IAEA Board of Governors adopted a guide (GOV 1621), there was no provision stipulating the length of time for which safeguards should be applied to facilities under agreements concluded pursuant to the INFCIRC 66/Rev.2 system. Normally safeguards under new agreements concluded by the IAEA, when covering individual facilities submitted to Agency safeguards, should last for the operating life of such a facility and be applied to all fissile material produced for so long as it remains in existence. Canada fully supports this position which is reflected in Canadian policy.

Standby Safeguards

Canada is aware of the need to ensure continuance of safeguards coverage in the event the IAEA may not be able to apply safeguards at any time in the future. "Standby" safeguards are necessary even under agreements pursuant to INFCIRC 153, however, for the NPT and its concomitant safeguards regime have a potentially limited lifespan, as a country can abrogate its NPT obligations on three months notice, if it decides that extraordinary events, related to the subject matter of the Treaty have jeopardized its supreme national interests. The NPT itself could expire 25 years after its entry into force (i.e., in 1995) if States Party to it do not decide at that time to extend it or continue it indefinitely. Under Agreements concluded in accordance with current Canadian safeguards policy, if such a situation were to arise,

Canada would then have the right to administer safeguards in the recipient State in order to verify that Canadian origin nuclear items are used only for peaceful uses and, in particular, are not used for the development or manufacture of any nuclear explosive device. Similarly under the new policy Canada exercises this right with non-NPT countries with respect to agreements covering Canadian supplies.

#### Retransfers

In order to ensure that the guarantees over the use of exported Canadian nuclear resources remain effective, it is a further element of Canadian policy that transfers of Canadian nuclear materials, equipment and technology on items produced with these, beyond the jurisdiction of the receiving Party to a third country, may not take place without prior written consent of the Government of Canada.

This stipulation protects against the possibility of a recipient of Canadian supplies transferring those supplies to a third state which may not share Canada's non-proliferation objectives, and which might not accept the guarantees required under Canadian policy in the case of bilateral transfers.

#### Control on Enrichment and Reprocessing

Because of the particular sensitivity of reprocessing and enrichment facilities in the context of nuclear weapons proliferation, Canada seeks the right of joint control over reprocessing and enrichment of Canadian supplied materials. No Canadian origin nuclear material could be reprocessed or enriched without the prior consent of the Government of Canada.

### Technology

The NPT is silent on the question of technology requiring safeguards, and while the IAEA Statute makes mention of it, the political and practical difficulties involved have discouraged attempts to impose safeguards in this area. In Canada's view, now shared by other important nuclear suppliers, it is inconsistent to require stringent controls over nuclear equipment and material while neglecting to cover the technology to build facilities and to produce fissile material. It is therefore Canadian policy to require that safeguards be placed on all nuclear facilities built with Canadian technology. The retransfer of technology by a recipient is also subject to Canadian control.

### Sanctions

In the event of violation of a bilateral nuclear cooperation agreement, Canadian safeguards agreements provide Canada with the right to suspend all nuclear cooperation and shipment of nuclear material, and with the right to demand the recipient state cease using Canadian nuclear supplies and return these to Canada. Depending upon the nature of the violation the matter could be referred to the international community for the application of international sanctions, since the suspension of bilateral nuclear cooperation with one supplier state alone has only limited effect.

### Outlook

Present Canadian policy has placed us in the vanguard of safeguards applied by nuclear suppliers. This has created additional problems, both in practice and in principle. Controls over technology, for example, are both difficult to enforce and difficult to determine

fairly. Not all nations are willing to accept the kind of stringent controls outlined above as they consider these may infringe upon their national sovereignty.

Moreover, to the extent that Canadian safeguards requirements go beyond IAEA standards and capacities, a degree of bilateral verification activity is necessary. While the main thrust of safeguards verification procedures will continue to be under IAEA administration, officials of the Atomic Energy Control Board (AECB), acting in close consultation with the IAEA to avoid duplication of effort, will carry out consultations and evaluate data to verify that our safeguards requirements, particularly those on reprocessing, retransfers and technology, are being adhered to by our nuclear customers. To meet the challenge posed by our safeguards policy, the AECB is expanding its own manpower resources to ensure its ability to carry out the requisite verification activities.

Canada continues to work through appropriate international fora for wider adherence to the NPT. To provide a further incentive to non-NPT countries to ratify the NPT, the Canadian Government has decided that bilateral official development assistance in the future under new undertakings (i.e., those that do not flow from existing treaty obligations) would be made available only to NPT parties. Furthermore, in making decisions on Government commercial financing for exports of nuclear equipment, materials and technology, the prospective purchaser's adherence to the NPT will be considered an important factor. Since financing is an indispensable condition for international reactor sales, this decision has far-reaching consequences.

Canada also continues to press for the adoption of "full fuel cycle" safeguards. Canada seeks to encourage still more non-nuclear weapon states to make general commitments to non-proliferation and believes that the acceptance of IAEA safeguards on all the peaceful nuclear activities of a state, whether of imported or indigenous origin provides the best assurances to the international community of a state's compliance with its undertaking to use nuclear energy for peaceful purposes only.

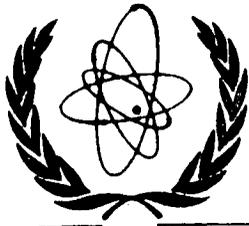
Canada supports other important initiatives currently underway within the IAEA aimed at reducing the nuclear weapons proliferation risk. One of these initiatives is the Agency's feasibility study of regional fuel cycle centres aimed at the reduction of the total number of such centres, thereby reducing the weapons proliferation risk by limiting the number of facilities producing fissile material.

Canada also supports the recently announced revised recommendations of the Agency on the physical protection of nuclear materials (INFCIRC/225), since stringent control of these materials, particularly when in international or national transit, is necessary to reduce the risk of sabotage or theft. Canadian safeguards agreements provide, inter alia, that the receiving Party shall take all measures necessary, commensurate with the assessed threat prevailing from time to time, to ensure the physical security of all transferred Canadian origin nuclear material and derivatives, and shall in all cases be guided by the standards and recommendations established by the IAEA regarding the protection of nuclear material.

The Government is aware that joint international action is necessary to improve safeguards application world wide. For this reason Canada will continue to take a leading role in various international organizations to improve safeguards standards.

At the same time the Government is aware that while safeguards on peaceful nuclear activities provide a measure of assurance and safety, they are only one element in a highly inter-related international political and economic system. Safeguards do not put aside fears of the existing nuclear weapons arsenals nor do they deal with the root problems which cause international conflict. Unless countries can rely on effective guarantees of some kind to protect them against perceived threats to their national security, they may seek a deterrent in kind to such threats. To meet these problems the international community must make greater efforts to overcome existing military confrontations.

It is for these reasons that Canadian policy on international security is far more broadly based than insistence on nuclear safeguards. We have sought to maintain a stable security balance while promoting détente between East and West. Our peacekeeping role has sought to promote regional stability. Through aid both in the UN and bilaterally, we foster the creation of a more harmonious and just international economic order. These policies have done much to foster a better climate of international security, and continued efforts on our part and by other countries can do much to lessen international tension, thereby reducing the need for more countries to have recourse to nuclear weapons as a means to protect their vital interests.



International Atomic Energy Agency

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**THE AGENCY'S SAFEGUARDS SYSTEM  
(1965, AS PROVISIONALLY EXTENDED IN 1966 AND 1968)**

1. The Agency's safeguards system, as approved by the Board of Governors in 1965, and provisionally extended in 1966 and 1968, is set forth in this document for the information of all Members.
2. The development of the system from 1961 onwards has been as follows:

System		
Nature	Name	Set forth in document
The first system	The Agency's Safeguards System (1961)	INFCIRC/26
The 1961 system as extended to cover large reactor facilities	The Agency's Safeguards System (1961, as Extended in 1964)	INFCIRC/26 and Add.1
The revised system	The Agency's Safeguards System (1965)	INFCIRC/66
The revised system with additional provisions for reprocessing plants	The Agency's Safeguards System (1965 as Provisionally Extended in 1966)	INFCIRC/66/Rev.1
The revised system with further additional provisions for safeguarded nuclear material in conversion plants and fabrication plants	The Agency's Safeguards System (1965, as Provisionally Extended in 1966 and 1968)	INFCIRC/66/Rev.2

**THE AGENCY'S SAFEGUARDS SYSTEM  
(1965, AS PROVISIONALLY EXTENDED IN 1966 AND 1968)**

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# THE AGENCY'S SAFEGUARDS SYSTEM (1965, AS PROVISIONALLY EXTENDED IN 1966 AND 1968)

## I. GENERAL CONSIDERATIONS

### A. THE PURPOSE OF THIS DOCUMENT

1. Pursuant to Article II of its Statute the Agency has the task of seeking "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world". Inasmuch as the technology of nuclear energy for peaceful purposes is closely coupled with that for the production of materials for nuclear weapons, the same Article of the Statute provides that the Agency "shall 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".
2. The principal purpose of the present document is to establish a system of controls to enable the Agency to comply with this statutory obligation with respect to the activities of Member States in the field of the peaceful uses of nuclear energy, as provided in the Statute. The authority to establish such a system is provided by Article III.A.5. of the Statute, which authorizes the Agency to "establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose". This Article further authorizes the Agency to "apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy". Article XII.A sets forth the rights and responsibilities that the Agency is to have, to the extent relevant, with respect to any project or arrangement which it is to safeguard.
3. The principles set forth in this document and the procedures for which it provides are established for the information of Member States, to enable them to determine in advance the circumstances and manner in which the Agency would administer safeguards, and for the guidance of the organs of the Agency itself, to enable the Board and the Director General to determine readily what provisions should be included in agreements relating to safeguards and how to interpret such provisions.
4. Provisions of this document that are relevant to a particular project, arrangement or activity in the field of nuclear energy will only become legally binding upon the entry into force of a *safeguards agreement* <sup>1)</sup> and to the extent that they are incorporated therein. Such incorporation may be made by reference.
5. Appropriate provisions of this document may also be incorporated in bilateral or multilateral arrangements between Member States, including all those that provide for the transfer to the Agency of responsibility for administering safeguards. The Agency will not assume such responsibility unless the principles of the safeguards and the procedures to be used are essentially consistent with those set forth in this document.
6. Agreements incorporating provisions from the earlier version of the Agency's safeguards system <sup>2)</sup> will continue to be administered in accordance with such provisions, unless all States parties thereto request the Agency to substitute the provisions of the present document.
7. Provisions relating to types of *principal nuclear facilities*, other than *reactors*, which may produce, process or use safeguarded *nuclear material* will be developed as necessary.
8. The principles and procedures set forth in this document shall be subject to periodic review in the light of the further experience gained by the Agency as well as of technological developments.

1) The use of italics indicates that a term has a specialized meaning in this document and is defined in Part IV.

2) Set forth in documents INF/IRC/26 and Add.1.

## B. GENERAL PRINCIPLES OF THE AGENCY'S SAFEGUARDS

### The Agency's obligations

9. Bearing in mind Article II of the Statute, the Agency shall implement safeguards in a manner designed to avoid hampering a State's economic or technological development.
10. The safeguards procedures set forth in this document shall be implemented in a manner designed to be consistent with prudent management practices required for the economic and safe conduct of nuclear activities.
11. In no case shall the Agency request a State to stop the construction or operation of any *principal nuclear facility* to which the Agency's safeguards procedures extend, except by explicit decision of the Board
12. The State or States concerned and the Director General shall hold consultations regarding the application of the provisions of the present document.
13. In implementing safeguards, the Agency shall take every precaution to protect commercial and industrial secrets. No member of the Agency's staff shall disclose, except to the Director General and to such other members of the staff as the Director General may authorize to have such information by reason of their official duties in connection with safeguards, any commercial or industrial secret or any other confidential information coming to his knowledge by reason of the implementation of safeguards by the Agency.
14. The Agency shall not publish or communicate to any State, organization or person any information obtained by it in connection with the implementation of safeguards, except that:
  - (a) Specific information relating to such implementation in a State may be given to the Board and to such Agency staff members as require such knowledge by reason of their official duties in connection with safeguards, but only to the extent necessary for the Agency to fulfil its safeguards responsibilities;
  - (b) Summarized lists of items being safeguarded by the Agency may be published upon decision of the Board; and
  - (c) Additional information may be published upon decision of the Board and if all States directly concerned agree.

### Principles of implementation

15. The Agency shall implement safeguards in a State if:
  - (a) The Agency has concluded with the State a *project agreement* under which materials, services, equipment, facilities or information are supplied, and such agreement provides for the application of safeguards; or
  - (b) The State is a party to a bilateral or multilateral arrangement under which materials, services, equipment, facilities or information are supplied or otherwise transferred, and:
    - (i) All the parties to the arrangement have requested the Agency to administer safeguards; and
    - (ii) The Agency has concluded the necessary *safeguards agreement* with the State; or
  - (c) The Agency has been requested by the State to safeguard certain nuclear activities under the latter's jurisdiction, and the Agency has concluded the necessary *safeguards agreement* with the State.

16. In the light of Article XII.A.5 of the Statute, it is desirable that *safeguards agreements* should provide for the continuation of safeguards, subject to the provisions of this document, with respect to produced special fissionable material and to any materials substituted therefor.
17. The principal factors to be considered by the Board in determining the relevance of particular provisions of this document to various types of materials and facilities shall be the form, scope and amount of the assistance supplied, the character of each individual project and the degree to which such assistance could further any military purpose. The related *safeguards agreement* shall take account of all pertinent circumstances at the time of its conclusion.
18. In the event of any non-compliance by a State with a *safeguards agreement*, the Agency may take the measures set forth in Articles XII.A.7 and XII.C of the Statute.

## II. CIRCUMSTANCES REQUIRING SAFEGUARDS

### A. NUCLEAR MATERIALS SUBJECT TO SAFEGUARDS

19. Except as provided in paragraphs 21 - 28, *nuclear material* shall be subject to the Agency's safeguards if it is being or has been:
  - (a) Supplied under a *project agreement*; or
  - (b) Submitted to safeguards under a *safeguards agreement* by the parties to a bilateral or multilateral arrangement; or
  - (c) *Unilaterally submitted* to safeguards under a *safeguards agreement*; or
  - (d) Produced, processed or used in a *principal nuclear facility* which has been:
    - (i) Supplied wholly or substantially under a *project agreement*; or
    - (ii) Submitted to safeguards under a *safeguards agreement* by the parties to a bilateral or multilateral arrangement; or
    - (iii) *Unilaterally submitted* to safeguards under a *safeguards agreement*; or
  - (e) Produced in or by the use of safeguarded *nuclear material*; or
  - (f) Substituted, pursuant to paragraph 26(d), for safeguarded *nuclear material*.
20. A *principal nuclear facility* shall be considered as substantially supplied under a *project agreement* if the Board has so determined.

### B. EXEMPTIONS FROM SAFEGUARDS

#### General exemptions

21. *Nuclear material* that would otherwise be subject to safeguards shall be exempted from safeguards at the request of the State concerned, provided that the material so exempted in that State may not at any time exceed:
  - (a) 1 kilogram in total of special fissionable material, which may consist of one or more of the following:
    - (i) Plutonium;

- (ii) Uranium with an *enrichment* of 0.2 (20 %) and above, taken account of by multiplying its weight by its *enrichment*;
- (iii) Uranium with an *enrichment* below 0.2 (20 %) and above that of natural uranium, taken account of by multiplying its weight by five times the square of its *enrichment*;
- (b) 10 metric tons in total of natural uranium and depleted uranium with an *enrichment* above 0.005 (0.5 %);
- (c) 20 metric tons of depleted uranium with an *enrichment* of 0.005 (0.5 %) or below; and
- (d) 20 metric tons of thorium.

#### Exemptions related to reactors

22. Produced or used *nuclear material* that would otherwise be subject to safeguards pursuant to paragraph 19(d) or (e) shall be exempted from safeguards if:

- (a) It is plutonium produced in the fuel of a *reactor* whose rate of production does not exceed 100 grams of plutonium per year; or
- (b) It is produced in a *reactor* determined by the Agency to have a maximum calculated power for continuous operation of less than 3 thermal megawatts, or is used in such a *reactor* and would not be subject to safeguards except for such use, provided that the total power of the *reactors* with respect to which these exemptions apply in any State may not exceed 6 thermal megawatts.

23. Produced special fissionable material that would otherwise be subject to safeguards pursuant only to paragraph 19(e) shall in part be exempted from safeguards if it is produced in a *reactor* in which the ratio of fissionable isotopes within safeguarded *nuclear material* to all fissionable isotopes is less than 0.3 (calculated each time any change is made in the loading of the *reactor* and assumed to be maintained until the next such change). Such fraction of the produced material as corresponds to the calculated ratio shall be subject to safeguards.

#### C. SUSPENSION OF SAFEGUARDS

24. Safeguards with respect to *nuclear material* may be suspended while the material is transferred, under an arrangement or agreement approved by the Agency, for the purpose of processing, reprocessing, testing, research or development, within the State concerned or to any other Member State or to an international organization, provided that the quantities of *nuclear material* with respect to which safeguards are thus suspended in a State may not at any time exceed;

- (a) 1 *effective kilogram* of special fissionable material;
- (b) 10 metric tons in total of natural uranium and depleted uranium with an *enrichment* above 0.005 (0.5 %);
- (c) 20 metric tons of depleted uranium with an *enrichment* of 0.005 (0.5 %) or below; and
- (d) 20 metric tons of thorium.

25. Safeguards with respect to *nuclear material* in irradiated fuel which is transferred for the purpose of reprocessing may also be suspended if the State or States concerned have, with the agreement of the Agency, placed under safeguards substitute *nuclear material* in accordance with paragraph 26(d) for the period of suspension. In addition, safeguards with respect to plutonium contained in irradiated fuel which is transferred for the purpose of reprocessing may be suspended for a period not to exceed six

months if the State or States concerned have, with the agreement of the Agency, placed under safeguards a quantity of uranium whose *enrichment* in the isotope uranium-235 is not less than 0.9 (90%) and the uranium-235 content of which is equal in weight to such plutonium. Upon expiration of the said six months or the completion of reprocessing, whichever is earlier, safeguards shall, with the agreement of the Agency, be applied to such plutonium and shall cease to apply to the uranium substituted therefor.

#### D. TERMINATION OF SAFEGUARDS

26. *Nuclear material* shall no longer be subject to safeguards after:

- (a) It has been returned to the State that originally supplied it (whether directly or through the Agency), if it was subject to safeguards only by reason of such supply and if:
  - (i) It was not *improved* while under safeguards; or
  - (ii) Any special fissionable material that was produced in it under safeguards has been separated out, or safeguards with respect to such produced material have been terminated; or
- (b) The Agency has determined that:
  - (i) It was subject to safeguards only by reason of its use in a *principal nuclear facility* specified in paragraph 19(d);
  - (ii) It has been removed from such facility; and
  - (iii) Any special fissionable material that was produced in it under safeguards has been separated out, or safeguards with respect to such produced material have been terminated; or
- (c) The Agency has determined that it has been consumed, or has been diluted in such a way that it is no longer usable for any nuclear activity relevant from the point of view of safeguards, or has become practicably irrecoverable; or
- (d) The State or States concerned have, with the agreement of the Agency, placed under safeguards, as a substitute, such amount of the same element, not otherwise subject to safeguards, as the Agency has determined contains fissionable isotopes:
  - (i) Whose weight (with due allowance for processing losses) is equal to or greater than the weight of the fissionable isotopes of the material with respect to which safeguards are to terminate; and
  - (ii) Whose ratio by weight to the total substituted element is similar to or greater than the ratio by weight of the fissionable isotopes of the material with respect to which safeguards are to terminate to the total weight of such material;provided that the Agency may agree to the substitution of plutonium for uranium-235 contained in uranium whose *enrichment* is not greater than 0.05 (5.0%); or
- (e) It has been transferred out of the State under paragraph 28(d), provided that such material shall again be subject to safeguards if it is returned to the State in which the Agency had safeguarded it; or
- (f) The conditions specified in the *safeguards agreement*, pursuant to which it was subject to Agency safeguards, no longer apply, by expiration of the agreement or otherwise.

27. If a State wishes to use safeguarded source material for non-nuclear purposes, such as the production of alloys or ceramics, it shall agree with the Agency on the circumstances under which the safeguards on such material may be terminated.

## E. TRANSFER OF SAFEGUARDED NUCLEAR MATERIAL OUT OF THE STATE

28. No safeguarded *nuclear material* shall be transferred outside the jurisdiction of the State in which it is being safeguarded until the Agency has satisfied itself that one or more of the following conditions apply:

- (a) The material is being returned, under the conditions specified in paragraph 26(a), to the State that originally supplied it; or
- (b) The material is being transferred subject to the provisions of paragraph 24 or 25; or
- (c) Arrangements have been made by the Agency to safeguard the material in accordance with this document in the State to which it is being transferred; or
- (d) The material was not subject to safeguards pursuant to a *project agreement* and will be subject, in the State to which it is being transferred, to safeguards other than those of the Agency but generally consistent with such safeguards and accepted by the Agency.

## III. SAFEGUARDS PROCEDURES

### A. GENERAL PROCEDURES

#### Introduction

29. The safeguards procedures set forth below shall be followed, as far as relevant, with respect to safeguarded *nuclear materials*, whether they are being produced, processed or used in any *principal nuclear facility* or are outside any such facility. These procedures also extend to facilities containing or to contain such materials, including *principal nuclear facilities* to which the criteria in paragraph 19(d) apply.

#### Design review

30. The Agency shall review the design of *principal nuclear facilities*, for the sole purpose of satisfying itself that a facility will permit the effective application of safeguards.

31. The design review of a *principal nuclear facility* shall take place at as early a stage as possible. In particular, such review shall be carried out in the case of:

- (a) An Agency project, before the project is approved;
- (b) A bilateral or multilateral arrangement under which the responsibility for administering safeguards is to be transferred to the Agency, or an activity *unilaterally submitted* by a State, before the Agency assumes safeguards responsibilities with respect to the facility;
- (c) A transfer of safeguarded *nuclear material* to a *principal nuclear facility* whose design has not previously been reviewed, before such transfer takes place; and
- (d) A significant modification of a *principal nuclear facility* whose design has previously been reviewed, before such modification is undertaken.

32. To enable the Agency to perform the required design review, the State shall submit to it relevant design information sufficient for the purpose, including information on such basic characteristics of the *principal nuclear facility* as may bear on the Agency's safeguards procedures. The Agency shall require only the minimum amount of information and data consistent with carrying out its responsibility under this section. It shall complete the review promptly after the submission of this information by the State and shall notify the latter of its conclusions without delay.

### Records

33. The State shall arrange for the keeping of records with respect to *principal nuclear facilities* and also with respect to all safeguarded *nuclear material* outside such facilities. For this purpose the State and the Agency shall agree on a system of records with respect to each facility and also with respect to such material, on the basis of proposals to be submitted by the State in sufficient time to allow the Agency to review them before the records need to be kept.
34. If the records are not kept in one of the working languages of the Board, the State shall make arrangements to facilitate their examination by inspectors.
35. The records shall consist, as appropriate, of:
- (a) Accounting records of all safeguarded *nuclear material*; and
  - (b) Operating records for *principal nuclear facilities*.
36. All records shall be retained for at least two years.

### Reports

#### GENERAL REQUIREMENTS

37. The State shall submit to the Agency reports with respect to the production, processing and use of safeguarded *nuclear material* in or outside *principal nuclear facilities*. For this purpose the State and the Agency shall agree on a system of reports with respect to each facility and also with respect to safeguarded *nuclear material* outside such facilities, on the basis of proposals to be submitted by the State in sufficient time to allow the Agency to review them before the reports need to be submitted. The reports need include only such information as is relevant for the purpose of safeguards.
38. Unless otherwise provided in the applicable *safeguards agreement*, reports shall be submitted in one of the working languages of the Board.

#### ROUTINE REPORTS

39. Routine reports shall be based on the records compiled in accordance with paragraphs 33-36 and shall consist, as appropriate, of:
- (a) Accounting reports showing the receipt, transfer out, inventory and use of all safeguarded *nuclear material*. The inventory shall indicate the nuclear and chemical composition and physical form of all material and its location on the date of the report; and
  - (b) Operating reports showing the use that has been made of each *principal nuclear facility* since the last report and, as far as possible, the programme of future work in the period until the next routine report is expected to reach the Agency.
40. The first routine report shall be submitted as soon as:
- (a) There is any safeguarded *nuclear material* to be accounted for; or
  - (b) The *principal nuclear facility* to which it relates is in a condition to operate.

#### PROGRESS IN CONSTRUCTION

41. The Agency may, if so provided in a *safeguards agreement*, request information as to when particular stages in the construction of a *principal nuclear facility* have been or are to be reached.

#### SPECIAL REPORTS

42. The State shall report to the Agency without delay:

- (a) If any unusual incident occurs involving actual or potential loss or destruction of, or damage to, any safeguarded *nuclear material* or *principal nuclear facility*; or
- (b) If there is good reason to believe that safeguarded *nuclear material* is lost or unaccounted for in quantities that exceed the normal operating and handling losses that have been accepted by the Agency as characteristic of the facility.

43. The State shall report to the Agency, as soon as possible, and in any case within two weeks, any transfer not requiring advance notification that will result in a significant change (to be defined by the Agency in agreement with the State) in the quantity of safeguarded *nuclear material* in a facility, or in a complex of facilities considered as a unit for this purpose by agreement with the Agency. Such report shall indicate the amount and nature of the material and its intended use.

#### AMPLIFICATION OF REPORTS

44. At the Agency's request the State shall submit amplifications or clarifications of any report, in so far as relevant for the purpose of safeguards.

#### Inspections

##### GENERAL PROCEDURES

45. The Agency may inspect safeguarded *nuclear materials* and *principal nuclear facilities*.
46. The purpose of safeguards inspections shall be to verify compliance with *safeguards agreements* and to assist States in complying with such agreements and in resolving any questions arising out of the implementation of safeguards.
47. The number, duration and intensity of inspections actually carried out shall be kept to the minimum consistent with the effective implementation of safeguards, and if the Agency considers that the authorized inspections are not all required, fewer shall be carried out.
48. Inspectors shall neither operate any facility themselves nor direct the staff of a facility to carry out any particular operation.

##### ROUTINE INSPECTIONS

49. Routine inspections may include, as appropriate:
- (a) Audit of records and reports;
  - (b) Verification of the amount of safeguarded *nuclear material* by physical inspection, measurement and sampling;
  - (c) Examination of *principal nuclear facilities*, including a check of their measuring instruments and operating characteristics; and
  - (d) Check of the operations carried out at *principal nuclear facilities* and at *research and development facilities* containing safeguarded *nuclear material*.

50. Whenever the Agency has the right of access to a *principal nuclear facility* at all times<sup>3)</sup>, it may perform inspections of which notice as required by paragraph 4 of the *Inspectors Document* need not be given, in so far as this is necessary for the effective application of safeguards. The actual procedures to implement these provisions shall be agreed upon between the parties concerned in the *safeguards agreement*.

##### INITIAL INSPECTIONS OF PRINCIPAL NUCLEAR FACILITIES

51. To verify that the construction of a *principal nuclear facility* is in accordance with the design

reviewed by the Agency, an initial inspection or inspections of the facility may be carried out, if so provided in a *safeguards agreement*:

- (a) As soon as possible after the facility has come under Agency safeguards, in the case of a facility already in operation; or
- (b) Before the facility starts to operate, in other cases.

52. The measuring instruments and operating characteristics of the facility shall be reviewed to the extent necessary for the purpose of implementing safeguards. Instruments that will be used to obtain data on the *nuclear materials* in the facility may be tested to determine their satisfactory functioning. Such testing may include the observation by inspectors of commissioning or routine tests by the staff of the facility, but shall not hamper or delay the construction, commissioning or normal operation of the facility.

#### SPECIAL INSPECTIONS

53. The Agency may carry out special inspections if:

- (a) The study of a report indicates that such inspection is desirable; or
- (b) Any unforeseen circumstance requires immediate action.

The Board shall subsequently be informed of the reasons for and the results of each such inspection.

54. The Agency may also carry out special inspections of substantial amounts of safeguarded *nuclear material* that are to be transferred outside the jurisdiction of the State in which it is being safeguarded, for which purpose the State shall give the Agency sufficient advance notice of any such proposed transfer.

### B. SPECIAL PROCEDURES FOR REACTORS

#### Reports

55. The frequency of submission of routine reports shall be agreed between the Agency and the State, taking into account the frequency established for routine inspections. However, at least two such reports shall be submitted each year and in no case shall more than 12 such reports be required in any year.

#### Inspections

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

57. 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 <i>throughput</i> ; (c) Maximum potential annual production of special fissionable material ( <i>Effective kilograms of nuclear material</i> )	Maximum number of routine inspections annually
Up to 1	0
More than 1 and up to 5	1
More than 5 and up to 10	2
More than 10 and up to 15	3
More than 15 and up to 20	4
More than 20 and up to 25	5
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58. 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*.

**C. SPECIAL PROCEDURES RELATING TO SAFEGUARDED NUCLEAR MATERIAL  
OUTSIDE PRINCIPAL NUCLEAR FACILITIES**

**Nuclear material in research and development facilities**

**ROUTINE REPORTS**

59. Only accounting reports need be submitted in respect of *nuclear material in research and development facilities*. The frequency of submission of such routine reports shall be agreed between the Agency and the State, taking into account the frequency established for routine inspections; however, at least one such report shall be submitted each year and in no case shall more than 12 such reports be required in any year.

**ROUTINE INSPECTIONS**

60. The maximum frequency of routine inspections of safeguarded *nuclear material in a research and development facility* shall be that specified in the table in paragraph 57 for the total amount of material in the facility.

**Source material in sealed storage**

61. The following simplified procedures for safeguarding stockpiled source material shall be applied if a State undertakes to store such material in a sealed storage facility and not to remove it therefrom without previously informing the Agency.

DESIGN OF STORAGE FACILITIES

62. The State shall submit to the Agency information on the design of each sealed storage facility and agree with the Agency on the method and procedure for sealing it.

ROUTINE REPORTS

63. Two routine accounting reports in respect of source material in sealed storage shall be submitted each year.

ROUTINE INSPECTIONS

64. The Agency may perform one routine inspection of each sealed storage facility annually.

REMOVAL OF MATERIAL

65. The State may remove safeguarded source material from a sealed storage facility after informing the Agency of the amount, type and intended use of the material to be removed, and providing sufficient other data in time to enable the Agency to continue safeguarding the material after it has been removed.

Nuclear material in other locations

66. Except to the extent that safeguarded *nuclear material* outside of *principal nuclear facilities* is covered by any of the provisions set forth in paragraphs 59-65, the following procedures shall be applied with respect to such material (for example, source material stored elsewhere than in a sealed storage facility, or special fissionable material used in a sealed neutron source in the field).

ROUTINE REPORTS

67. Routine accounting reports in respect of all safeguarded *nuclear material* in this category shall be submitted periodically. The frequency of submission of such reports shall be agreed between the Agency and the State, taking into account the frequency established for routine inspections; however, at least one such report shall be submitted each year and in no case shall more than 12 such reports be required in any year.

ROUTINE INSPECTIONS

68. The maximum frequency of routine inspections of safeguarded *nuclear material* in this category shall be one inspection annually if the total amount of such material does not exceed five *effective kilograms*, and shall be determined from the table in paragraph 57 if the amount is greater.

IV. DEFINITIONS

- 69. "Agency" means the International Atomic Energy Agency.
- 70. "Board" means the Board of Governors of the Agency.
- 71. "Director General" means the Director General of the Agency.
- 72. "Effective kilograms" means :
  - (a) In the case of plutonium, its weight in kilograms;

- (b) In the case of uranium with an *enrichment* of 0.01 (1 %) and above, its weight in kilograms multiplied by the square of its *enrichment*;
  - (c) In the case of uranium with an *enrichment* below 0.01 (1 %) and above 0.005 (0.5 %), its weight in kilograms multiplied by 0.0001; and
  - (d) In the case of depleted uranium with an *enrichment* of 0.005 (0.5 %) or below, and in the case of thorium, its weight in kilograms multiplied by 0.00005.
73. "Enrichment" means the ratio of the combined weight of the isotopes uranium-233 and uranium-235 to that of the total uranium in question.
74. "Improved" means, with respect to *nuclear material*, that either:
- (a) The concentration of fissionable isotopes in it has been increased; or
  - (b) The amount of chemically separable fissionable isotopes in it has been increased; or
  - (c) Its chemical or physical form has been changed so as to facilitate further use or processing.
75. "Inspector" means an Agency official designated in accordance with the *Inspectors Document*.
76. "Inspectors Document" means the Annex to the Agency's document GC(V)/INF/39.
77. "Nuclear material" means any source or special fissionable material as defined in Article XX of the Statute.
78. "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.
79. "Project agreement" means a *safeguards agreement* relating to an Agency project and containing provisions as foreseen in Article XI.F.4(b) of the Statute.
80. "Reactor" means any device in which a controlled, self-sustaining fission chain-reaction can be maintained.
81. "Research and development facility" means a facility, other than a *principal nuclear facility*, used for research or development in the field of nuclear energy.
82. "Safeguards agreement" means an agreement between the Agency and one or more Member States which contains an undertaking by one or more of those States not to use certain items in such a way as to further any military purpose and which gives the Agency the right to observe compliance with such undertaking. Such an agreement may concern:
- (a) An Agency project;
  - (b) A bilateral or multilateral arrangement in the field of nuclear energy under which the Agency may be asked to administer safeguards; or
  - (c) Any of a State's nuclear activities *unilaterally submitted* to Agency safeguards.
83. "Statute" means the Statute of the Agency.
84. "Throughput" means the rate at which *nuclear material* is introduced into a facility operating at full capacity.
85. "Unilaterally submitted" means submitted by a State to Agency safeguards, pursuant to a *safeguards agreement*.

## ANNEX I

### PROVISIONS FOR REPROCESSING PLANTS

#### INTRODUCTION

1. The Agency's Safeguards System (1965) is so formulated as to permit application to *principal nuclear facilities* other than *reactors* as foreseen in paragraph 7. This Annex lays down the additional procedures which are applicable to the safeguarding of *reprocessing plants*. However, because of the possible need to revise these procedures in the light of experience, they shall be subject to review at any time and shall in any case be reviewed after two years' experience of their application has been gained.

#### SPECIAL PROCEDURES

##### Reports

2. The frequency of submission of routine reports shall be once each calendar month.

##### Inspections

3. A *reprocessing plant* having an annual *throughput* not exceeding 5 effective kilograms of nuclear material, and the safeguarded nuclear material in it, may be routinely inspected twice a year. A *reprocessing plant* having an annual *throughput* exceeding 5 effective kilograms of nuclear material, and the safeguarded nuclear material in it, may be inspected at all times. The arrangements for inspections set forth in paragraph 50 shall apply to all inspections to be made under this paragraph.<sup>1)</sup>

4. When a *reprocessing plant* is under Agency safeguards only because it contains safeguarded nuclear material, the inspection frequency shall be based on the rate of delivery of safeguarded nuclear material.

5. The State and the Agency shall co-operate in making all the necessary arrangements to facilitate the taking, shipping or analysis of samples, due account being taken of the limitations imposed by the characteristics of a plant already in operation when placed under Agency safeguards.

##### Mixtures of safeguarded and unsafeguarded nuclear material

6. By agreement between the State and the Agency, the following special arrangements may be made in the case of a *reprocessing plant* to which the criteria in paragraph 19(d) do not apply, and in which safeguarded and unsafeguarded nuclear materials are present:

- (a) Subject to the provisions of sub-paragraph (b) below, the Agency shall restrict its safeguards procedures to the area in which irradiated fuel is stored, until such time as all or any part of such fuel is transferred out of the storage area into other parts of the plant. Safeguards procedures shall cease to apply to the storage area or plant when either contains no safeguarded nuclear material; and
- (b) Where possible safeguarded nuclear material shall be measured and sampled separately from unsafeguarded material, and at as early a stage as possible. Where separate measurement, sampling or processing are not possible, the whole of the material being processed in that *campaign* shall be subject to the safeguards procedures set out in this Annex. At the conclusion of the processing the nuclear material that is thereafter to be safeguarded shall be selected by agreement between the State and the Agency from the whole output of the plant resulting from that *campaign*, due account being taken of any processing losses accepted by the Agency.

<sup>1)</sup> It is understood that for plants having an annual *throughput* of more than 60 effective kilograms, the right of access at all times would normally be implemented by means of continuous inspection.

### DEFINITIONS

7. "Reprocessing plant" <sup>2)</sup> means a facility to separate irradiated *nuclear materials* and fission products, and includes the facility's head-end treatment section and its associated storage and analytical sections.
8. "Campaign" means the period during which the chemical processing equipment in a *reprocessing plant* is operated between two successive wash-outs of the *nuclear material* present in the equipment.

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2) This term is synonymous with the term "a plant for processing nuclear material irradiated in a reactor" which is used in paragraph 78.

## ANNEX II

PROVISIONS FOR SAFEGUARDED NUCLEAR MATERIAL IN  
CONVERSION PLANTS AND FABRICATION PLANTS

## INTRODUCTION

1. The Agency's Safeguards System (1965, as Provisionally Extended in 1966) is so formulated as to permit application to *principal nuclear facilities* other than *reactors* as foreseen in paragraph 7. This Annex lays down the additional procedures which are applicable to safeguarded *nuclear material* in *conversion plants* and *fabrication plants*<sup>1)</sup>. However, because of the possible need to revise these procedures in the light of experience, they shall be subject to review at any time and shall in any case be reviewed after two years' experience of their application has been gained.

## SPECIAL PROCEDURES

## Reports

2. The frequency of submission of routine reports shall be once each calendar month.

## Inspections

3. A *conversion plant* or *fabrication plant* to which the criteria in paragraph 19(d) apply and the *nuclear material* in it, may be inspected at all times if the plant inventory at any time, or the annual input, of *nuclear material* exceeds five *effective kilograms*. Where neither the inventory at any time, nor the annual input, exceeds five *effective kilograms* of *nuclear material*, the routine inspections shall not exceed two a year. The arrangements for inspection set forth in paragraph 50 shall apply to all inspections to be made under this paragraph<sup>2)</sup>.

4. When a *conversion plant* or *fabrication plant* to which the criteria in paragraph 19(d) do not apply contains safeguarded *nuclear material* the frequency of routine inspections shall be based on the inventory at any time and the annual input of safeguarded *nuclear material*. Where the inventory at any time, or the annual input, of safeguarded *nuclear material* exceeds five *effective kilograms* the plant may be inspected at all times. Where neither the inventory at any time, nor the annual input, exceeds five *effective kilograms* of safeguarded *nuclear material* the routine inspections shall not exceed two a year. The arrangements for inspection set forth in paragraph 50 shall apply to all inspections to be made under this paragraph<sup>2)</sup>.

5. The intensity of inspection of safeguarded *nuclear material* at various steps in a *conversion plant* or *fabrication plant* shall take account of the nature, isotopic composition and amount of safeguarded *nuclear material* in the plant. Safeguards shall be applied in accordance with the general principles set forth in paragraphs 9-14. Emphasis shall be placed on inspection to control uranium of high enrichments and plutonium.

6. Where a plant may handle safeguarded and unsafeguarded *nuclear material*, the State shall notify the Agency in advance of the programme for handling safeguarded batches to enable the Agency to make inspections during these periods, due account being also taken of the arrangements under paragraph 10 below.

1) This terminology is intended to be synonymous with the term "a plant for processing or fabricating *nuclear material* (excepting a mine or ore-processing plant)" which is used in paragraph 78.

2) It is understood that for plants having an inventory at any time, or an annual input, of more than 60 *effective kilograms* the right of access at all times would normally be implemented by means of continuous inspection. Where neither the inventory at any time nor the annual input exceeds one *effective kilogram* of *nuclear material* the plant would not normally be subject to routine inspection.

7. The State and the Agency shall co-operate in making all the necessary arrangements to facilitate the preparation of inventories of safeguarded *nuclear material* and the taking, shipping and/or analysis of samples, due account being taken of the limitations imposed by the characteristics of a plant already in operation when placed under Agency safeguards.

#### Residues, scrap and waste

8. The State shall ensure that safeguarded *nuclear material* contained in residues, scrap or waste created during conversion or fabrication is recovered, as far as is practicable, in its facilities and within a reasonable period of time. If such recovery is not considered practicable by the State, the State and the Agency shall co-operate in making arrangements to account for and dispose of the material.

#### Safeguarded and unsafeguarded nuclear material

9. By agreement between the State and the Agency, the following special arrangements may be made in the case of a *conversion plant* or a *fabrication plant* to which the criteria in paragraph 19(d) do not apply, and in which safeguarded and unsafeguarded *nuclear material* are both present:

- (a) Subject to the provisions of sub-paragraph (b) below, the Agency shall restrict its safeguards procedures to the area in which safeguarded *nuclear material* is stored, until such time as all or any part of such *nuclear material* is transferred out of the storage area into other parts of the plant. Safeguards procedures shall cease to be applied to the storage area or plant when it contains no safeguarded *nuclear material*; and
- (b) Where possible, safeguarded *nuclear material* shall be measured and sampled separately from unsafeguarded *nuclear material*, and at as early a stage as possible. Where separate measurement, sampling or processing is not possible, any *nuclear material* containing safeguarded *nuclear material* shall be subject to the safeguards procedures set out in this Annex. At the conclusion of processing, the *nuclear material* that is thereafter to be safeguarded shall be selected, in accordance with paragraph 11 below when applicable, by agreement between the State and the Agency, due account being taken of any processing losses accepted by the Agency.

#### Blending of nuclear material

10. When safeguarded *nuclear material* is to be blended with either safeguarded or unsafeguarded *nuclear material*, the State shall notify the Agency sufficiently in advance of the programme of blending to enable the Agency to exercise its right to obtain evidence, through inspection of the blending operation or otherwise, that the blending is performed according to the programme.

11. When safeguarded and unsafeguarded *nuclear material* are blended, if the ratio of fissionable isotopes in the safeguarded component going into the blend to all the fissionable isotopes in the blend is 0.3 or greater, and if the concentration of fissionable isotopes in the unsafeguarded *nuclear material* is increased by such blending, then the whole blend shall remain subject to safeguards. In other cases the following procedures shall apply:

- (a) Plutonium/plutonium blending. The quantity of the blend that shall continue to be safeguarded shall be such that its weight, when multiplied by the square of the weight fraction of contained fissionable isotopes, is not less than the weight of originally safeguarded plutonium multiplied by the square of the weight fraction of fissionable isotopes therein, provided however that:
  - (i) In cases where the weight of the whole blend, when multiplied by the square of the weight fraction of contained fissionable isotopes, is less than the weight of originally

safeguarded plutonium multiplied by the square of the weight fraction of fissionable isotopes therein, the whole of the blend shall be safeguarded; and

- (ii) The number of fissionable atoms in the portion of the blend that shall continue to be under safeguards shall in no case be less than the number of fissionable atoms in the originally safeguarded plutonium;
- (b) Uranium/uranium blending. The quantity of the blend that shall continue to be safeguarded shall be such that the number of *effective kilograms* is not less than the number of *effective kilograms* in the originally safeguarded uranium, provided however that:
- (i) In cases where the number of *effective kilograms* in the whole blend is less than in the safeguarded uranium, the whole of the blend shall be safeguarded; and
  - (ii) The number of fissionable atoms in the portion of the blend that shall continue to be under safeguards shall in no case be less than the number of fissionable atoms in the originally safeguarded uranium;
- (c) Uranium/plutonium blending. The whole of the resultant blend shall be safeguarded until the uranium and the plutonium constituents are separated. After separation of the uranium and plutonium, safeguards shall apply to the originally safeguarded component; and
- (d) Due account shall be taken of any processing losses agreed upon between the State and the Agency.

#### DEFINITIONS

12. "Conversion plant" means a facility (excepting a mine or ore-processing plant) to *improve* unirradiated *nuclear material*, or irradiated *nuclear material* that has been separated from fission products, by changing its chemical or physical form so as to facilitate further use or processing. The term *conversion plant* includes the facility's storage and analytical sections. The term does not include a plant intended for separating the isotopes of a *nuclear material*.

13. "Fabrication plant" means a plant to manufacture fuel elements or other components containing *nuclear material* and includes the plant's storage and analytical sections.

THE STRUCTURE AND  
CONTENT OF AGREEMENTS  
BETWEEN  
THE AGENCY AND STATES  
REQUIRED IN CONNECTION  
WITH THE TREATY  
ON THE  
NON-PROLIFERATION  
OF NUCLEAR WEAPONS

The Board of Governors has requested  
the Director General  
to use the material reproduced in this booklet  
as the basis for negotiating safeguards agreements  
between the Agency  
and non-nuclear-weapon States  
party to the Treaty on the Non-Proliferation  
of Nuclear Weapons.

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## PART I

### BASIC UNDERTAKING

1. The Agreement should contain, in accordance with Article III.1 of the Treaty on the Non-Proliferation of Nuclear Weapons<sup>1)</sup>, an undertaking by the State to accept safeguards, in accordance with the terms of the Agreement, on all source or special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.

### APPLICATION OF SAFEGUARDS

2. The Agreement should provide for the Agency's right and obligation to ensure that safeguards will be applied, in accordance with the terms of the Agreement, on all source or special fissionable material in all peaceful nuclear activities within the territory of the State, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices.

### CO-OPERATION BETWEEN THE AGENCY AND THE STATE

3. The Agreement should provide that the Agency and the State shall co-operate to facilitate the implementation of the safeguards provided for therein.

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1) Reproduced in document INFCIRC/140.

## IMPLEMENTATION OF SAFEGUARDS

4. The Agreement should provide that safeguards shall be implemented in a manner designed:

- (a) To avoid hampering the economic and technological development of the State or international co-operation in the field of peaceful nuclear activities, including international exchange of *nuclear material*<sup>2)</sup>;
- (b) To avoid undue interference in the State's peaceful nuclear activities, and in particular in the operation of *facilities*; and
- (c) To be consistent with prudent management practices required for the economic and safe conduct of nuclear activities.

5. The Agreement should provide that the Agency shall take every precaution to protect commercial and industrial secrets and other confidential information coming to its knowledge in the implementation of the Agreement. The Agency shall not publish or communicate to any State, organization or person any information obtained by it in connection with the implementation of the Agreement, except that specific information relating to such implementation in the State may be given to the Board of Governors and to such Agency staff members as require such knowledge by reason of their official duties in connection with safeguards, but only to the extent necessary for the Agency to fulfil its responsibilities in implementing the Agreement. Summarized information on *nuclear material* being safeguarded by the Agency under the Agreement may be published upon decision of the Board if the States directly concerned agree.

6. The Agreement should provide that in implementing safeguards pursuant thereto the Agency shall take full account of technological developments in the field of safeguards, and shall make every effort to ensure optimum cost-effectiveness and the application of the principle of safeguarding effectively the flow of *nuclear material* subject to safeguards under the Agreement by use of instruments and other techniques at certain *strategic points* to the extent that present or future technology permits. In order to ensure optimum cost-effectiveness, use should be made, for example, of such means as:

- (a) Containment as a means of defining *material balance areas* for accounting purposes;
- (b) Statistical techniques and random sampling in evaluating the flow of *nuclear material*; and
- (c) Concentration of verification procedures on those stages in the nuclear fuel cycle involving the production, processing, use or storage of *nuclear material* from which nuclear weapons or other nuclear explosive devices could readily be made, and minimization of verification procedures in respect of other *nuclear material*, on condition that this does not hamper the Agency in applying safeguards under the Agreement.

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2) Terms in italics have specialized meanings, which are defined in paragraphs 98—116 below.

## NATIONAL SYSTEM OF ACCOUNTING FOR AND CONTROL OF NUCLEAR MATERIAL

7. The Agreement should provide that the State shall establish and maintain a system of accounting for and control of all *nuclear material* subject to safeguards under the Agreement, and that such safeguards shall be applied in such a manner as to enable the Agency to verify, in ascertaining that there has been no diversion of *nuclear material* from peaceful uses to nuclear weapons or other nuclear explosive devices, findings of the State's system. The Agency's verification shall include, inter alia, independent measurements and observations conducted by the Agency in accordance with the procedures specified in Part II below. The Agency, in its verification, shall take due account of the technical effectiveness of the State's system.

## PROVISION OF INFORMATION TO THE AGENCY

8. The Agreement should provide that to ensure the effective implementation of safeguards thereunder the Agency shall be provided, in accordance with the provisions set out in Part II below, with information concerning *nuclear material* subject to safeguards under the Agreement and the features of *facilities* relevant to safeguarding such material. The Agency shall require only the minimum amount of information and data consistent with carrying out its responsibilities under the Agreement. Information pertaining to *facilities* shall be the minimum necessary for safeguarding *nuclear material* subject to safeguards under the Agreement. In examining design information, the Agency shall, at the request of the State, be prepared to examine on premises of the State design information which the State regards as being of particular sensitivity. Such information would not have to be physically transmitted to the Agency provided that it remained available for ready further examination by the Agency on premises of the State.

## AGENCY INSPECTORS

9. The Agreement should provide that the State shall take the necessary steps to ensure that Agency inspectors can effectively discharge their functions under the Agreement. The Agency shall secure the consent of the State to the designation of Agency inspectors to that State. If the State, either upon proposal of a designation or at any other time after a designation has been made, objects to the designation, the Agency shall propose to the State an alternative designation or designations. The repeated refusal of a State to accept the designation of Agency inspectors which would impede the inspections conducted under the Agreement would be considered by the Board upon referral by the Director General with a view to appropriate action. The visits and activities of Agency inspectors shall be so arranged as to reduce to a

minimum the possible inconvenience and disturbance to the State and to the peaceful nuclear activities inspected, as well as to ensure protection of industrial secrets or any other confidential information coming to the inspectors' knowledge.

## PRIVILEGES AND IMMUNITIES

10. The Agreement should specify the privileges and immunities which shall be granted to the Agency and its staff in respect of their functions under the Agreement. In the case of a State party to the Agreement on the Privileges and Immunities of the Agency<sup>3)</sup>, the provisions thereof, as in force for such State, shall apply. In the case of other States, the privileges and immunities granted should be such as to ensure that:

- (a) The Agency and its staff will be in a position to discharge their functions under the Agreement effectively; and
- (b) No such State will be placed thereby in a more favourable position than States party to the Agreement on the Privileges and Immunities of the Agency.

## TERMINATION OF SAFEGUARDS

### Consumption or dilution of nuclear material

11. The Agreement should provide that safeguards shall terminate on *nuclear material* subject to safeguards thereunder upon determination by the Agency that it has been consumed, or has been diluted in such a way that it is no longer usable for any nuclear activity relevant from the point of view of safeguards, or has become practicably irrecoverable.

### Transfer of nuclear material out of the State

12. The Agreement should provide, with respect to *nuclear material* subject to safeguards thereunder, for notification of transfers of such material out of the State, in accordance with the provisions set out in paragraphs 92—94 below. The Agency shall terminate safeguards under the Agreement on *nuclear material* when the recipient State has assumed responsibility therefor, as provided for in paragraph 91. The Agency shall maintain records indicating each transfer and, where applicable, the re-application of safeguards to the transferred *nuclear material*.

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3) Reproduced in document INFCIRC/9/Rev. 2.

Provisions relating to nuclear material to be used in non-nuclear activities

13. The Agreement should provide that if the State wishes to use *nuclear material* subject to safeguards thereunder in non-nuclear activities, such as the production of alloys or ceramics, it shall agree with the Agency on the circumstances under which the safeguards on such *nuclear material* may be terminated.

#### NON-APPLICATION OF SAFEGUARDS TO NUCLEAR MATERIAL TO BE USED IN NON-PEACEFUL ACTIVITIES

14. The Agreement should provide that if the State intends to exercise its discretion to use *nuclear material* which is required to be safeguarded thereunder in a nuclear activity which does not require the application of safeguards under the Agreement, the following procedures will apply:

- (a) The State shall inform the Agency of the activity, making it clear:
  - (i) That the use of the *nuclear material* in a non-proscribed military activity will not be in conflict with an undertaking the State may have given and in respect of which Agency safeguards apply, that the *nuclear material* will be used only in a peaceful nuclear activity; and
  - (ii) That during the period of non-application of safeguards the *nuclear material* will not be used for the production of nuclear weapons or other nuclear explosive devices;
- (b) The Agency and the State shall make an arrangement so that, only while the *nuclear material* is in such an activity, the safeguards provided for in the Agreement will not be applied. The arrangement shall identify, to the extent possible, the period or circumstances during which safeguards will not be applied. In any event, the safeguards provided for in the Agreement shall again apply as soon as the *nuclear material* is reintroduced into a peaceful nuclear activity. The Agency shall be kept informed of the total quantity and composition of such unsafeguarded *nuclear material* in the State and of any exports of such material; and
- (c) Each arrangement shall be made in agreement with the Agency. The Agency's agreement shall be given as promptly as possible; it shall only relate to the temporal and procedural provisions, reporting arrangements, etc., but shall not involve any approval or classified knowledge of the military activity or relate to the use of the *nuclear material* therein.

#### FINANCE

15. The Agreement should contain one of the following sets of provisions:
- (a) An agreement with a Member of the Agency should provide that

each party thereto shall bear the expenses it incurs in implementing its responsibilities thereunder. However, if the State or persons under its jurisdiction incur extraordinary expenses as a result of a specific request by the Agency, the Agency shall reimburse such expenses provided that it has agreed in advance to do so. In any case the Agency shall bear the cost of any additional measuring or sampling which inspectors may request; or

(b) An agreement with a party not a Member of the Agency should in application of the provisions of Article XIV.C of the Statute, provide that the party shall reimburse fully to the Agency the safeguards expenses the Agency incurs thereunder. However, if the party or persons under its jurisdiction incur extraordinary expenses as a result of a specific request by the Agency, the Agency shall reimburse such expenses provided that it has agreed in advance to do so.

### THIRD PARTY LIABILITY FOR NUCLEAR DAMAGE

16. The Agreement should provide that the State shall ensure that any protection against third party liability in respect of nuclear damage, including any insurance or other financial security, which may be available under its laws or regulations shall apply to the Agency and its officials for the purpose of the implementation of the Agreement, in the same way as that protection applies to nationals of the State.

### INTERNATIONAL RESPONSIBILITY

17. The Agreement should provide that any claim by one party thereto against the other in respect of any damage, other than damage arising out of a nuclear incident, resulting from the implementation of safeguards under the Agreement, shall be settled in accordance with international law.

### MEASURES IN RELATION TO VERIFICATION OF NON-DIVERSION

18. The Agreement should provide that if the Board, upon report of the Director General, decides that an action by the State is essential and urgent in order to ensure verification that *nuclear material* subject to safeguards under the Agreement is not diverted to nuclear weapons or other nuclear explosive devices the Board shall be able to call upon the State to take the required action without delay, irrespective of whether procedures for the settlement of a dispute have been invoked.

19. The Agreement should provide that if the Board upon examination of relevant information reported to it by the Director General finds that the

Agency is not able to verify that there has been no diversion of *nuclear material* required to be safeguarded under the Agreement to nuclear weapons or other nuclear explosive devices, it may make the reports provided for in paragraph C of Article XII of the Statute and may also take, where applicable, the other measures provided for in that paragraph. In taking such action the Board shall take account of the degree of assurance provided by the safeguards measures that have been applied and shall afford the State every reasonable opportunity to furnish the Board with any necessary reassurance.

#### **INTERPRETATION AND APPLICATION OF THE AGREEMENT AND SETTLEMENT OF DISPUTES**

20. The Agreement should provide that the parties thereto shall, at the request of either, consult about any question arising out of the interpretation or application thereof.

21. The Agreement should provide that the State shall have the right to request that any question arising out of the interpretation or application thereof be considered by the Board; and that the State shall be invited by the Board to participate in the discussion of any such question by the Board.

22. The Agreement should provide that any dispute arising out of the interpretation or application thereof except a dispute with regard to a finding by the Board under paragraph 19 above or an action taken by the Board pursuant to such a finding which is not settled by negotiation or another procedure agreed to by the parties should, on the request of either party, be submitted to an arbitral tribunal composed as follows: each party would designate one arbitrator, and the two arbitrators so designated would elect a third, who would be the Chairman. If, within 30 days of the request for arbitration, either party has not designated an arbitrator, either party to the dispute may request the President of the International Court of Justice to appoint an arbitrator. The same procedure would apply if, within 30 days of the designation or appointment of the second arbitrator, the third arbitrator had not been elected. A majority of the members of the arbitral tribunal would constitute a quorum, and all decisions would require the concurrence of two arbitrators. The arbitral procedure would be fixed by the tribunal. The decisions of the tribunal would be binding on both parties.

#### **FINAL CLAUSES**

##### **Amendment of the Agreement**

23. The Agreement should provide that the parties thereto shall, at the request of either of them, consult each other on amendment of the Agreement. All amendments shall require the agreement of both parties. It might additionally be provided, if convenient to the State, that the agreement of the

parties on amendments to Part II of the Agreement could be achieved by recourse to a simplified procedure. The Director General shall promptly inform all Member States of any amendment to the Agreement.

#### Suspension of application of Agency safeguards under other agreements

24. Where applicable and where the State desires such a provision to appear, the Agreement should provide that the application of Agency safeguards in the State under other safeguards agreements with the Agency shall be suspended while the Agreement is in force. If the State has received assistance from the Agency for a project, the State's undertaking in the Project Agreement not to use items subject thereto in such a way as to further any military purpose shall continue to apply.

#### Entry into force and duration

25. The Agreement should provide that it shall enter into force on the date on which the Agency receives from the State written notification that the statutory and constitutional requirements for entry into force have been met. The Director General shall promptly inform all Member States of the entry into force.

26. The Agreement should provide for it to remain in force as long as the State is party to the Treaty on the Non-Proliferation of Nuclear Weapons<sup>1)</sup>.

## PART II

### INTRODUCTION

27. The Agreement should provide that the purpose of Part II thereof is to specify the procedures to be applied for the implementation of the safeguards provisions of Part I.

### OBJECTIVE OF SAFEGUARDS

28. The Agreement should provide that the objective of safeguards is the timely detection of diversion of significant quantities of *nuclear material* from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection.

29. To this end the Agreement should provide for the use of material accountancy as a safeguards measure of fundamental importance, with containment and surveillance as important complementary measures.

30. The Agreement should provide that the technical conclusion of the Agency's verification activities shall be a statement, in respect of each *material balance area*, of the amount of *material unaccounted for* over a specific period, giving the limits of accuracy of the amounts stated.

### NATIONAL SYSTEM OF ACCOUNTING FOR AND CONTROL OF NUCLEAR MATERIAL

31. The Agreement should provide that pursuant to paragraph 7 above the Agency, in carrying out its verification activities, shall make full use of the State's system of accounting for and control of all *nuclear material* subject to safeguards under the Agreement, and shall avoid unnecessary duplication of the State's accounting and control activities.

32. The Agreement should provide that the State's system of accounting for and control of all *nuclear material* subject to safeguards under the Agreement

shall be based on a structure of material balance areas, and shall make provision as appropriate and specified in the Subsidiary Arrangements for the establishment of such measures as:

- (a) A measurement system for the determination of the quantities of *nuclear material* received, produced, shipped, lost or otherwise removed from inventory, and the quantities on inventory;
- (b) The evaluation of precision and accuracy of measurements and the estimation of measurement uncertainty;
- (c) Procedures for identifying, reviewing and evaluating differences in shipper/receiver measurements;
- (d) Procedures for taking a *physical inventory*;
- (e) Procedures for the evaluation of accumulations of unmeasured inventory and unmeasured losses;
- (f) A system of records and reports showing, for each *material balance area*, the inventory of *nuclear material* and the changes in that inventory including receipts into and transfers out of the *material balance area*;
- (g) Provisions to ensure that the accounting procedures and arrangements are being operated correctly; and
- (h) Procedures for the provision of reports to the Agency in accordance with paragraphs 59—69 below.

#### STARTING POINT OF SAFEGUARDS

33. The Agreement should provide that safeguards shall not apply thereunder to material in mining or ore processing activities.

34. The Agreement should provide that:

- (a) When any material containing uranium or thorium which has not reached the stage of the nuclear fuel cycle described in sub-paragraph (c) below is directly or indirectly exported to a non-nuclear-weapon State, the State shall inform the Agency of its quantity, composition and destination, unless the material is exported for specifically non-nuclear purposes;
- (b) When any material containing uranium or thorium which has not reached the stage of the nuclear fuel cycle described in sub-paragraph (c) below is imported, the State shall inform the Agency of its quantity and composition, unless the material is imported for specifically non-nuclear purposes; and
- (c) When any *nuclear material* of a composition and purity suitable for fuel fabrication or for being isotopically enriched leaves the plant or the process stage in which it has been produced, or when such *nuclear material*, or any other *nuclear material* produced at a later stage in the nuclear fuel cycle, is imported into the State, the *nuclear material* shall become subject to the other safeguards procedures specified in the Agreement.

## TERMINATION OF SAFEGUARDS

35. The Agreement should provide that safeguards shall terminate on *nuclear material* subject to safeguards thereunder under the conditions set forth in paragraph 11 above. Where the conditions of that paragraph are not met, but the State considers that the recovery of safeguarded *nuclear material* from residues is not for the time being practicable or desirable, the Agency and the State shall consult on the appropriate safeguards measures to be applied. It should further be provided that safeguards shall terminate on *nuclear material* subject to safeguards under the Agreement under the conditions set forth in paragraph 13 above, provided that the State and the Agency agree that such *nuclear material* is practicably irrecoverable.

## EXEMPTIONS FROM SAFEGUARDS

36. The Agreement should provide that the Agency shall, at the request of the State, exempt *nuclear material* from safeguards, as follows:

- (a) Special fissionable material, when it is used in gram quantities or less as a sensing component in instruments;
- (b) *Nuclear material*, when it is used in non-nuclear activities in accordance with paragraph 13 above, if such *nuclear material* is recoverable; and
- (c) Plutonium with an isotopic concentration of plutonium-238 exceeding 80%.

37. The Agreement should provide that *nuclear material* that would otherwise be subject to safeguards shall be exempted from safeguards at the request of the State, provided that *nuclear material* so exempted in the State may not at any time exceed:

- (a) One kilogram in total of special fissionable material, which may consist of one or more of the following:
  - (i) Plutonium;
  - (ii) Uranium with an *enrichment* of 0.2 (20%) and above, taken account of by multiplying its weight by its *enrichment*; and
  - (iii) Uranium with an *enrichment* below 0.2 (20%) and above that of natural uranium, taken account of by multiplying its weight by five times the square of its *enrichment*;
- (b) Ten metric tons in total of natural uranium and depleted uranium with an *enrichment* above 0.005 (0.5%);
- (c) Twenty metric tons of depleted uranium with an *enrichment* of 0.005 (0.5%) or below; and
- (d) Twenty metric tons of thorium;

or such greater amounts as may be specified by the Board of Governors for uniform application.

38. The Agreement should provide that if exempted *nuclear material* is to be

processed or stored together with safeguarded *nuclear material*, provision should be made for the re-application of safeguards thereto.

## SUBSIDIARY ARRANGEMENTS

39. The Agreement should provide that the Agency and the State shall make Subsidiary Arrangements which shall specify in detail, to the extent necessary to permit the Agency to fulfil its responsibilities under the Agreement in an effective and efficient manner, how the procedures laid down in the Agreement are to be applied. Provision should be made for the possibility of an extension or change of the Subsidiary Arrangements by agreement between the Agency and the State without amendment of the Agreement.

40. It should be provided that the Subsidiary Arrangements shall enter into force at the same time as, or as soon as possible after, the entry into force of the Agreement. The State and the Agency shall make every effort to achieve their entry into force within 90 days of the entry into force of the Agreement, a later date being acceptable only with the agreement of both parties. The State shall provide the Agency promptly with the information required for completing the Subsidiary Arrangements. The Agreement should also provide that, upon its entry into force, the Agency shall be entitled to apply the procedures laid down therein in respect of the *nuclear material* listed in the inventory provided for in paragraph 41 below.

## INVENTORY

41. The Agreement should provide that, on the basis of the initial report referred to in paragraph 62 below, the Agency shall establish a unified inventory of all *nuclear material* in the State subject to safeguards under the Agreement, irrespective of its origin, and maintain this inventory on the basis of subsequent reports and of the results of its verification activities. Copies of the inventory shall be made available to the State at agreed intervals.

## DESIGN INFORMATION

### General

42. Pursuant to paragraph 8 above, the Agreement should stipulate that design information in respect of existing *facilities* shall be provided to the Agency during the discussion of the Subsidiary Arrangements, and that the time limits for the provision of such information in respect of new *facilities* shall be specified in the Subsidiary Arrangements. It should further be stipulated that such information shall be provided as early as possible before *nuclear material* is introduced into a new *facility*.

43. The Agreement should specify that the design information in respect of each *facility* to be made available to the Agency shall include, when applicable:

(a) The identification of the *facility*, stating its general character, purpose, nominal capacity and geographic location, and the name and address to be used for routine business purposes;

(b) A description of the general arrangement of the *facility* with reference, to the extent feasible, to the form, location and flow of *nuclear material* and to the general layout of important items of equipment which use, produce or process *nuclear material*;

(c) A description of features of the *facility* relating to material accountancy, containment and surveillance; and

(d) A description of the existing and proposed procedures at the *facility* for *nuclear material* accountancy and control, with special reference to *material balance areas* established by the operator, measurements of flow and procedures for *physical inventory* taking.

44. The Agreement should further provide that other information relevant to the application of safeguards shall be made available to the Agency in respect of each *facility*, in particular on organizational responsibility for material accountancy and control. It should also be provided that the State shall make available to the Agency supplementary information on the health and safety procedures which the Agency shall observe and with which the inspectors shall comply at the *facility*.

45. The Agreement should stipulate that design information in respect of a modification relevant for safeguards purposes shall be provided for examination sufficiently in advance for the safeguards procedures to be adjusted when necessary.

#### Purposes of examination of design information

46. The Agreement should provide that the design information made available to the Agency shall be used for the following purposes:

(a) To identify the features of *facilities* and *nuclear material* relevant to the application of safeguards to *nuclear material* in sufficient detail to facilitate verification;

(b) To determine *material balance areas* to be used for Agency accounting purposes and to select those *strategic points* which are *key measurement points* and which will be used to determine the *nuclear material* flows and inventories; in determining such *material balance areas* the Agency shall, inter alia, use the following criteria:

(i) The size of the *material balance area* should be related to the accuracy with which the material balance can be established;

(ii) In determining the *material balance area* advantage should be taken of any opportunity to use containment and surveillance to help ensure the completeness of flow measurements and thereby

simplify the application of safeguards and concentrate measurement efforts at *key measurement points*;

(iii) A number of *material balance areas* in use at a *facility* or at distinct sites may be combined in one *material balance area* to be used for Agency accounting purposes when the Agency determines that this is consistent with its verification requirements; and

(iv) If the State so requests, a special *material balance area* around a process step involving commercially sensitive information may be established ;

(c) To establish the nominal timing and procedures for taking of *physical inventory* for Agency accounting purposes;

(d) To establish the records and reports requirements and records evaluation procedures;

(e) To establish requirements and procedures for verification of the quantity and location of *nuclear material*; and

(f) To select appropriate combinations of containment and surveillance methods and techniques and the *strategic points* at which they are to be applied.

It should further be provided that the results of the examination of the design information shall be included in the Subsidiary Arrangements.

#### Re-examination of design information

47. The Agreement should provide that design information shall be re-examined in the light of changes in operating conditions, of developments in safeguards technology or of experience in the application of verification procedures, with a view to modifying the action the Agency has taken pursuant to paragraph 46 above.

#### Verification of design information

48. The Agreement should provide that the Agency, in co-operation with the State, may send inspectors to *facilities* to verify the design information provided to the Agency pursuant to paragraphs 42—45 above for the purposes stated in paragraph 46.

### INFORMATION IN RESPECT OF NUCLEAR MATERIAL OUTSIDE FACILITIES

49. The Agreement should provide that the following information concerning *nuclear material* customarily used outside *facilities* shall be provided as applicable to the Agency:

(a) A general description of the use of the *nuclear material*, its geographic location, and the user's name and address for routine business purposes; and

- (b) A general description of the existing and proposed procedures for *nuclear material* accountancy and control, including organizational responsibility for material accountancy and control.

The Agreement should further provide that the Agency shall be informed on a timely basis of any change in the information provided to it under this paragraph.

50. The Agreement should provide that the information made available to the Agency in respect of *nuclear material* customarily used outside *facilities* may be used, to the extent relevant, for the purposes set out in subparagraphs 46(b)–(f) above.

## RECORDS SYSTEM

### General

51. The Agreement should provide that in establishing a national system of accounting for and control of *nuclear material* as referred to in paragraph 7 above, the State shall arrange that records are kept in respect of each *material balance area*. Provision should also be made that the Subsidiary Arrangements shall describe the records to be kept in respect of each *material balance area*.

52. The Agreement should provide that the State shall make arrangements to facilitate the examination of records by inspectors, particularly if the records are not kept in English, French, Russian or Spanish.

53. The Agreement should provide that the records shall be retained for at least five years.

54. The Agreement should provide that the records shall consist, as appropriate, of:

- (a) Accounting records of all *nuclear material* subject to safeguards under the Agreement; and
- (b) Operating records for *facilities* containing such *nuclear material*.

55. The Agreement should provide that the system of measurements on which the records used for the preparation of reports are based shall either conform to the latest international standards or be equivalent in quality to such standards.

### Accounting records

56. The Agreement should provide that the accounting records shall set forth the following in respect of each *material balance area*:

- (a) All *inventory changes*, so as to permit a determination of the *book inventory* at any time;
- (b) All measurement results that are used for determination of the *physical inventory*; and
- (c) All *adjustments* and *corrections* that have been made in respect of *inventory changes*, *book inventories* and *physical inventories*.

57. The Agreement should provide that for all *inventory changes* and *physical inventories* the records shall show, in respect of each *batch of nuclear material*: material identification, *batch data* and *source data*. Provision should further be included that records shall account for uranium, thorium and plutonium separately in each *batch of nuclear material*. Furthermore, the date of the *inventory change* and, when appropriate, the originating *material balance area* and the receiving *material balance area* or the recipient, shall be indicated for each *inventory change*.

#### Operating records

58. The Agreement should provide that the operating records shall set forth as appropriate in respect of each *material balance area*:

- (a) Those operating data which are used to establish changes in the quantities and composition of *nuclear material*;
- (b) The data obtained from the calibration of tanks and instruments and from sampling and analyses, the procedures to control the quality of measurements and the derived estimates of random and systematic error;
- (c) A description of the sequence of the actions taken in preparing for, and in taking, a *physical inventory*, in order to ensure that it is correct and complete; and
- (d) A description of the actions taken in order to ascertain the cause and magnitude of any accidental or unmeasured loss that might occur.

### REPORTS SYSTEM

#### General

59. The Agreement should specify that the State shall provide the Agency with reports as detailed in paragraphs 60—69 below in respect of *nuclear material* subject to safeguards thereunder.

60. The Agreement should provide that reports shall be made in English, French, Russian or Spanish, except as otherwise specified in the Subsidiary Arrangements.

61. The Agreement should provide that reports shall be based on the records kept in accordance with paragraphs 51—58 above and shall consist, as appropriate, of accounting reports and special reports.

#### Accounting reports

62. The Agreement should stipulate that the Agency shall be provided with an initial report on all *nuclear material* which is to be subject to safeguards

thereunder. It should also be provided that the initial report shall be dispatched by the State to the Agency within 30 days of the last day of the calendar month in which the Agreement enters into force, and shall reflect the situation as of the last day of that month.

63. The Agreement should stipulate that for each *material balance area* the State shall provide the Agency with the following accounting reports:

- (a) *Inventory change* reports showing changes in the inventory of *nuclear material*. The reports shall be dispatched as soon as possible and in any event within 30 days after the end of the month in which the *inventory changes* occurred or were established; and
- (b) *Material balance* reports showing the material balance based on a *physical inventory* of *nuclear material* actually present in the *material balance area*. The reports shall be dispatched as soon as possible and in any event within 30 days after the *physical inventory* has been taken.

The reports shall be based on data available as of the date of reporting and may be corrected at a later date as required.

64. The Agreement should provide that *inventory change* reports shall specify identification and *batch data* for each *batch* of *nuclear material*, the date of the *inventory change* and, as appropriate, the originating *material balance area* and the receiving *material balance area* or the recipient. These reports shall be accompanied by concise notes:

- (a) Explaining the *inventory changes*, on the basis of the operating data contained in the operating records provided for under subparagraph 58(a) above; and
- (b) Describing, as specified in the Subsidiary Arrangements, the anticipated operational programme, particularly the taking of a *physical inventory*.

65. The Agreement should provide that the State shall report each *inventory change, adjustment and correction* either periodically in a consolidated list or individually. The *inventory changes* shall be reported in terms of *batches*; small amounts, such as analytical samples, as specified in the Subsidiary Arrangements, may be combined and reported as one *inventory change*.

66. The Agreement should stipulate that the Agency shall provide the State with semi-annual statements of *book inventory* of *nuclear material* subject to safeguards, for each *material balance area*, as based on the *inventory change* reports for the period covered by each such statement.

67. The Agreement should specify that the material balance reports shall include the following entries, unless otherwise agreed by the Agency and the State:

- (a) *Beginning physical inventory*;
- (b) *Inventory changes* (first increases, then decreases);
- (c) *Ending book inventory*;
- (d) *Shipper/receiver differences*;
- (e) *Adjusted ending book inventory*;
- (f) *Ending physical inventory*; and
- (g) *Material unaccounted for*.

A statement of the *physical inventory*, listing all *batches* separately and specifying material identification and *batch data* for each *batch*, shall be attached to each material balance report.

#### Special reports

68. The Agreement should provide that the State shall make special reports without delay:

- (a) If any unusual incident or circumstances lead the State to believe that there is or may have been loss of *nuclear material* that exceeds the limits to be specified for this purpose in the Subsidiary Arrangements; or
- (b) If the containment has unexpectedly changed from that specified in the Subsidiary Arrangements to the extent that unauthorized removal of *nuclear material* has become possible.

#### Amplification and clarification of reports

69. The Agreement should provide that at the Agency's request the State shall supply amplifications or clarifications of any report, in so far as relevant for the purpose of safeguards.

### INSPECTIONS

#### General

70. The Agreement should stipulate that the Agency shall have the right to make inspections as provided for in paragraphs 71—82 below.

#### Purposes of inspections

71. The Agreement should provide that the Agency may make ad hoc inspections in order to:

- (a) Verify the information contained in the initial report on the *nuclear material* subject to safeguards under the Agreement;
- (b) Identify and verify changes in the situation which have occurred since the date of the initial report; and
- (c) Identify, and if possible verify the quantity and composition of, *nuclear material* in accordance with paragraphs 93 and 96 below, before its transfer out of or upon its transfer into the State.

72. The Agreement should provide that the Agency may make routine inspections in order to:

- (a) Verify that reports are consistent with records;
- (b) Verify the location, identity, quantity and composition of all *nuclear*

*material* subject to safeguards under the Agreement; and

(c) Verify information on the possible causes of *material unaccounted for, shipper/receiver differences* and uncertainties in the *book inventory*.

73. The Agreement should provide that the Agency may make special inspections subject to the procedures laid down in paragraph 77 below:

- (a) In order to verify the information contained in special reports; or
- (b) If the Agency considers that information made available by the State, including explanations from the State and information obtained from routine inspections, is not adequate for the Agency to fulfil its responsibilities under the Agreement.

An inspection shall be deemed to be special when it is either additional to the routine inspection effort provided for in paragraphs 78—82 below, or involves access to information or locations in addition to the access specified in paragraph 76 for ad hoc and routine inspections, or both.

#### Scope of inspections

74. The Agreement should provide that for the purposes stated in paragraphs 71—73 above the Agency may:

- (a) Examine the records kept pursuant to paragraphs 51—58;
- (b) Make independent measurements of all *nuclear material* subject to safeguards under the Agreement;
- (c) Verify the functioning and calibration of instruments and other measuring and control equipment;
- (d) Apply and make use of surveillance and containment measures; and
- (e) Use other objective methods which have been demonstrated to be technically feasible.

75. It should further be provided that within the scope of paragraph 74 above the Agency shall be enabled:

- (a) To observe that samples at *key measurement points* for material balance accounting are taken in accordance with procedures which produce representative samples, to observe the treatment and analysis of the samples and to obtain duplicates of such samples;
- (b) To observe that the measurements of *nuclear material* at *key measurement points* for material balance accounting are representative, and to observe the calibration of the instruments and equipment involved;
- (c) To make arrangements with the State that, if necessary:
  - (i) Additional measurements are made and additional samples taken for the Agency's use;
  - (ii) The Agency's standard analytical samples are analysed;
  - (iii) Appropriate absolute standards are used in calibrating instruments and other equipment; and
  - (iv) Other calibrations are carried out;

- (d) To arrange to use its own equipment for independent measurement and surveillance, and if so agreed and specified in the Subsidiary Arrangements, to arrange to install such equipment;
- (e) To apply its seals and other identifying and tamper-indicating devices to containments, if so agreed and specified in the Subsidiary Arrangements; and
- (f) To make arrangements with the State for the shipping of samples taken for the Agency's use.

#### Access for inspections

76. The Agreement should provide that:
- (a) For the purposes specified in sub-paragraphs 71(a) and (b) above and until such time as the *strategic points* have been specified in the Subsidiary Arrangements, the Agency's inspectors shall have access to any location where the initial report or any inspections carried out in connection with it indicate that *nuclear material* is present;
  - (b) For the purposes specified in sub-paragraph 71(c) above the inspectors shall have access to any location of which the Agency has been notified in accordance with sub-paragraphs 92(c) or 95(c) below;
  - (c) For the purposes specified in paragraph 72 above the Agency's inspectors shall have access only to the *strategic points* specified in the Subsidiary Arrangements and to the records maintained pursuant to paragraphs 51—58 ; and
  - (d) In the event of the State concluding that any unusual circumstances require extended limitations on access by the Agency, the State and the Agency shall promptly make arrangements with a view to enabling the Agency to discharge its safeguards responsibilities in the light of these limitations. The Director General shall report each such arrangement to the Board.
77. The Agreement should provide that in circumstances which may lead to special inspections for the purposes specified in paragraph 73 above the State and the Agency shall consult forthwith. As a result of such consultations the Agency may make inspections in addition to the routine inspection effort provided for in paragraphs 78—82 below, and may obtain access in agreement with the State to information or locations in addition to the access specified in paragraph 76 above for ad hoc and routine inspections. Any disagreement concerning the need for additional access shall be resolved in accordance with paragraphs 21 and 22; in case action by the State is essential and urgent, paragraph 18 above shall apply.

#### Frequency and intensity of routine inspections

78. The Agreement should provide that the number, intensity, duration and timing of routine inspections shall be kept to the minimum consistent with

the effective implementation of the safeguards procedures set forth therein, and that the Agency shall make the optimum and most economical use of available inspection resources.

79. The Agreement should provide that in the case of *facilities* and *material balance areas* outside *facilities* with a content or *annual throughput*, whichever is greater, of *nuclear material* not exceeding five *effective kilograms*, routine inspections shall not exceed one per year. For other *facilities* the number, intensity, duration, timing and mode of inspections shall be determined on the basis that in the maximum or limiting case the inspection régime shall be no more intensive than is necessary and sufficient to maintain continuity of knowledge of the flow and inventory of *nuclear material*.

80. The Agreement should provide that the maximum routine inspection effort in respect of *facilities* with a content or *annual throughput* of *nuclear material* exceeding five *effective kilograms* shall be determined as follows:

(a) For reactors and sealed stores, the maximum total of routine inspection per year shall be determined by allowing one sixth of a *man-year of inspection* for each such *facility* in the State;

(b) For other *facilities* involving plutonium or uranium enriched to more than 5%, the maximum total of routine inspection per year shall be determined by allowing for each such *facility*  $30 \times \sqrt{E}$  man-days of inspection per year, where E is the inventory or *annual throughput* of *nuclear material*, whichever is greater, expressed in *effective kilograms*. The maximum established for any such *facility* shall not, however, be less than 1.5 *man-years of inspection*; and

(c) For all other *facilities*, the maximum total of routine inspection per year shall be determined by allowing for each such *facility* one third of a *man-year of inspection* plus  $0.4 \times E$  man-days of inspection per year, where E is the inventory or *annual throughput* of *nuclear material*, whichever is greater, expressed in *effective kilograms*.

The Agreement should further provide that the Agency and the State may agree to amend the maximum figures specified in this paragraph upon determination by the Board that such amendment is reasonable.

81. Subject to paragraphs 78—80 above the criteria to be used for determining the actual number, intensity, duration, timing and mode of routine inspections of any *facility* shall include:

(a) The form of *nuclear material*, in particular, whether the material is in bulk form or contained in a number of separate items; its chemical composition and, in the case of uranium, whether it is of low or high *enrichment*; and its accessibility;

(b) The effectiveness of the State's accounting and control system, including the extent to which the operators of *facilities* are functionally independent of the State's accounting and control system; the extent to which the measures specified in paragraph 32 above have been implemented by the State; the promptness of reports submitted to the Agency; their consistency with the Agency's independent verification;

and the amount and accuracy of the *material unaccounted for*, as verified by the Agency;

(c) Characteristics of the State's nuclear fuel cycle, in particular, the number and types of *facilities* containing *nuclear material* subject to safeguards, the characteristics of such *facilities* relevant to safeguards, notably the degree of containment; the extent to which the design of such *facilities* facilitates verification of the flow and inventory of *nuclear material*; and the extent to which information from different *material balance areas* can be correlated;

(d) International interdependence, in particular, the extent to which *nuclear material* is received from or sent to other States for use or processing; any verification activity by the Agency in connection therewith; and the extent to which the State's nuclear activities are interrelated with those of other States; and

(e) Technical developments in the field of safeguards, including the use of statistical techniques and random sampling in evaluating the flow of *nuclear material*.

82. The Agreement should provide for consultation between the Agency and the State if the latter considers that the inspection effort is being deployed with undue concentration on particular *facilities*.

#### Notice of inspections

83. The Agreement should provide that the Agency shall give advance notice to the State before arrival of inspectors at *facilities* or *material balance areas* outside *facilities*, as follows:

(a) For ad hoc inspections pursuant to sub-paragraph 71(c) above, at least 24 hours, for those pursuant to sub-paragraphs 71(a) and (b), as well as the activities provided for in paragraph 48, at least one week;

(b) For special inspections pursuant to paragraph 73 above, as promptly as possible after the Agency and the State have consulted as provided for in paragraph 77, it being understood that notification of arrival normally will constitute part of the consultations; and

(c) For routine inspections pursuant to paragraph 72 above, at least 24 hours in respect of the *facilities* referred to in sub-paragraph 80(b) and sealed stores containing plutonium or uranium enriched to more than 5%, and one week in all other cases.

Such notice of inspections shall include the names of the inspectors and shall indicate the *facilities* and the *material balance areas* outside *facilities* to be visited and the periods during which they will be visited. If the inspectors are to arrive from outside the State the Agency shall also give advance notice of the place and time of their arrival in the State.

84. However, the Agreement should also provide that, as a supplementary measure, the Agency may carry out without advance notification a portion of the routine inspections pursuant to paragraph 80 above in accordance with

the principle of random sampling. In performing any unannounced inspections, the Agency shall fully take into account any operational programme provided by the State pursuant to paragraph 64(b). Moreover, whenever practicable, and on the basis of the operational programme, it shall advise the State periodically of its general programme of announced and unannounced inspections, specifying the general periods when inspections are foreseen. In carrying out any unannounced inspections, the Agency shall make every effort to minimize any practical difficulties for *facility* operators and the State, bearing in mind the relevant provisions of paragraphs 44 above and 89 below. Similarly the State shall make every effort to facilitate the task of the inspectors.

#### Designation of inspectors

85. The Agreement should provide that:

- (a) The Director General shall inform the State in writing of the name, qualifications, nationality, grade and such other particulars as may be relevant, of each Agency official he proposes for designation as an inspector for the State;
- (b) The State shall inform the Director General within 30 days of the receipt of such a proposal whether it accepts the proposal;
- (c) The Director General may designate each official who has been accepted by the State as one of the inspectors for the State, and shall inform the State of such designations; and
- (d) The Director General, acting in response to a request by the State or on his own initiative, shall immediately inform the State of the withdrawal of the designation of any official as an inspector for the State.

The Agreement should also provide, however, that in respect of inspectors needed for the purposes stated in paragraph 48 above and to carry out ad hoc inspections pursuant to sub-paragraphs 71(a) and (b) the designation procedures shall be completed if possible within 30 days after the entry into force of the Agreement. If such designation appears impossible within this time limit, inspectors for such purposes shall be designated on a temporary basis.

86. The Agreement should provide that the State shall grant or renew as quickly as possible appropriate visas, where required, for each inspector designated for the State.

#### Conduct and visits of inspectors

87. The Agreement should provide that inspectors, in exercising their functions under paragraphs 48 and 71—75 above, shall carry out their activities in a manner designed to avoid hampering or delaying the construction, commissioning or operation of *facilities*, or affecting their safety. In particular

inspectors shall not operate any *facility* themselves or direct the staff of a *facility* to carry out any operation. If inspectors consider that in pursuance of paragraphs 74 and 75, particular operations in a *facility* should be carried out by the operator, they shall make a request therefor.

88. When inspectors require services available in the State, including the use of equipment, in connection with the performance of inspections, the State shall facilitate the procurement of such services and the use of such equipment by inspectors.

89. The Agreement should provide that the State shall have the right to have inspectors accompanied during their inspections by representatives of the State, provided that inspectors shall not thereby be delayed or otherwise impeded in the exercise of their functions.

#### STATEMENTS ON THE AGENCY'S VERIFICATION ACTIVITIES

90. The Agreement should provide that the Agency shall inform the State of:

- (a) The results of inspections, at intervals to be specified in the Subsidiary Arrangements; and
- (b) The conclusions it has drawn from its verification activities in the State, in particular by means of statements in respect of each *material balance area*, which shall be made as soon as possible after a *physical inventory* has been taken and verified by the Agency and a material balance has been struck.

#### INTERNATIONAL TRANSFERS

##### General

91. The Agreement should provide that *nuclear material* subject or required to be subject to safeguards thereunder which is transferred internationally shall, for purposes of the Agreement, be regarded as being the responsibility of the State:

- (a) In the case of import, from the time that such responsibility ceases to lie with the exporting State, and no later than the time at which the *nuclear material* reaches its destination; and
- (b) In the case of export, up to the time at which the recipient State assumes such responsibility, and no later than the time at which the *nuclear material* reaches its destination.

The Agreement should provide that the States concerned shall make suitable arrangements to determine the point at which the transfer of responsibility will take place. No State shall be deemed to have such responsibility for *nuclear material* merely by reason of the fact that the *nuclear material* is in transit on or over its territory or territorial waters, or that it is being transported under its flag or in its aircraft.

### Transfers out of the State

92. The Agreement should provide that any intended transfer out of the State of safeguarded *nuclear material* in an amount exceeding one *effective kilogram*, or by successive shipments to the same State within a period of three months each of less than one *effective kilogram* but exceeding in total one *effective kilogram*, shall be notified to the Agency after the conclusion of the contractual arrangements leading to the transfer and normally at least two weeks before the *nuclear material* is to be prepared for shipping. The Agency and the State may agree on different procedures for advance notification. The notification shall specify:

- (a) The identification and, if possible, the expected quantity and composition of the *nuclear material* to be transferred, and the *material balance area* from which it will come;
- (b) The State for which the *nuclear material* is destined ;
- (c) The dates on and locations at which the *nuclear material* is to be prepared for shipping;
- (d) The approximate dates of dispatch and arrival of the *nuclear material*; and
- (e) At what point of the transfer the recipient State will assume responsibility for the *nuclear material*, and the probable date on which this point will be reached.

93. The Agreement should further provide that the purpose of this notification shall be to enable the Agency if necessary to identify, and if possible verify the quantity and composition of, *nuclear material* subject to safeguards under the Agreement before it is transferred out of the State and, if the Agency so wishes or the State so requests, to affix seals to the *nuclear material* when it has been prepared for shipping. However, the transfer of the *nuclear material* shall not be delayed in any way by any action taken or contemplated by the Agency pursuant to this notification.

94. The Agreement should provide that, if the *nuclear material* will not be subject to Agency safeguards in the recipient State, the exporting State shall make arrangements for the Agency to receive, within three months of the time when the recipient State accepts responsibility for the *nuclear material* from the exporting State, confirmation by the recipient State of the transfer.

### Transfers into the State

95. The Agreement should provide that the expected transfer into the State of *nuclear material* required to be subject to safeguards in an amount greater than one *effective kilogram*, or by successive shipments from the same State within a period of three months each of less than one *effective kilogram* but exceeding in total one *effective kilogram*, shall be notified to the Agency as much in advance as possible of the expected arrival of the *nuclear material*, and in any case not later than the date on which the recipient State assumes re-

sponsibility therefor. The Agency and the State may agree on different procedures for advance notification. The notification shall specify:

- (a) The identification and, if possible, the expected quantity and composition of the *nuclear material*;
- (b) At what point of the transfer responsibility for the *nuclear material* will be assumed by the State for the purposes of the Agreement, and the probable date on which this point will be reached; and
- (c) The expected date of arrival, the location to which the *nuclear material* is to be delivered and the date on which it is intended that the *nuclear material* should be unpacked.

96. The Agreement should provide that the purpose of this notification shall be to enable the Agency if necessary to identify, and if possible verify the quantity and composition of, *nuclear material* subject to safeguards which has been transferred into the State, by means of inspection of the consignment at the time it is unpacked. However, unpacking shall not be delayed by any action taken or contemplated by the Agency pursuant to this notification.

#### Special reports

97. The Agreement should provide that in the case of international transfers a special report as envisaged in paragraph 68 above shall be made if any unusual incident or circumstances lead the State to believe that there is or may have been loss of *nuclear material*, including the occurrence of significant delay during the transfer.

## DEFINITIONS

98. "Adjustment" means an entry into an accounting record or a report showing a *shipper/receiver difference* or *material unaccounted for*.

99. "Annual throughput" means, for the purposes of paragraphs 79 and 80 above, the amount of *nuclear material* transferred annually out of a *facility* working at nominal capacity.

100. "Batch" means a portion of *nuclear material* handled as a unit for accounting purposes at a *key measurement point* and for which the composition and quantity are defined by a single set of specifications or measurements. The *nuclear material* may be in bulk form or contained in a number of separate items.

101. "Batch data" means the total weight of each element of *nuclear material* and, in the case of plutonium and uranium, the isotopic composition when appropriate. The units of account shall be as follows:

- (a) Grams of contained plutonium;
- (b) Grams of total uranium and grams of contained uranium-235 plus uranium-233 for uranium enriched in these isotopes; and
- (c) Kilograms of contained thorium, natural uranium or depleted uranium.

For reporting purposes the weights of individual items in the *batch* shall be added together before rounding to the nearest unit.

102. "Book inventory" of a *material balance area* means the algebraic sum of the most recent *physical inventory* of that *material balance area* and of all *inventory changes* that have occurred since that *physical inventory* was taken.

103. "Correction" means an entry into an accounting record or a report to rectify an identified mistake or to reflect an improved measurement of a quantity previously entered into the record or report. Each correction must identify the entry to which it pertains.

104. "Effective kilogram" means a special unit used in safeguarding *nuclear material*. The quantity in "effective kilograms" is obtained by taking:

- (a) For plutonium, its weight in kilograms;
- (b) For uranium with an *enrichment* of 0.01 (1%) and above, its weight in kilograms multiplied by the square of its *enrichment*;
- (c) For uranium with an *enrichment* below 0.01 (1%) and above 0.005 (0.5%), its weight in kilograms multiplied by 0.0001; and
- (d) For depleted uranium with an *enrichment* of 0.005 (0.5%) or below, and for thorium, its weight in kilograms multiplied by 0.00005.

105. "Enrichment" means the ratio of the combined weight of the isotopes uranium-233 and uranium-235 to that of the total uranium in question.

106. "Facility" means:

- (a) A reactor, a critical facility, a conversion plant, a fabrication plant, a reprocessing plant, an isotope separation plant or a separate storage installation; or
- (b) Any location where *nuclear material* in amounts greater than one *effective kilogram* is customarily used.

107. "Inventory change" means an increase or decrease, in terms of *batches*, of *nuclear material* in a *material balance area*; such a change shall involve one of the following:

- (a) Increases:
  - (i) Import;
  - (ii) Domestic receipt: receipts from other *material balance areas*, receipts from a non-safeguarded (non-peaceful) activity or receipts at the starting point of safeguards;
  - (iii) Nuclear production: production of special fissionable material in a reactor; and
  - (iv) De-exemption: reapplication of safeguards on *nuclear material* previously exempted therefrom on account of its use or quantity.
- (b) Decreases:
  - (i) Export;
  - (ii) Domestic shipment: shipments to other *material balance areas* or shipments for a non-safeguarded (non-peaceful) activity;
  - (iii) Nuclear loss: loss of *nuclear material* due to its transformation into other element(s) or isotope(s) as a result of nuclear reactions;
  - (iv) Measured discard: *nuclear material* which has been measured, or estimated on the basis of measurements, and disposed of in

such a way that it is not suitable for further nuclear use;

(v) Retained waste: *nuclear material* generated from processing or from an operational accident, which is deemed to be unrecoverable for the time being but which is stored;

(vi) Exemption: exemption of *nuclear material* from safeguards on account of its use or quantity; and

(vii) Other loss: for example, accidental loss (that is, irretrievable and inadvertent loss of *nuclear material* as the result of an operational accident) or theft.

108. "Key measurement point" means a location where *nuclear material* appears in such a form that it may be measured to determine material flow or inventory. "Key measurement points" thus include, but are not limited to, the inputs and outputs (including measured discards) and storages in *material balance areas*.

109. "Man-year of inspection" means, for the purposes of paragraph 80 above, 300 man-days of inspection, a man-day being a day during which a single inspector has access to a *facility* at any time for a total of not more than eight hours.

110. "Material balance area" means an area in or outside of a *facility* such that:

(a) The quantity of *nuclear material* in each transfer into or out of each "material balance area" can be determined; and

(b) The *physical inventory* of *nuclear material* in each "material balance area" can be determined when necessary, in accordance with specified procedures,

in order that the material balance for Agency safeguards purposes can be established.

111. "Material unaccounted for" means the difference between *book inventory* and *physical inventory*.

112. "Nuclear material" means any source or any special fissionable material as defined in Article XX of the Statute. The term source material shall not be interpreted as applying to ore or ore residue. Any determination by the Board under Article XX of the Statute after the entry into force of this Agreement which adds to the materials considered to be source material or special fissionable material shall have effect under this Agreement only upon acceptance by the State.

113. "Physical inventory" means the sum of all the measured or derived estimates of *batch* quantities of *nuclear material* on hand at a given time within a *material balance area*, obtained in accordance with specified procedures.

114. "Shipper/receiver difference" means the difference between the quantity of *nuclear material* in a *batch* as stated by the shipping *material balance area* and as measured at the receiving *material balance area*.

115. "Source data" means those data, recorded during measurement or calibration or used to derive empirical relationships, which identify *nuclear material* and provide *batch data*. "Source data" may include, for example, weight of compounds, conversion factors to determine weight of element, specific gravity,

element concentration, isotopic ratios, relationship between volume and manometer readings and relationship between plutonium produced and power generated.

116. "Strategic point" means a location selected during examination of design information where, under normal conditions and when combined with the information from all "strategic points" taken together, the information necessary and sufficient for the implementation of safeguards measures is obtained and verified; a "strategic point" may include any location where key measurements related to material balance accountancy are made and where containment and surveillance measures are executed.

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