APPENDIX IX-C

THE INTERNATIONAL ATOMIC ENERGY AGENCY AND INTERNATIONAL SAFEGUARDS

by

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THE IAEA AND INTERNATIONAL SAFEGUARDS

A. THE STATUTE, THE LEGAL FRAMEWORK.

On the 23rd of October 1956 the Statute of the International Atomic Energy Agency (11) was approved by the Conference on the Statute of the International Atomic Energy Agency at the headquarters of the United Nations. The Statute was opened for signature on the 26th of October 1956 and came into force on the 29th of July 1957. In order to clearly understand the Agency's safeguards objectives, its authorized safeguards functions, and the legal framework for the Agency's safeguards, responsibilities and rights, some familiarity with the Statute is necessary. The appropriate safeguards related Articles from the Statute are summarized below and in full in Annex A. The entire statute has been reprinted in "FACTS ON NUCLEAR PROLIFERATION, A HANDBOOK" (12).

The objectives of the Agency are defined in the Statute under Article II which provides that the Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world and that so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.

The Safeguards functions are defined in the Statute under Articles III, AS and B2 which authorize the Agency to establish and administer safeguards on special fissionable and other materials, services, equipment, facilities, and information made available by the Agency, and to apply safeguards, at the request of the parties, to bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy. Thus, this Article provides for the application of safeguards to declared nuclear facilities as opposed to the full fuel cycle safeguards of the NPT and permits a State to operate an indigenous, undeclared nuclear facility without IAEA safeguards. For example, the Indian nuclear facilities used to

produce the plutonium used in their first nuclear test were not under IAEA safeguards although other facilities had been declared and were safeguarded by the IAEA.

Article III B-2 provides for Agency control over the use of special fissionable materials which has been received by the Agency, for its own projects or projects with other states in order to ensure that these materials are used only for peaceful purposes. Article XI F-4 requires that such projects shall be subject to the safeguards provided for in Article XII, the relevant safeguards being specified in the agreement.

The Agency's safeguards, responsibilities and rights are specified in the Statute under Article XII. This very important Article should be examined closely. However, in summary, it provides for the following:

XII Al.- Design review of facilities and equipment to permit effective application of the safeguards.

XII A2.- Observance of any health and safety measures prescribed by the Agency.

XII A3.- Maintenance and production of operating records.

XII A4.- Submission of progress reports.

XII A5.- Approval of the means to be used for the chemical processing of irradiated materials, the requirement that the special fissionable materials recovered or produced. as a by-product under continuing Agency safeguards, and the deposit with the Agency of any excess of any special fissionable materials recovered or produced as a by-product over what is needed for the above-stated uses in order to prevent stockpiling of these materials. This unused Article has recently received considerable attention

in connection with the establishment of Regional Nuclear Fuel Cycle Centers. The provisions of this article have assumed particular significance in view of the enormous amounts of plutonium that will be produced by nuclear power reactors in the 80's and the danger that would follow from the diversion of even a relatively small amount of this stockpile for weapons purposes. These "approval" and "deposit" provisions of the Statute when coupled with the concept of a Multinational or Regional Nuclear Fuel Cycle Center (RNCC) should offer an acceptable solution to what is otherwise a very difficult and potentially dangerous problem.

XII A6.- Dispatch of Agency Inspectors into the territory of the recipient State who shall have access at all times to all places and data and to any person who by reason of his occupation deals with materials, equipment, or facilities which are required by this Statute to be safeguarded, and the determination of compliance with the undertaking between the Agency and the State against use in furtherance of any military purpose.

XII A7.- The recipient State or States to take requested corrective steps within a reasonable time, suspension or termination of assistance and withdraw any materials and equipment made available by the Agency or a member in furtherance of the project in the event of non-compliance.

XII B.- Establishment of a staff of inspectors.

XII C.- Verification of records and reports. This Article also provides that the inspectors shall report any non-compliance to the Director General who shall thereupon transmit the report to the Board of Governors. If the State or States fail to remedy forthwith any non-compliance which it finds to have occurred, the Board is required to report the non-compliance to all members and to the Security Council and General Assembly of the United Nations.

> The Board may also direct curtailment or suspension of assistance being provided by the Agency or by a member, and call for the return of materials and equipment made available to the recipient member or group of members. Finally, the Agency may also, in accordance with Article XIX, suspend any non-complying member from the exercise of the privileges and rights of membership. The actions noted above represent the range of sanctions permitted by the Statute in the event of a non-compliance and failure by a member State to take the requested corrective action. The need for stronger sanctions by the nuclear supplier states, at least, is obvious.

The safeguards activities of the IAEA are explicitly directed at the problem of "horizontal proliferation", i.e., a decision by a non-nuclear weapon State to divert special fissionable materials to further a military purpose. Diversion is defined in the first document approved by the Board of Governors on the 31st of January 1961 describing the Agency's safeguards (13) to mean:

> "...the use by a recipient State of fissionable or other materials, facilities or equipment supplied by the Agency so as to further any military purpose or in violation of any other condition prescribed in the Agreement between the Agency and the State concerning the use of such materials, facilities or equipment."

It is clear from the Statute, from this description of the Agency's Safeguards System and all subsequent Agency safeguards documents, that the Agency is not legally authorized to address the problem of the terrorist or the non-state adversary nor, of course, the question of "vertical proliferation"- Those functions not explicitly authorized by the Statute are reserved to the State. The IAEA does not

have police powers and it cannot prevent a diversion of nuclear materials to some military purpose. The Statute is also silent on the closely related problem of physical security. The Agency's activities in this area will be treated separately in this review but it should be stressed here that the Agency does not have the statutory authority to make even a recommendation in the area of physical protection. In the Agency document entitled "THE PHYSICAL PROTECTION OF NUCLEAR MATERIALS" (14) it is noted under Section 2. Objectives, that:

> "The Agency has no responsibility either for the provision of a State's physical protection system or for the supervision, control or implementation of such a system. The Agency may informally advise the State on the results of observations made during its normal safeguards activities. Further assistance by the Agency will be provided only when so requested by the State."

Finally, it is important to note that the Statute does not address the problem of the detection of clandestine facilities; a very important matter, as has been noted, which was included in the 1946 Report of the Findings of the Scientific and Technical Committee of the UNAEC. This decision would appear to reflect the conscious omission by the States of this activity because, of necessity, any intelligence activity would constitute an unacceptable infringement of the sovereign rights of the State. Therefore, this essential element of any comprehensive non-proliferation policy must remain the responsibility of the intelligence agencies of the individual States, although cooperation in this sensitive area would clearly enhance the deterrent aspect of such efforts.

IAEA and International Safeguards

Although many States now accept the arrival of an international inspector at their borders as a routine matter it should be remembered that the safeguards Provision of Article XII, less than twenty years old, represents a watershed event in the field of international treaty verification and a major first step in the relinquishment of a State's sovereign rights to a higher need and authority. The very broad inspection rights of Article XII, A-6 which provided for "access at all times to all places and data and to any person" have not been repeated even in INFCIRC/26. This description of the Agency's Safeguards System includes a table of frequency of routine inspections; a response both to the concerns of the State and the practical problems of staffing and inspecting research reactors. The acceptance of the principle of international inspection extends well-beyond the proliferation of nuclear weapons and suggests that the treaty verification problems of other arms control agreements might yield to similar approaches.

There have been a number of suggestions in the past that, if the Agency is unable to undertake important new duties or responsibilities which are not authorized in the Statute, then the Statute should be amended to provide the legal basis for these new functions. This course of action, however, will not necessarily produce the desired results. Officials familiar with the operation of international organizations and with recent world political developments caution that the opening of the Statute to amendment can result in major changes which are not desirable and which may reduce rather than enhance the role of the organization. The establishment of a well-developed consensus and a carefully prepared agenda should precede any decision to amend the Statute of the International Atomic Energy Agency.

IAEA and International Safeguards-B.

B. MEMBERSHIP, ORGANIZATION, AND FINANCE

Membership. The Director General of the IAEA, Dr. Sigvard Eklund, in his report to the Twentieth Session of the General Conference of the International Atomic Energy Agency in Rio de Janeiro, September 1976, stated that:

> "Since 1957 the number of member States has grown from 60 to 109 with a corresponding increase in attendance at the General Conference. The Agency's executive body, the Board of Governors, now has 34 members compared with 23 in 1957 and 25 in 1963. The regular budget has increased as a result of growing activities, inflation and exchange rates from just over $4,000,000 in 1958 to $37,000,000 in 1976. The staff of the Agency has increased from 400 in 1958 to 1200 now."

The list of the Member States, which now totals 110, is given in Annex B.

Organization. The Organization Chart shown in Figure 1. for the International Atomic Energy Agency is taken from "The Agency's Program for 1977 - 82 and Budget for 1977 (15). Not shown in the Organization Chart is the Scientific Advisory Committee which reports to the Director General and the recently established Standing Advisory Group on Safeguards Implementation (SAGSI) which also reports to the Director General. SAGSI is currently considering the problem of more effective reporting to the Board of Governors and to the Member States of the results of the Agency's safeguards operation.

In Figure 1, it may be seen that the Department of Safeguards and Inspections (DSI) is currently divided into the Division of Development, the Division of Operations and a group for Information Treatment. These three subdivisions report directly to the Inspector General, Dr. Rudolph Rometsch. The Director General is now considering a

ORGANIZATIONAL CHART

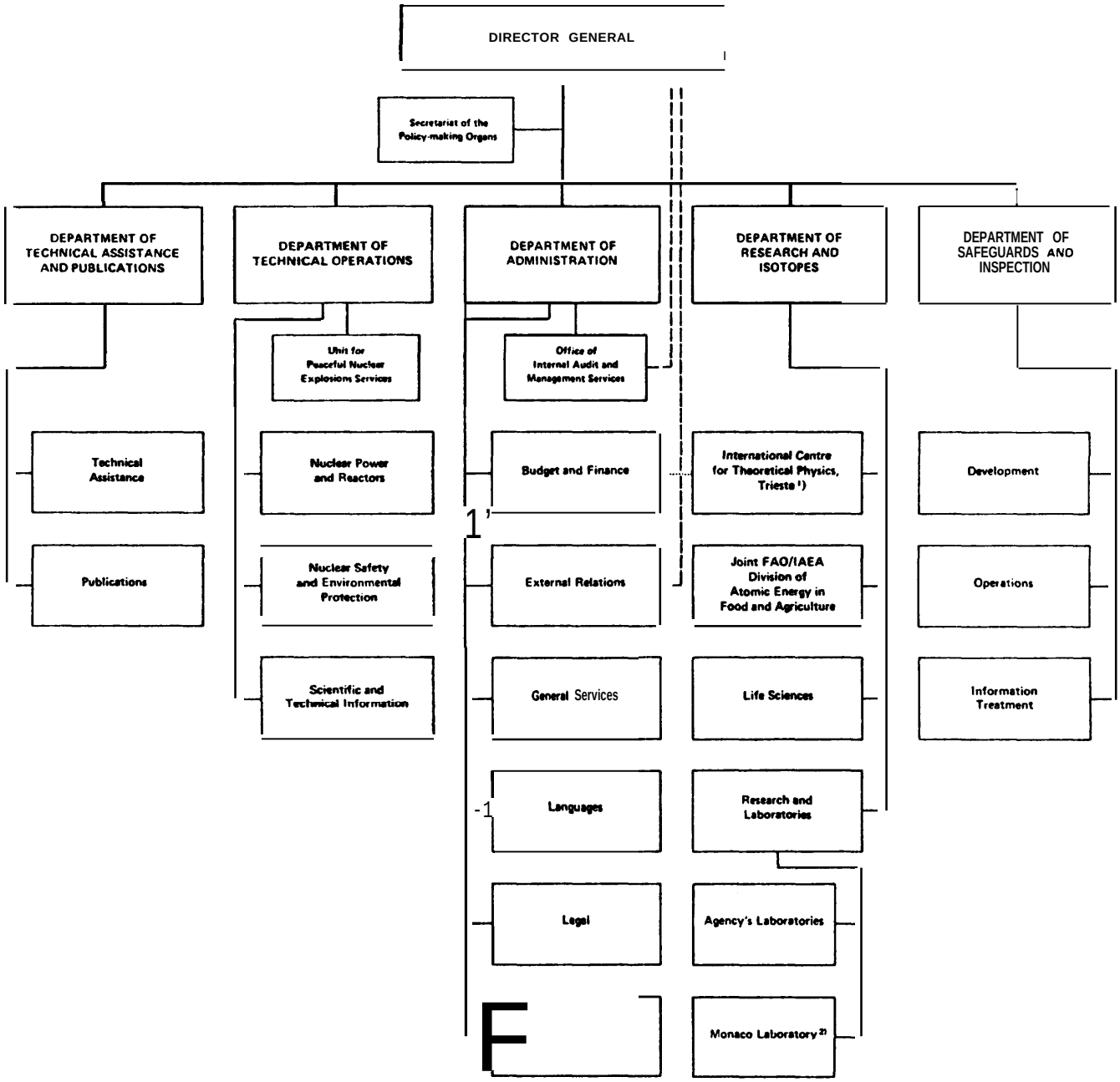

Figure 1.

Office of the Inspector General
R. Rometsch – Inspector General
(H. Seitl)
E. Burkert
E. Siedl
S. Hobden

Section for Standardization and Administrative Support
B. Sanders (Head)
R. Shroff
H. Seitl
E. Haegglund
V. Pettik
M. Hasan
V. Brown
J. Schuller

DIVISION OF DEVELOPMENT
A. von Baeckmann – Director
T. Ambrus

Section for System Studies
D. Tolchenkov (Head)
J. Lovett
M. Honami
Y. Panitkov
S. Wakamatsu 3/
K. Frauenberger
A. Schiffmann

Section for Methods and Techniques
A. Waligura (Head)
B. Clark
N. Beyer
M. de Carolis
E. Dermendjiev
A. Keddar
Ye Konnov
s. Sanatani
G. Boese
Me Siwy
1. Umar

Section for Field Operations
G. Hough (Head)
T. Beetle
E. Szabo
V. Sukhoruchkin
D. Terrey
H. Garbsch
C. Hagerty

Section for Account and Reports
C. Buechler (Head)
I. Hutchinson
O. Lendvai
W. Scherzer
M. Jesenko
R. Mahrenberger
C. Broskovic

Regional Section I South and South East
J. Beranek (Head)
R. Diaz-Duque
I. Hiramatsu
D. Petrunin
G. Rabot
R. Schaer
R. Ekarv
K. Sanders
S* Turel
CO Delegard
CO Kummer
G. Reset schnig

Regional Section II Americas
W. Frenzel (Head)
A. Massera
G. Rubinstein 2/
I. Todorescu
H. Gonzalez-M.
J. Kaniewski
B. Lee
G. Martinez-Garcia
V. Narang
W. Theis
O, Zoch
A. Moncada
Jo Clarke
1. Eberhart
B. Lefebvre

DIVISION OF OPERATIONS
S. Nakićenović – Director
J. de Groot

Regional Section II Central and Northern Europe
V. Fortakov (Head)
M. Ferraris
A. Janikowski
H. Kawamoto
V. Poroykov
J. Hornsby
A. Lumetti
L. Oudejans
V. Slizov
E. Woelfl
R. Stanzel
J. Henderson

Regional Section IV Far East
L. Thorne (Acting Head)
E, Kerr
D. Ahimsa
C. Lin
P. Noir
W. Payne
A. Ramalho
T. Rosescu
W. Alston
u. Barda
H. Frittum
N. Harms
E. Yellin
I, Stoiber
A. Katter
R. Henke

INFORMATION TREATMENT
V. Shmelev – Head
S. Booty
G. Farris
W. Gmelin
A. Roumiantsev
M. Miah
G. Russinov
J. Nardi 1/
S. Onnen 1/
J. Wooten 1/
M. Uhlir
B. Futschek
E. Bayona
H. Karpiuk
M. Asunta-J.
C. Arachchi
M. Bakardjiev
D. Schweiger
M. Tarko

Regional Section V Euratom
S. Thorstensen (Acting Head)
J. Wilson
B. Agu
H. Rose
H. Werner
I. Mishev
D. Perricos
M. Yousif
S. Curzon-Howe

1/ Cost free expert
2/ Temporarily assigned to SSAS
3/ Cost free trainee

Figure 2.

re-organization of DSI which will result in four divisions: Development, two Operational Divisions, and a Division of Information. Pending approval of this re-organization by the Board of Governors a new EURATOM section which will form the nucleus of the second operational division was established on the 15th of October 1976.

A more detailed presentation of the organization of the Department of Safeguards and Inspections is shown in Figure 2. In the Manning Tables of the 1977 Agency Budget, DSI has a total of 138 authorized positions for the year 1976 of which 102 are professional and 36 are GS Ratings or subprofessional. The number of established posts for 1977 show a total of 161 positions of which 111 are professional and 50 are GS. The preliminary estimate for 1978 is a total staff of 179 with 122 professionals and 57 GS positions. These changes in staffing reflect the anticipated increase in inspection activity resulting from the implementation under NPT of the IAEA-EURATOM and Japanese Safeguards Agreement as well as the United States and United Kingdom safeguards offer.

A recent internal analysis of the distribution of nationalities in DSI as of 1 March 1976 shows that of a total of 43 inspectors, in the Division of Operations, only 3 were U.S. nationals, whereas in the Division of Development 6 of the 20 professionals were U. S. citizens. In general, the IAEA personnel policy attempts to balance the available positions within the Agency among the different nationalities of the States of which it is composed. Information on the name, nationality and grade of each professional and support staff by department and division is published annually in the Agency publication INFCIRC/22. (16) An analysis of the information included in INFCIRC/22/REV.15 published in June of 1975 shows that approximately 18% or 68 of the total professional staff of 378 were U. S. nationals. It can be seen from this that the ratio of U. S. nationals in DSI is reasonably close to the overall ratio for the Agency, although for the Operations Division

it is approximately 6%; a figure considerably below the norm. The relatively low number of U. S. nationals in the Operations Division is a source of concern because, in general, U. S. nationals have performed very well and the Division needs staff with high technical competence, strong motivation and a commitment to painstaking and difficult work. An additional source of concern is the refusal of many countries to accept as inspectors nationals from other countries because of language or political consideration. The Director General specifically addressed this issue in his speech to the General Conference in September of this year when he said:

> "I wish to make an appeal to the States which have accepted our Safeguards System: Please accept also our inspectors irrespective of their nationality. We are now sometimes facing a situation where Country 'A' may accept an inspector from Country 'B' but 'B' not from 'A'."

The effective use of Agency inspectors is materially influenced by this type of action on the part of the member States. A remedy could be rapidly effected if it was the desire of the member States to do so. The problem can be more fully appreciated if one refers to the list of inspectors, the countries to which they are accredited, and the inspectors designated as Country Officers which is regularly published by the Department of Safeguards and Inspections.

In the evaluation of the effectiveness of international safeguards those issues which involve the inspectors are often overlooked in favor of legal, technical, or financial matters. In practice, the inspector will probably determine the success or failure of the safeguards effort. For example, special policies might be established for the hiring and retention of the inspection staff. After a fixed probationary period the Department should have the option to encourage a career decision in the field of safeguards inspection

by offering a long-term contract. The Department should also be free to terminate an inspector at the conclusion of the probationary period should his performance not meet Department standards without the political pressure which is often brought to bear in these matters when an international organization is involved. As part of the career development of the inspector, it is essential not only to maintain but to improve his proficiency by attendance at both established and special training programs. The Department is also faced with special problems of promotion and salary scales when compared with the professional requirements and duties of the staff members of other departments of the Agency.

Finally, and perhaps the most intangible, is the question of maintaining inspector morale when faced with difficult and sometimes dangerous working conditions, long and arduous periods of travel away from the Headquarters and his family, and the uncertainty that the work to be done is, as he has been told, really a matter of vital importance to the peace and security of the world. The responsibility for sustaining the inspector's morale does not stop at the desk of the Inspector General, but involves political and personal relationships at many levels within the Agency. The Agency' morale can in fact be profoundly affected by events which occur in other parts of the world. For example, the failure of the United States and the Soviet Union to take strong and unequivocal positions following the test of the Indian nuclear device in May of 1974 deeply affected the staff and the silence which followed that explosion still haunts the halls and offices of the IAEA.

Finances. Of the adjusted budget for 1976 of $37,002,000 the Department of Safeguards and Inspections required $6,443,000. Of this amount, $3,180,000 was obligated to salaries and wages; of the remaining $3,263,000 common staff costs accounted for $917,000; travel $410,700; scientific and technical contracts $490,000; scientific supplies and equipment $510,000; laboratory services $496,000 and supporting 'services,

meetings and miscellaneous $440,000. The detailed costs of the safeguards program is given in Annex C. Table I shows the safeguards cost in relation to total Agency expenditures under the Agency's budget 1971 through 1976. The estimated budget for DSI in 1977 is $7,951,000. The preliminary estimate for 1978 is $9,111,000. (15)

TABLE I

SAFEGUARDS COSTS
IN RELATION TO TOTAL AGENCY EXPENDITURE
UNDER THE AGENCY'S BUDGET 1971-76

Year	Safeguards costs (us $ 000)	Total Budget (us $ 000)	Safeguards Costs in percent of Regular Budget
1971	1 636	14 010	11.7%
1972	2 035	16 532	12.3%
1973	2 564	19 881	12.9%
1974	3 441	25 064	13.7%
1975	04 802	29 675	16.2%
1976	6 443	34 702	18.6%

IAEA and International Safeguards-B.

In 1971 it was decided that the safeguards costs should be adjusted in order to take account of the position of the countries with lower per capita incomes. Developing Member States whose base rate of assessment for 1971 was 0.04% of the Agency's budget pay an annual share of safeguards expenses of about $750.00. The 34 industrialized Member States bear 95% of the safeguards cost, while the remaining 72 members contribute 5%. The Board of Governors has recommended and the General Conference has adopted this year a resolution that will freeze at their present levels the contributions of the developing countries to the safeguards budget. The freeze will last from 1977 to 1980. The Director General in his speech before the General Conference suggested that:

> "this period should be used to re-examine the basic principals for financing the costs of safeguards and to establish a sound system that takes into account both the principals that every member state should contribute towards safeguards expenses and the recommendations of the NPT Review Conference to lighten the burden on the developing member states."

In response to the growth of nuclear power throughout the world and the greatly increased safeguards responsibilities of the Agency, the Department of Safeguards and Inspection has in the last ten years grown faster than any other department. With the implementation of the IAEA-EURATOM and Japanese Safeguards Agreement and the implementation of the United States and the United Kingdom offers to place their nuclear facilities not related to military uses under IAEA Safeguards, this trend can be expected to continue. In the opinion of some officials the limitations on the Agency's ability to implement its safeguards responsibilities will not be due to financial constraints but, rather, the limitations will be of a political nature and will reflect the attitudes and the determination of the member states, both nuclear and non-nuclear, to support credible effective safeguards.

IAEA and International Safeguards-B.

In addition to the assessed contributions to the Agency budget the United States has, beginning in 1974, undertaken a program to strengthen Agency safeguards by the provision of gifts-in-kind. In the Foreign Assistance Act of 1975 approximately $200,000 was identified for support of Agency safeguards. Initially, in FY 1976 an additional $300,000 was made available through the gifts-in-kind and that amount was subsequently increased by $1,000,000 (the Glenn Amendment) as Congressional concern for the effectiveness of Agency safeguards has grown. In FY 1977, $1,600,000 has been authorized including the first increment in a $5,000,000-five-year-program has also been authorized. Officials of the United States Government and the IAEA met during the first two weeks of November to coordinate a long-term program to strengthen the Agency's program including; major improvements in the Agency's safeguards data management and data analysis programs, substantial increases in the in-training programs for Agency inspectors, the provision of technical experts in many areas, the development of improved instrumentation for the non-destructive nuclear measurements, and the development of improved surveillance and containment devices.

It is reported that the Federal Republic of Germany has also made an offer of gifts-in-kind to the Agency of approximately $300,000 for the coming year. It is important that the other nuclear suppliers and the Soviet Union also join in this effort to meet the technical and financial needs of the Agency's safeguards program in the critical period ahead. If the principle of international inspection is to be widely accepted, the Agency's Safeguards System must not be a creature of United States Policy nor should it even appear to be so.

IAEA and International Safeguards-C.

C. **NON-NPT OR FACILITY SAFEGUARDS.**

Information Circular/26. The safeguards described in Article XII of the Agency's Statute were intended by the drafters to be only a framework for the actual IAEA's Safeguards System. (17) The fleshing out of that framework and the detailed elaboration of safeguards procedures and techniques that have been developed over the past twenty years has been accomplished by the joint efforts of the Division of Safeguards and Inspections and a large number of experts from the Member States who have participated in both formal and informal technical meetings held at the Agency and elsewhere. In the early stages of the evolution of the IAEA Safeguard System the Agency was concerned only with the safeguarding of research, tests and power reactors with less than 100 (MWT) megawatts thermal output, the source and special fissionable materials used and produced in these reactors, and the small research and development facilities.

The first document outlining the Agency's Safeguards System for use with research reactors was approved on the 31st of January 1961 by the Board of Governors and has been published by the Agency as Information Circular/26 (18). This document is reproduced in Annex D. INFCIRC/26 is of interest historically because it established a pattern for the organization and content of subsequent Agency safeguard documents. The Introduction, Paragraph 3 specified:

> "Agency Safeguards will be applied to materials and facilities voluntarily placed under Agency safeguards by a State or States. Where two or more States request the Agency to administer the safeguards provisions of an agreement between those States, the Agency will apply those provisions provided that they are consistent with the procedures laid down in this document. The administration of safeguards

> by the Agency under this Paragraph shall be governed by an agreement pursuant to the Statute between the Agency and the State or States concerned which shall be made for a specific period."

In Paragraph 4 of the Introduction it is stated that:

> "procedures covering other types of nuclear facilities will be developed as the probable need for them becomes evident. In regard to produced material the safeguards provided for this document relate only to the first generation of produced material."

From the Statute as well as the Introduction of INFCIRC/26 it is clear that the Agency's intent was to develop a facility specific safeguard system, that safeguards were to be applied to both materials and facilities voluntarily placed under the Agency's System, that the Agency's facility safeguard would evolve as the need developed, that the agreements would be made for a specific period, that an agreement between the State and the Agency would govern the safeguards applied by the Agency and, finally, the Agency's Safeguards System was to be reviewed after a period of two years in order to evaluate the experience gained by the Agency as well as the technological developments which had taken place during the interval.

Two of the items in this list, in particular, those relating to pursuit of produced fissionable material past the first generation and a specific date for the termination of a safeguards agreement have become sources of difficulty in the last few years. As understanding of the problems involved in safeguarding a fully developed nuclear fuel cycle have increased, it has become clear that both of these weaknesses offered a legal route for the acquisition of unsafeguarded fissionable material. The final

item is also significant because it reflected an awareness on the part of the Agency even then that their safeguards procedure would continue to evolve in the response to technological change and that they should be continuously reviewed in the light of actual experience. Some of the criticism of the Agency's safeguards procedures, while well founded, does not take into consideration this evolutionary aspect. Because, practice may fall far short of expectations in the early stages, disillusionment sets in and leads to the conclusion that because safeguards at some point are inadequate they cannot be made to succeed either in theory or in practice.

Information Circular/66/Rev.2.

The first major change in facility specific safeguards occurred in 1964 when the Agency Safeguards System was extended to include large power reactors. INFCIRC/26 and Add. 1. (19) Subsequently, following a review of the Agency's System, a revised document, THE AGENCY'S SAFEGUARDS SYSTEM, INFCIRC/66, which describes the IAEA Safeguards System now in use for those States which have not ratified the NPT, was approved by the Board of Governors. This document was provisionally extended in 1966 to include Annex I, "Provisions for Reprocessing Plants", (21) The final extension occurred in 1968 with the addition of Annex 11, "Provisions for Safeguarding Nuclear Material in Conversion Plants and Fabrication Plants". (22) This document has been reprinted in full as Annex II in the Government Publication (1; op.cit.) "NUCLEAR WEAPONS PROLIFERATION AND THE INTERNATIONAL ATOMIC ENERGY AGENCY". Some of the more important provisions are reproduced in Annex E.

In the Introduction to INFCIRC 66/Rev. 2 can be seen a continuation of those trends which first appeared in INFCIRC/26. Concern for the impact of safeguards on the States' nuclear industry becomes even more explicit. For example, under B. General Principles of the Agency's Safeguards, The Agency's Obligations include the following:

IAEA and International Safeguards-C. ’

9. Safeguards shall avoid hampering a State’s economic or technological development.

10. Safeguards must be consistent with prudent management practices required for the economic and safe conduct of nuclear activities.

11. The Agency may not request a State to stop the construction or operation of any principal nuclear facility except by explicit decision of the Board.

13. The Agency shall take every precaution to protect commercial and industrial secrets and 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.

“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.”

Part III. Safeguards Procedures, still provides in Paragraph 29 for safeguards procedures which are to be applied to nuclear materials as well as the facilities containing or to contain such materials.”

The States’ concerns that information provided in the design review might compromise their industrial secrets or unnecessarily infringe on their sovereignty is reflected in the revisions which appear in Paragraph 30 and 32 where the sole purpose of such a review is the effective application of safeguards.

The Agency is enjoined not to publish or communicate to any State, organization or person information obtained in connection with the implementation of safeguards. Specific information, however, may be given to the Board or to such Agency staff members as required by reason of their official duties. In addition, upon decision of the Board, summarized lists of items being safeguarded by the Agency may be published and if all States directly concerned agree, additional information may be published.

Under Part B. Principles of Implementation there appear two qualifications, one related to the pursuit of produced fissionable material and the other related to factors to be considered by the Board when considering the content of Agency safeguards agreements 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."**

And where the Agency shall require only the minimum amount of information and data consistent with carrying out its responsibility under this section.

In general, these revisions address the preoccupation of some of the States whose nuclear industries were experiencing rapid growth that international safeguards would prove to be a serious economic burden and could possibly seriously jeopardize the competitive position of their industries, as they began to compete for international markets with the United States. As can be seen from the paragraphs which have been

reproduced in Annex E when compared with Information Circular/26 there now appear specific Agency obligations to minimize the impact of safeguards on a State's economic or technological development, the implementation of safeguards should be consistent with prudent management practices, the Agency may not oppose or delay construction of principal nuclear facilities, and the matter of protection of commercial and industrial secrets as well as the protection of any data obtained in the course of the implementation of Agency safeguards have become formalized. The latter point has been noted by many of the Agency's critics as a principal source of the inability of any outside group or State to properly evaluate the effectiveness of Agency safeguards. It is interesting to note, however, that at least in Paragraph 14A a provision is included for making available specific information relating to such implementation in a State to the Board of Governors; and a provision which does not appear in Paragraph 41 of Information Circular/26.

Paragraph 16 of INFCIRC/66 does acknowledge the desirability of providing for the continuation of safeguards on special fissionable materials produced in a facility to which Agency safeguards have been applied or to any material substituted therefore. It can only be observed that the provisions of Paragraph 17 of the Revised Agency Safeguard System represents a considerable departure from the ".. .access at all times to all places and data.. ." of Article XII, A-6 of the Statute.

A comparison of the sections on Design Review in INFCIRC/22 and INFCIRC/66/Rev. 2 reflects, as has been noted, the concern of the States about the possible disclosure of industrial secrets and the need to minimize the impact of the Agency's activities in the exercise of this function. It is important, when considering the effectiveness of Agency safeguards, to keep in mind that no nuclear facility presently under international safeguards inspectio$_n$ included as one of the initial

design requirements of the facility the necessity to optimize safeguards inspection activities. In fact, the safeguards procedures which have been developed have suffered from the fact that even simple provisions which could have been incorporated during the construction of the facility at a relatively modest additional cost were not included. As a result, desirable and sometimes essential modifications could not be made for structural reasons or because the costs would be prohibitively expensive. In this section there is no suggestion that the Agency and the State might at the earliest stages in the design of a nuclear facility review the safeguards requirements in order to ensure that cost effective safeguards might be applied.

One of the earliest applications of Agency safeguards under INFCIRC/26-66 began in 1962 following the completion of negotiations between the IAEA and the AEC for the implementation of safeguards to four U. S. reactors. This was followed by the entry into force on November 1, 1963 of the first Agency trilateral safeguards agreement, an agreement between the United States, Japan and the International Atomic Energy Agency. This Agreement covered any nuclear material, equipment and/or facilities supplied to Japan by the United States. In addition, the Agreement also included the important provision that Agency safeguards would apply to any fissionable material produced in the Japanese facilities even if this material should be returned to the United States for processing unless the United States substituted an equivalent quantity of like material in Japan. This latter feature permitted a supplier country such as the United States, the United Kingdom or the Soviet Union to avoid IAEA inspection of third party fissionable material if the principal of substitution was employed. By the end of 1965 three additional trilateral agreements were in effect, two between the IAEA, Japan, and Canada and the United Kingdom respectively and the remaining between the IAEA, Denmark and the United Kingdom. In the ten succeeding years agreements have been completed

which permit safeguards to be applied in twenty States, under eleven project agreements, twenty-one safeguards transfer agreements, and eight unilateral submission agreements. During 1975 the Agency carried out 299 inspections under these agreements. A list of the agreements providing for safeguards other than those in connection with NPT approved by the Board of Governors as of 31 December 1975 is shown in Annex F.

In 1975 the United States had 30 Agreements for Cooperation in the Civil Uses of Atomic Energy. Of these, 20 were for cooperation in nuclear research and power, 2 involved only nuclear power stations and 8 agreements were for research only. In addition, the United States had bilateral agreements for cooperation with EURATOM and with the IAEA. A list of our Bilateral agreements for cooperation is given in Annex G.

The safeguards provisions of many of these agreements have been suspended and in favor of United States-IAEA Trilateral Safeguards Agreements for the application of safeguards to U. S. supplied material. Annex H contains a list of these U. S.-IAEA Trilateral Safeguards Agreements. A number of these Agreements have been suspended in turn, as a result of negotiations between these countries and the IAEA in fulfillment of the safeguards obligations undertaken in the Non-Proliferation Treaty.

D. NPT OR FULL FUEL CYCLE SAFEGUARDS.

The Treaty on the Non-Proliferation of Nuclear Weapons. On July 1, 1968 the Treaty on the Non-Proliferation of Nuclear Weapons (7, 12, op.cit.) was opened for signature and the Treaty entered into force on March 5, 1970. These events represented the culmination of a major initiative on the part of the United States, the United Kingdom, and the Soviet Union supported by a number of the major non-nuclear industrialized States to limit the further spread of nuclear weapons. In the negotiations on the draft of the NPT, the possibility of including a safeguards article was a subject of extended discussion. With the resolution of the issue in favor of incorporating such an article, the debate turned to the means and methods to be used. The Federal Republic of Germany, in particular, took the position that the formulation of the safeguards principles as expressed in INFCIRC/66 would have to be replaced by a less intrusive and intensive safeguards system which would be applied to all fissionable material in the State, i.e., full fuel cycle safeguard. This new safeguards concept which was included in the preambulatory paragraph to the NPT stated that :

> "Expressing their support for research, development and other efforts to further the application, within the framework of the International Atomic Energy Agency Safeguards System, of the principle of safeguarding effectively the flow of source and special fissionable materials by use of instruments and other techniques at certain strategic points."

The emphasis was on the flow of material at certain strategic points. The safeguarding of facilities had disappeared. The political undertakings designed to halt the spread of nuclear weapons were embodied in Articles I and 11 of the Treaty which provided that both the nuclear weapon States and the non-nuclear weapon States would not transfer or receive whatsoever nuclear weapons or any other nuclear explosive devices. The verification provisions of these

obligations were enumerated in Article III, the Safeguards Article. Article 111 provides that:

> "1. Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfillment of its obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices. Procedures for the safeguards required by this article shall be followed with respect to source or special fissionable material whether it is being produced, processed or used in any principal nuclear facility or is outside any such facility. The safeguards required by this article shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere.
>
> "2. Each State Party to the Treaty undertakes not to provide: (a) source or special fissionable material, or (b) equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this article.

"3. The safeguards required by this article shall be implemented in a manner designed to comply with article IV of this Treaty, and to avoid hampering the economic or technological development of the Parties or international cooperation in the field of peaceful nuclear activities, including the international exchange of nuclear material and equipment for the processing, use or production of nuclear material for peaceful purposes in accordance with the provisions of this article and the principle of safeguarding set forth in the Preamble of the Treaty.

"4. Non-nuclear-weapon States Party to the Treaty shall conclude agreements with the International Atomic Energy Agency to meet the requirements of this article either individually or together with other States in accordance with the Statute of the International Atomic Energy Agency. Negotiation of such agreements shall commence within 180 days from the original entry into force of the Treaty. For States depositing their instruments of ratification or accession after the 180 day period, negotiation of such agreements shall commence not later than the date of such deposit. Such agreements shall enter into force not later than eighteen months after the date of initiation of negotiations."

The significant features of Article III-2 are that (1) the IAEA is assigned the responsibility for implementing NPT safeguards as set forth in agreements to be negotiated between the States and the International Atomic Energy in accordance with the Statute of the Agency and the Agency's Safeguards System, (2) the exclusive purpose of the verification is the fulfillment of the States Treaty obligations with a view to preventing the diversion of "nuclear energy from peaceful uses to nuclear

weapon or other nuclear explosive devices" - a significant departure from the initial objective in the IAEA Statute to ensure that atomic energy "is not used in such a way as to further any military purpose," and, (3) of great importance, the provision that safeguards would be required on all source or special fissionable material in all peaceful nuclear activities within the territory of the State, i.e., full fuel cycle safeguards, under its jurisdiction or under its control anywhere. This last provision marks a major advance over the facility specific safeguards system which the Agency had developed under INFCIR 66/Rev. 2.

Information Circular/153. In order to adapt the IAEA's Facility Safeguards System to the new requirements for NPT safeguard on all the fissionable material within a State, the Board of Governors of the IAEA established a committee shortly after the NPT came into force to advise it on the agreements which would be required between the Agency and the NPT Nations. This Safeguards Committee began negotiations in June of 1970. Delegates from 48 Member States of the IAEA participated under the chairmanship of the present Secretary General of the United Nations, Dr. Kurt Waldhein and Prof. Bruno Straub from Hungary. By March of 1971 the negotiations had been completed and in May of 1971 the Agency issued Information Circular/153 (10, op.cit.) entitled "THE STRUCTURE AND CONTENT OF AGREEMENTS BETWEEN THE AGENCY AND STATES REQUIRED IN CONNECTION WITH THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS". The full text of INFCIRC/153 also has been reprinted as Appendix 4 in 'NUCLEAR WEAPONS PROLIFERATION AND THE INTERNATIONAL ATOMIC ENERGY AGENCY", (1., Op.cite)

Nine months after INFCIRC/153 was issued, a "model agreement had been drafted which embodied the principles and safeguards procedures detailed in this Circular especially designed for safeguarding the full nuclear fuel cycle. It is interesting to note, however, that in 1968 the first country to take the step of unilaterally submitting

all of its nuclear activity to the IAEA was Mexico. This action was undertaken in fulfillment of its obligation under Article XIII of the "Treaty for the Prohibition of Nuclear Weapons in Latin America" (THE TLATELOLCO Treaty), (23) which entered into force April 22, 1968. At the end of 1975 the Agency had safeguards agreements in force with 64 states of which 44 were with states party to the NPT (24).

Some of the important provisions of INFCIRC/153 are summarized below and reproduced in Annex 1. As required by the NPT the basic undertaking of INFCIRC/153 (Paragraph 1) requires states party to the Treaty to accept safeguards on all source or special fissionable material in all peaceful nuclear activities within its territory for the exclusive purpose of verifying that this material has not been diverted to nuclear weapons or other nuclear explosive devices. Thus the State is obligated to accept full fuel cycle safeguards, the emphasis is on the diversion of material and the concern is with the use of such material for any nuclear explosive device even if its stated application is for peaceful uses only, i.e., Peaceful Nuclear Explosive (PNE).

Under the Section on Implementation of Safeguards, Paragraphs 4, 5 and 6, the document repeats the provision included in INFCIRC/66 Rev. 2 concerning the protection of commercial interests and industrial secrets and in Paragraph 5 repeats the prohibition that 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.

Paragraph 6 was drafted in response to the preambulatory paragraph to the NPT which, as has been noted above, introduced the concepts of safeguarding the flow of materials at certain strategic points. The need for cost effective safeguards is stressed and the Agency is enjoined to take full advantage of all technological developments in the field of safeguards. Finally, this paragraph directs that the Agency's safeguards procedures should be concentrated on those stages in the fuel cycle where

nuclear material suitable for weapons purposes is available.

Paragraph 7 is of particular significance and described the establishment of a national system of accounting for the control of nuclear materials. It is this national system that provides the nuclear material accountancy' data and the many reports on which the INFCIRC/153 safeguards system depends. This paragraph also contains the crucial right of Agency inspectors to make independent measurements and observations in the course of verifying that there has been no diversion of nuclear materials from peaceful uses to nuclear weapons or other nuclear explosive devices.

Paragraph 8 is concerned with the provision of design information to the Agency. In order to further protect the proprietary rights of the nuclear facilities the Agency is directed, at the request of the State to examine the design information on the premises of the State and such information need not be physically transmitted to the Agency as long as it is available for examination on the premises of the State.

In Part 2 of INFCIRC/153 the objectives of safeguards are defined in paragraphs 28, 29 and 30. These important paragraphs state that: (1) the objective is the timely detection of significant quantities of nuclear material to the manufacture of nuclear weapons or for purposes unknown and the deterrence of such diversion by the risk of early detection, (2) material accountancy is the safeguards measure of fundamental importance with containment and surveillance as important complementary measures and, (3) 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 un-accounted for over a specific period, giving the limits of accuracy of the amounts stated.

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Compared with INFCIRC/66/Rev.2 the Section on Design Information in INFCIRC/153, Paragraphs 42 through 46, represents a considerable elaboration.

Paragraph 43 specifies that Design Information should be made available to the Agency primarily to assist the Agency to monitor the flow of nuclear material, those features relating to material accountancy, containment and surveillance, and those features which will assist in establishing material balance areas, the measurement of flow, and the procedures for physical inventory taking.

For the first time in Paragraph 46 the purpose of examination of Design Information is specified in great detail . For example: to determine material balance areas (MBAs), to establishing timing and procedures for taking physical inventories, to establish research and reports requirements. Of particular interest is the provision that special material balance areas may be established around a process step involving commercially sensitive information, such as the centrifuge cascade of an uranium isotope separation plant. In such an arrangement Agency inspectors would not have access to the cascade area.

The responsibilities of the national systems of accounting and control of nuclear material with respect to the maintenance of records and the submission of reports are elaborated in the sections on Record Systems, Paragraphs 51-58, and the Reports Systems, Paragraphs 59-69. It is clear that NPT or full fuel cycle safeguards is critically dependent on the effective operation of national systems of the States.

The purposes of the three different types of safeguards inspections, ad hoc, routine, and special, are detailed in Paragraphs 71, 72 and 73. Routine inspections are, of course, the most common and Paragraph 72 provides that these inspections are to be made in order to (1) verify the consistency between records and reports, (2) verify the

location, identity, quantity and composition of all nuclear material subject to safeguards, and (3) verify the possible causes of material unaccounted for, etc.

In a significant change related to access for inspections, Paragraph 76 C and D provide for inspectors to have access only to the strategic points specified in the subsidiary arrangements and the State may conclude that unusual circumstances require extended limitation on access by the Agency. In this latter event the State and Agency shall make arrangements which will enable the Agency to fully discharge its safeguards responsibilities.

Finally, and of major importance are the Paragraphs 78 through 81, which are concerned with the frequency and intensity of routine inspections. The emphasis in these paragraphs is on reducing to a minimum the number, intensity, duration and timing of routine inspections consistent with effective implementation of safeguards, cost effectiveness, and optimum use of inspection resources. Formulae are developed for the maximum routine inspection effect (MRIE). For example, the inspection effort for reactors is limited to one sixth of a man-year for each such facility in the State. Facilities handling plutonium or uranium enriched to more than 5% shall be allowed 30 /E man-days where, E is the inventory or throughput, whichever is greater, expressed in effective kilograms. All other facilities are allowed a maximum of 1/3 + 0.4E man-days where E is again the inventory or throughput in effective kilograms.

The Agency is required to duly consider in its safeguards the farm of the material, the effectiveness of the State's accounting and control system and the characteristics of the State’s nuclear fuel cycle.

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It was the intent of the Delegations of the Member States that engaged in the negotiations which preceded the drafting of INFCIRC/153 that NPT safeguards would reflect the concepts of safeguarding the flow of nuclear materials at certain strategic points that appeared in the preamble to the NPT. Facilities themselves were no longer subject to safeguards as they had been under INFCIRC/66/Rev.2. The emphasis now was on limited access only to strategic points, the definition of material balance areas, material accountancy and specific formulas for determining the maximum routine inspection effort for any facility as a function of the annual throughput of nuclear material. These departures from the original provisions in the Statute of "access at all times to all places" have been compensated, at least in part by the new requirements for national systems of accounting and control of nuclear material and the redundancy that is inherent in the safeguarding of a State's full nuclear fuel cycle. These new functions are of immense value. One cannot help but recall, however, the fact that the United States and the Canadian Delegation supported by the Soviet Union, fought a loosing rear-guard action during the negotiations in the Safeguards Committee against those delegations which were determined that NPT Safeguards would be held to a minimum, would be as nonintrusive as possible, and could not possibly provide a competitive advantage to those which might not be subject to safeguards because they were either not parties to the NPT or were nuclear weapon States. There seems little question that in the minds of some of the delegations the principal deterrent in the Non-Proliferation Treaty was political in nature and the safeguards provision was secondary.

The critics of safeguards maintain that, in principle, no safeguards system can be perfect yet perfection is what must be assured. Many difficult problems are cited. Among them is the fact that in practice, the cumulative analytical errors in the measurements of the flow of nuclear material in a State's fuel cycle or even in a

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large nuclear plant may be many times the amount of fissionable material required to make an explosive device. Significant quantities are defined in terms of these amounts. Recently, the problem of ''critical time" has received close attention (27). It is argued that now the time required to make an explosive device is so short that safeguards are irrelevant. There is insufficient time to react or respond to a detected diversion. However, in spite of the many limitations which have been so carefully built into INFCIRC/153, it is the opinion of knowledgeable observers that a technically sound and effective Safeguards System can be designed which will meet the NPT objective of "timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities."

Given **the constraints, the development of an effective safeguards system becomes primarily a problem of manpower, money, and technological improvements. Some of** the **results of the present technical analysis of this problem and the proposed technical solutions are presented in the following section,** IAEA Safeguards Technical Manual and Safeguards Implementation Procedures.

E. IAEA SAFEGUARDS TECHNICAL MANUAL AND SAFEGUARDS IMPLEMENTATION PROCEDURES

The Safeguards Technical Manual (STM). With the request of the Board of Governors that the Director General use INFCIRC/153 as the basis of negotiating NPT safeguards agreements between the Agency and the non-nuclear weapon States party to Treaty on the Non-Proliferation of Nuclear Weapons, the Staff of the Department of Safeguards and Inspections assisted by experts from the Member States began preparation of a Safeguards Technical Manual which would form the basis of the procedures and techniques used in the Agency's Safeguards System. Two sections of the STM have been completed and issued as technical documents by the International Atomic Energy Agency, INTRODUCTION, PART A-SAFEGUARDS OBJECTIVES, CRITERIA, AND REQUIREMENTS, (4.op.cit.) and, PART E-METHODS AND TECHNIQUES, (28). An outline of the Safeguards Technical Manual is included as Annex 1. The remaining sections, PART B, NUCLEAR ACTIVITY AND FACILITY, PART C, INSPECTIONS, PART D, EVALUATION OF THE INFORMATION, AND PART F, STATISTICAL CONCEPTS AND TECHNIQUES, should be available for distribution in early 1977.

The Introduction to Part A is a concise statement of the Agency's understanding of its responsibilities, the identity of the State as the potential diverter and the necessarily adversary nature of Agency safeguards. The first five paragraphs are reproduced below:

"INTRODUCTION

"Nuclear and non-nuclear material, services, facilities, equipment and information which are to be used for legally defined purposes may be deliberately diverted from these purposes. Potential diverters are facility operators, individuals or groups of individuals and States.

The actions aimed at the detection and deterrence of this diversion are known as safeguards. The IAEA is authorized by its Statute to accept the responsibility of establishing and administering safeguards subsequent to a 'safeguards agreement' with a State or States.

"All safeguards agreements are built on the basis of an undertaking by the State. Before the Treaty on the Non-Proliferation of Nuclear Weapons came into force this undertaking had always been that 'special fissionable and other materials, services, equipment, facilities and information' shall not be 'used in such a way as to further any military purpose'. States party to the Non-Proliferation Treaty (NPT) undertake not to divert 'nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices' . For the application of safeguards these States also have to conclude with the IAEA agreements where this undertaking is incorporated by reference.

"IAEA safeguards are aimed at the timely detection of diversion by States having undertaken to accept safeguards in accordance with an agreement between the IAEA and the State and at the deterrence of such diversion by the risk of early detection by the IAEA. NPT safeguards agreements specify the procedures to be applied for safeguarding nuclear material.

"The IAEA Safeguards Technical Manual describes principles, procedures and techniques for safeguarding nuclear material. Tile IAEA has to decide in each particular situation whether these principles, procedures and techniques enable it to fulfill the responsibility of safeguarding non-nuclear material, services, facilities, equipment and information.

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> "In the Manual, the principle has been adopted that, under any type of safeguards agreement, the objective of IAEA nuclear material safeguards is the timely detection of diversion of significant quantities of nuclear material. The principle has also been adopted that, unless the IAEA Governing Organs establish other guidelines in this respect, the IAEA assumes that the goal of its safeguards procedures is to detect, if it would be missing in a State in a period of one year, the quantity of nuclear material needed to manufacture a single nuclear explosive device."

To this statement should be added the following excerpt from the Introduction to Chapter 2, DIVERSION OF NUCLEAR MATERIAL:

> "In the context of IAEA safeguards, the State with its corresponding capabilities and resources is considered as the potential divertor and the probability of attempted diversion is considered small but finite. The purpose of diversion is assumed to be the acquisition of nuclear material for uses proscribed by the relevant safeguards agreement."

This Chapter includes a systematic analysis of the diversion strategies which could be used by a State in the acquisition of nuclear material. These diversion strategies could involve:

> "a single facility or a number of facilities cooperating in the diversion and its concealment. Diversion could involve material already in a form suitable for the intended use or in a form requiring further processing before such use. This further processing could be undertaken immediately or the diverted material could be stockpiled for processing and used at a later time. The diverter may attempt to use safeguarded facilities to

process material which has been diverted at another safeguarded facility, or material which either is at the starting point of safeguards or has already undergone some processing and which must be under safeguard but has not been declared by the State. Such an attempt would provide the IAEA with a chance to detect at a facility material which had not previously been in a safeguarded facility or material which had been previously diverted.

"The material might be diverted in either a single removal or repeated removals. Immediate detection by the IAEA can only be possible if it applies strict containment and surveillance measures. Verification of the physical inventory and of the material balance provides for a delayed opportunity for detection of diversion."

The Chapter concludes with a section on the importance of diversion. The observation is made that:

"The importance of the diversion depends on the type and amount of diverted material. Materials, e.g., plutonium and highly enriched uranium, which are of immediate use for nuclear explosive devices represents a greater hazard than does the material which requires a lengthy and complex process to be used for these devices."

Table 11 taken from this Chapter, provides rough estimates of the times required to convert different materials to materials suitable for nuclear explosive devices.

Table II

Importance of Diversion (a)

Required conversion of nuclear material to the form suitable for the manufacture of nuclear explosive devices	Material Form	Approximate range of times required to convert nuclear material to the form suitable for manufacture of nuclear explosive devices
Physical change: or chemical and physical change, but no	Plutonium and highly enriched uranium as metal, oxide or solution	Days to weeks
Chemical and physical change with purification	Irradiated fuel, radioactive solution, cold scrap	Weeks to months
Isotopic, chemical and physical change	Natural and low enriched uranium	Less than one year

a) Based on the approximate times required to convert the material to material suitable to manufacture

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The remaining three Chapters of Part A of the STM, the IAEA Safeguards System, the States System of Accounting for and Control of Nuclear Material, and Guidelines for Application of IAEA Safeguard represent the most concise and definitive statement for both critics and advocates alike of the limitations and capabilities of international safeguards. This document should be carefully read and understood. Chapter 111 concludes with the following statement:

> "The technical conclusion of the IAEA'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'. It is important as a measure of the degree of agreement between the measurements of the operator and those of the IAEA and as a measure of the extent and the accuracy of the IAEA's measurements that the technical conclusion of the IAEA's verification activities includes the operator's MUF (Materials Unaccounted For) adjusted for any differences between the IAEA's and the operator's measurements and an estimate of the combined measurement uncertainties as indicated in Section 5.3.4.
>
> "The IAEA shall inform the State of the results of inspection and 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."

Chapter IV discusses the INFCIRC/153 requirement that the State shall establish and maintain a "State's System of Accounting for and Control of Nuclear Material" (SSAC). The SSAC is essential for the effective implementation of NPT safeguards and provides the following objectives for such a State System:

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> "(a) to contribute to the detection and prevention of unauthorized uses of nuclear material, detect losses of nuclear material, and provide information that could lead to the recovery of missing material;
>
> "(b) to provide the necessary means for the State to fulfill its obligations in the field of accounting for and control of nuclear material under international, contractual or other agreements;
>
> "(c) to assist the management of nuclear facilities or custodians of nuclear material to achieve optimum discharge of the obligations imposed on them by the SSAC: and
>
> "(d) to encourage the efficient, safe and economical use of nuclear material by operators through the use of the control measures prescribed by the SSAC."

Chapter V outlines the "Guidelines for the Application of IAEA Safeguards. This Chapter concludes with a discussion of the problems of timely detection, significant quantities, and detection probability and confidence levels. Guidelines are also provided for the verification and the examination of design information, the verification of the information contained in records and reports, the evaluation of material unaccounted for, and guidelines for taking into account the SSAC's activity,

Because of their relevance to any evaluation of Agency Safeguards effectiveness, the Sections on Significant Quantities (5.1.2) and Detection Probability and Confidence Level (5.1.3) are reproduced in Annex J. Based on the amounts of uranium and plutonium required for fast critical masses and experiments with fast critical assemblies the significant quantities of nuclear material required to manufacture a single nuclear

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explosive device has been taken by the IAEA to be:

(1) 8 kilograms of plutonium for all types of plutonium for which the isotopic concentration of PU-238 does not exceed 80 percent.

(2) 8 kilograms of contained U-233 and U-235 when the combined weight of the U-233 and the U-235 isotopes equal or exceed 20 percent of the total weight and when the U-233 isotopic concentration is the larger of the two isotopes. .

(3) 25 kilograms of contained U-235 when the isotopic concentration of the U-235 is larger than the concentration of U-233.

This section ends with the observation that, given the relatively small amounts of nuclear material required to make an explosive device, the IAEA would be confronted, for those States having a sizable scale of nuclear activity, with the necessity of making a statement on the non-diversion of a very small fraction of the State's inventory of nuclear material. Table III is a summary of the accuracy of material balance and frequency of inventory taking expected by the IAEA.

In the absence of any specific mention in either INFCIRC/66/Rev.2 or INFCIRC/153 of the concepts of degree of certitude of detection (detection probability) or the concepts of degree of certitude of not concluding that a diversion has taken place when it has not (confidence level) the IAEA has concluded that these two concepts are implicit in these documents. On the recommendation of Experts from the Member States, the IAEA has cleared values of 95 percent for both the probability of detection and the confidence level of detection.

In evaluating the performance of the Agency's Safeguards System in the future, it is these objectives, criteria and requirements that should be considered.

Table III

ACCURACY OF MATERIAL BALANCE AND FREQUENCY OF INVENTORY TAKING EXPECTED BY THE IAEA

Type of facility	Operator's accuracy of material balance (% of throughput or inventory) [a]	Operator's frequency of physical inventory taking (number per year)
Uranium isotopic enrichment	± 0.2	4
Uranium fuel fabrication	± 0.3	1 - 4 [b]
Plutonium fuel fabrication	± 0.5	4
Power reactors (uranium	± 0.2	Upon refuelling
Power reactors (plutonium)	-	Upon refuelling
Irradiated fuel processing (uranium)	± 0.8	4
Irradiated fuel processing (plutonium)	± 1	4
Unirradiated scrap recovery	± 2	1 - 4 [b]
Storage	- [c]	1 - 4 [b]
Research and Development	- [c]	1 - 4 [b]

[a] These accuracies are expressed as one standard deviation and represent the total random and systematic error components of a material balance.

[b] Four for plutonium and high enriched uranium (20% or greater in U-235) and uranium-233; two for low enriched uranium (less than 20% U-235); and one for natural and depleted uranium and thorium.

[c] There are no values available.

Safeguards Implementation Practices (SIP's). In parallel with the preparation of the Safeguards Technical Manual by the Division of Development, the Division of Operations began the preparation of Safeguards Implementations Practices documents (SIP) for each safeguarded facility. In contrast to the publication of the STM, the SIP'S are classified as Safeguards Confidential by the Agency not only because these documents are facility specific and may contain proprietary information which either the facility operators or the State are unwilling to release but also because they contain an Agency analysis of the diversion possibilities and the means the Agency may use to detect such activities.

A model SIP outline has been reproduced as Appendix 8 in "Nuclear Weapons Proliferation and the International Atomic Energy Agency" (1, op.cit.).

The SIP's are divided into two parts, a general part containing aspects which are common to all facilities or groups of facilities in a State or States and a facility part which is specific for each facility containing aspects which are particular to the given facility, Material Balance Area (MBA) or group of MBA's. The facility part draws heavily on the information obtained from the design review of the facility and, of particular significance, contains a detailed discussion of the diversion possibilities, means of concealment and the safeguards approach which might be used to detect such diversion.

Perhaps one of the most important functions of the SIP's is that it formalizes the Agency's analysis of the limitations currently experienced in its safeguarding and verification activities and identifies the improvements that should be made. Section 10 summarizes this situation.

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"7.0. Limitations

"The purpose of this important section is to draw attention to those shortcomings in safeguards implementations at the facility which are apparent at the time of preparing the SIP. For some reasons there may be a lack of standardization, inadequate inspection, lack of facility information, etc. This section will indicate where work remains to be done. It will also inform the Inspector General and the Director of the Division of Operations that the work is carried out with these shortcomings by the Regional Section.

"The list of limitations can also be used as a check list and will remind the persons concerned to work toward improved conditions. When the situation changes, a revised SIP will have to be issued."

Both the Safeguard Technical Manual and the Safeguards Implementation Procedures reveal an understanding of the necessarily adversary nature of international safeguards inspection and the resources that might be available to the potential diverter, the State. These documents also reflect a determination on the part of the IAEA to undertake meaningful verification and a determination to use not only the best methods and techniques that are currently available but also to remain in the fore-front of the State of the art. It should be observed that these documents like the descriptions of the Agency's Safeguards System which preceded them will evolve and hopefully improve with experience in the years ahead.

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F. THE MANAGEMENT AND ANALYSIS OF SAFEGUARDS DATA.

As has been mentioned in the section of this report on the organization of the IAEA and the Department of Safeguards and Inspections, the importance of the collection, processing and analysis of the rapidly increasing amount of safeguards data required by Information Circular 153 has been a subject of intense concern, particularly in the last two years. Starting in the late 60's, the Agency began with a very small staff the development of an indigenous data base management system for the processing of safeguards data and the preparation of reports. The magnitude of the problem to broaden the base of the Agency's in-house capability led initially to the formation of the Information Treatment Group and, very recently, to the decision to establish a Division for Information Treatment. The United States has actively participated in this effort and has over the last two years provided experts both to advise and to work directly with the Agency on this critical problem.

The requirements for the Agency's information handling system have been summarized in the introduction of a report, by Gmelin, FUNCTIONAL CHARACTERISTICS OF THE IAEA'S SAFEGUARDS INFORMATION HANDLING SYSTEM RELEASE 1, (29) which is quoted below:

> [11]2. INFCIRC/153 contains provisions that Member States, having concluded Safeguards Agreements with the Agency, should provide design information and reports on initial inventories, changes in the inventories and material balances in respect of each nuclear facility and material balance area for all nuclear materials subject to safeguards.

IAEA and International Safeguards-F.

"3. The Agency, on the other hand, should establish and maintain an accountancy system which would provide the data on the location and the movements of all nuclear material subject to safeguards on the basis of the reported information in order to support the Agency's verification activities in the field, to enable the preparation of safeguards statements and to adjust the inspection intensity,

"4. The provisions formulated in document INFCIRC/153 are specific in respect of the details of Agency accountancy by requesting the establishment of *a* modern and transparent accounting system, a system based on the material balance and the inventory change concept. These requirements reflect the recognition that the conventional accountancy systems, based on concepts developed in 1945-1950, would not cope with the information requirements of, for instance, IAEA safeguards necessary to follow the nuclear material used in the peaceful application of nuclear energy."

The necessity to maintain the safeguards confidential nature of the information received from the States and processed by the Data Base Information Handling System has contributed to the very slow development of this System.

The realization that the existing Data Base System would not be able to process the very large increases in Data anticipated as a result of the implementation of the IAEA-EURATOM and Japanese Safeguards Agreements as well as the United States and United Kingdom offers, led in October the selection of a commercially developed Data Base Management System to cope with the IAEA's problems. It is the intent to

supplement the new Data Base System with as many as possible of the programs developed for Release 1. However, important areas directly related to a full scale use of all of the information obtained by the Agency remains to be programmed. For example, information contained in inspector working papers are still processed by hand, the critical area of analysis of the data remains to be programmed as does the receipt and processing of data obtained from the non-destructive analysis measurements made by the inspectors.

The creation of a new Division of Information Treatment and the increases in staff of this group should make a major impact on this problem. The details of the organization of the new Division have not been released, however, one suggestion is a threefold division which would cover operational analysis, systems analysis and data analysis. Such an organization would treat the data produced by the facility itself, the data from the full fuel cycle of a State and the statistical treatment of the data obtained from these sources. In order to meet the six-fold increase in data to be processed which is estimated for the calendar year 1977, the staffing of the new division for 1977 has been approved at 12 professionals and 14 GS positions. For 1978 the recommendation is 13 professionals and 18 GS positions. The heavy emphasis in INFCIRC 153 on Material Accountancy and Measurement of the Flow of Nuclear Materials strongly suggests that the critical needs of this function in the months and years ahead must be met, if the Agency is to fulfill its responsibilities under the NPT.

This formidable task is now being coordinated by an inter-agency U. S. team working directly with the Staff of the IAEA to strengthen the Agency safeguards through U. S. Gifts-in-kind. It should be stressed that this is an area where the other major nuclear supplier states could make significant contributions. Every effort should be made to persuade them to do so.

IAEA and International Safeguards-G.

G. **THE CONFIDENTIALITY OF SAFEGUARDS INFORMATION.**

In Article VII F of the Statute, the Director General and his staff are instructed to:

> "...not disclose any industrial secrets or other confidential information coming to their knowledge by reason of their official duties for the Agency."

As has been noted in the sections quoted above from Part B, Paragraphs 13 and 14 of INFCIRC/66/Rev.2 and Part 1, Paragraph 5 of INFCIRC/153, this instruction has been made much more explicit and has been amplified in a number of details. These instructions initially intended to protect the commercial and industrial secrets of the Member States now presents a serious obstacle in the efforts of these States to ensure their bilateral safeguards responsibilities which have been transferred to the Agency under trilateral agreements are being effectively implemented. It appears that without an amendment to the Statute and major revisions to INFCIRC/66 and 153, the Agency cannot legally disclose specific information obtained during its safeguards inspection or from the reports which have been submitted to it by the Member States.

At the present time, the summary information on the safeguards activities of the Agency made available to the Board of Governors by the Director General is identical to the information included in the section on safeguards of the Annual Report. The safeguards summary from the Agency's 1975 Annual Report is reproduced in Annex K with the exception of Table 9 which is reproduced separately as Annex E.

IAEA and International Safeguards-G.

Although the information in the Annual Report is useful to the Board it does not provide the necessary detail, if the Board is to evaluate the effectiveness of the Agency's Safeguards System.

In an effort to resolve this dilemma the Director General mentioned in his report to the General Conference in September, 1976, his intention to submit periodically to the Board of Governors a Special Safeguards Implementation Report (SSIR). It is the intent of the Director General to present relevant information which would enable the Board to arrive at an opinion with respect to the effectiveness of the Agency's safeguards without disclosing confidential information on specific facility and, if possible, without jeopardizing the flexibility of safeguards implementation. The form and content of this report has been reviewed by the Standing Advisory Group on Safeguards Implementation (SAGSI) at its first meeting in December of 1975 and in subsequent meetings in May and October of 1976. It is generally assumed that a complete evaluation of the Agency's safeguards effort will include both quantitative and qualitative information on the verification achieved. Any more specific assessment of the success of SSIR in meeting the requests of the nuclear exporting Member States for reassurance on the Agency's Safeguards System will have to await the submission of this report to the Board of Governors.

IAEA and International Safeguards-H.

H. **DETERMINATION OF NON-COMPLIANCE AND THE AGENCY'S RESPONSE.**

As in the case of release of Safeguards Confidential information discussed immediately above, the actions which the Agency can take in the face of non-compliance are described in general terms in Article XIIC of the Statute reproduced in Annex A above and in more detail in paragraphs 18 through 22 of INFCIRC/153 which are reproduced in Annex L.

The failure of a State to comply with the provisions of INFCIRC/153 and the Safeguards Agreement between the State and the Agency can obviously cover a wide range of issues. At one end of the spectrum these failures might be trivial. They might include inadequacies in the National System for Accounting and Control, questions related to the content of records and reports, their prompt submission, or at the opposite end of the spectrum, a failure to comply with the basic undertaking of the Non-Proliferation Treaty. In general, these matters would be resolved if possible within DSI or the Secretariat and, if sufficiently serious, would be brought to the attention of the Board who shall "call upon the recipient State or States to remedy forewith any non-compliance which it finds to have occurred." On matters of interpretation and application of the Agreement, Paragraph 22 of INFCIRC 153 provides that the issue be submitted to an arbitral tribunal composed of three arbitrators. If this tribunal is not convened within 30 days either party may requests that the dispute be taken to the President of the International Court of Justice.

In practice, a determination by the Director General that the Agency had not been able to verify that there had not been a diversion of nuclear material would begin in the Department of Safeguards and Inspections with a report from the Chief of a Regional Section to the Inspector General that his inspectors, for example, had been

unable to verify an inventory, encountered unusually large, unexplained losses, or that they had other evidence for. the diversion or the apparent diversion of nuclear material. The inspector prior to the submission of his report would have endeavored, in turn, to resolve the discrepancies with the facility operator or at the level of the National System. Both the Agency and the Board are required to afford the State every reasonable opportunity to provide whatever necessary reassurance is required. There can be no question that initially, the Inspector General and the Director General would be faced with a necessity to evaluate both the quantitative and qualitative information before the Director General's report was forwarded to the Board of Governors. Many technical as well as subjective factors would have to be weighed. These would include the effectiveness of the State system of accounting, previous history, the magnitude of the suspected diversion, through-put of the Facility, the precision and accuracy of the measurements by both the Facility operator and the IAEA, the availability and reliability of the containment and surveillance devices, the magnitude of the inspection effort, the performance of inspectors themselves and, one suspects, questions of a political nature.

IAEA and International Safeguards-I.

1. **THE ROLE OF THE BOARD OF GOVERNORS.**

If the Board of Governors is unable to resolve a question of nondiversion brought to its attention by the Director General, it is instructed by the Statute to report the non-compliance to all members and to the Security Council and the General Assembly of the United Nations. Under the Statute, the Board may also "direct curtailment or suspension of assistance being provided by the Agency or by a member and call for the return of materials and equipment made available to the recipient member or group of members." As a final act, the Agency may suspend the membership of the State or States from the exercise of the privileges and rights of the membership. Up until the present time there has not been, of course, any occasion to exercise or test the interpretation of these powers. If, however, the phrase "or by a member" is interpreted to include the Supplier States, the return of this material and equipment at the "demand" of the Supplier States should considerably strengthen the Agency's position. The immensely more difficult problem of the actual application of sanctions would have to be the responsibility of the individual Member States and more particularly of the Supplier States acting individually or in concert. As has already been noted, the Agency cannot prevent diversion nor does it have the power to recover diverted material. It has no police powers.

In general, the Board of Governors operates by consensus. Votes are rarely taken and a demand for vote is made only when a State feels that its vital interests are at stake. The decision of the Board as well as the action of the General Conference have been unique in the absence of the political discord which has characterized the deliberations of many other international organizations. In spite of this record, it is difficult to predict the actions of the Board of Governors should it be confronted with a report from the Director General that he could not verify in a specific

State that there had been no diversion of nuclear material. Although it should not be the case, the response of the Board to such an announcement might be conditioned by the identity of the State and whether or not it was on the Board. Article XI of the Statute provides that:

> "E. Each member of the Board of Governors shall have one vote. Decisions on the amount of the Agency's budget shall be made by a two-thirds majority of those present and voting, as provided in paragraph H of Article XIV. Decisions on other questions, including the determination of additional questions or categories of questions to be decided by a two-thirds majority, shall be made by a majority of those present and voting. Two-thirds of all members of the Board shall constitute a quorum."

One could imagine circumstances surrounding a Board vote on non-compliance in which, regrettably, a majority might be difficult to obtain.

The present Board of Governors now includes representatives from thirty-four states. It must be assumed that this group would not be completely free from the regional, national, and political rivalries which separate the Member States outside of the Agency. Further, it must be assumed that the Governors would operate on instructions from their governments. In the final analysis any action by the Agency whether it involves assistance to a Developing Country, a safeguards inspection, or action by the Board of Governors on the diversion of nuclear materials is possible only with the sufferance of a majority of the Member States. Should the Board be confronted with a proven case of diversion, one must believe that the Member States, recognizing the threat to all, will instruct their Delegations and their Governors to take promptly those actions which are authorized by the Statute.

J. FACTORS INFLUENCING THE EFFECTIVENESS OF AGENCY SAFEGUARDS.

There are several political and institutional factors which may be expected in the next one to two years to have a marked impact on the effectiveness of the IAEA's ability to carry out its safeguards responsibilities. In general, officials, both inside and outside of the IAEA believe that the Agency's success or failure not only in its safeguards endeavors but in the full range of activities which are authorized in the Statute is dependent on the attitudes of the Member States. In the safeguards area the question of the attitude of the Member States is probably the most crucial factor. In spite of the progress that has been made with respect to the need for effective and credible safeguards, there remains an urgent educational need to enlarge the perceptions of the industrial states as well as the developing states on the dangers which proliferation present to all. Given a cooperative attitude by the Member States, their determination that the International Atomic Energy Agency's safeguards will be effective, and that strong National Systems for Accountancy and Control will be established and maintained, reasonable assurance can be provided that the diversion of nuclear materials to weapons purposes can be detected. Failing this, and confronted with inadequate funding and over-riding concerns for either national sovereignty, or the protection of industrial secrets, the success of the Agency's safeguards activities will be placed in serious doubt.

The most pressing, near term problem of an institutional nature directly affecting the operations of the Agency as a whole and its safeguards efforts, in particular, is the matter of the retirement, or imminent contract renewal of many key management people at the highest levels in the Agency. The Director General is sixty-six years old. If he is to have a successor, the nomination must be submitted to the Board of Governors in June of 1977. Many of the members of the Director General's immediate staff are his contemporaries and are also approaching mandatory retirement. Of

immediate concern is the fact that the contract covering the services of Dr. Rometsch, the Inspector General, must be renegotiated or a replacement recruited by September of 1977. The Agency has recently circulated a request for nominations for the position of Director, Division of Operations, Department of Safeguards and Inspections. As a result of the proposed reorganization of D.S.I., Directors will have to be nominated for the new Division of Operations and the Division of Information. Finally, the Head of the Section for Methods and Techniques, Division of Development is also approaching mandatory retirement and a replacement for this position will be required. The staffing of these positions will have a marked and long range effect on the Agency as well as the performance and morale of the Department of Safeguards and Inspections. It is not a matter in which decisions can be delayed. Agency regulations, as well as the needs of the individuals involved require that the personnel decisions in these areas be made as soon as possible.

The reorganization of the Department of Safeguards Inspections noted above was planned to meet the major increase in safeguards activities resulting from the implementation of the IAEA-EURATOM and Japanese Safeguards Agreements and the application of Agency Safeguards under the United States and United Kingdom offers. This substantial increase in the operational activities of D.S.I. will place new and exacting demands on the Department and on the management of the two Operations Divisions. At the level of the Inspector General there will be an even greater need for strong leadership and effective and imaginative management to meet this challenge.

It is too early to evaluate the impact of the very large increases which the United States Congress has authorized to strengthen and support IAEA safeguards. In fiscal 1975, approximately $200,000 was made available in gifts-in-kind through the Foreign Assistance Act. In fiscal year 1977 a total of approximately

$1,600,000 will be available through the Foreign Assistance Act of 1977 for similar gifts-in-kind. It was the recommendation of President Ford that approximately $5,000,000 should be made available to the IAEA over the next five years. The effective use of this money will require a careful and realistic assessment of the Agency' needs. The United States has established an Interagency Group to coordinate this major effort with members drawn from ERDA, State, ACDA, NRC and

Following a meeting in Vienna in November with IAEA and U. S. Mission staffs, an International Safeguards Project Office (ISPO) under the direction of Dr. H. Kouts was set up and a draft Program Plan for Technical Assistance to IAEA Safeguards (30) prepared.

If the United States does not actively strive to broaden this type of support among all of the Nuclear Supplier States and the Soviet Union, there is danger that the United States will find itself carrying a disproportionately large part of the burden. The report of a German decision to contribute approximately $300,000 in similar support for IAEA is heartening and should be encouraged. There are many areas where all of the supplier states could contribute from the training of inspectors to the use of their most advanced nuclear facilities for the development and testing of the newest safeguards procedures and techniques. Every state under safeguards would benefit. Those states that can contribute to the improvement of safeguards have an obligation to do so.

K. THE IAEA'S ROLE IN PHYSICAL PROTECTION.

As has been noted in the section of this report on the Statute of the IAEA and in the excerpt" from the section on Objectives of INFCIRC/225 (14, op.cit.) reproduced in this report, the IAEA does not have any responsibility for the provision, supervision, control or implementation of a State's physical protection system. The Agency may informally advise a State of its observations and it will provide assistance only when so requested by the State. In its role as an informal advisor and at the urging of some of the Member States, the United States in particular, the Agency has, in recognition of the importance of the problem of physical protection, convened a small panel of experts from the Member States in March of 1972. In connection with the recommendations of this panel of experts the Agency has published a document entitled, "RECOMMENDATIONS FOR THE PHYSICAL PROTECTION OF NUCLEAR MATERIALS", (31), which summarize the views of this panel. These recommendations were reviewed in early 1975 by experts from some of the Member States for the purpose of updating the original publication and reflecting the progress which had been made in the area of physical protection. The work of this panel has been published in a document, THE PHYSICAL PROTECTION OF NUCLEAR MATERIALS, INFCIRC/225, (14, op.cit.). The Agency is well aware that physical protection can make a substantial contribution to the effort of deterring the diversion of nuclear material, but it also recognizes that physical protection of nuclear material is an exclusive responsibility of the State, and in some States, an integral part of the State's National System of Accounting and Control.

At the present time, there does not appear a consensus in the Board of Governors, even among the nuclear supplier states on the subject of physical protection. This lack of consensus reflects deep seated national attitudes, for example the British reluctance to arm its police and other civil forces. Without such a consensus it is

not possible to take more positive steps in this area. Even though it is unlikely that the legal responsibilities of the IAEA in this area will change in the near future, the Agency recognizes the need to bring this problem to the attention of a much larger number of other states. It is considering, at this time, the possibility, of convening a meeting on the subject of physical protection for some time in the early part of 1977. In its advisory capacity, the Agency can act as a center for information of physical protection, it can convene, if requested, scientific meetings and symposia on the subject, although no such request has yet been received by the Agency from any country, and finally it could offer technical assistance in this area if asked.

The United States in concert with the IAEA and several other countries is also pursuing the drafting of an International Convention on Physical Security. This initiative was first proposed in a speech by the U. S. Secretary of State, Dr. Kissinger to the United Nations General Assembly on September 23, 1974. In this address, Dr. Kissinger proposed that:

> "The United States will urge the IAEA to draft an International Convention for enhancing physical security against theft or diversion of nuclear material. Such a convention should set forth specific standards and techniques for protecting material while in use, storage, and transfer."

The following year on September 22, Dr. Kissinger said in his address before the General Assembly that:

> "The United States has intensified its efforts within the IAEA and with other nations to broaden and strengthen international standards and safeguards and has proposed an international convention setting standards to protect the physical security of nuclear material in use, storage or transfer."

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A revised draft of an International Convention on Physical Protection is now being reviewed. In spite of the Importance and urgency of the problem, previous experience with international conventions suggests that prompt action in this area may not be forthcoming.

IAEA and International Safeguards-L.

L. **THE IAEA REGIONAL NUCLEAR FUEL CYCLE CENTER STUDY.**

With the growth and spread of nuclear power throughout the world a number of critical questions have arisen with respect to the storage and reprocessing of spent fuel, the storage of radioactive waste, the fabrication of mixed oxide fuel and the stockpiling of plutonium. These matters and related questions of physical security and safeguarding of such facilities were discussed at the General Conference of the IAEA in 1974, and within the General Assembly of the United Nations where Secretary of State, Dr. Kissinger took the occasion to draw the world's attention to these growing problems. In response to these concerns the IAEA undertook a preliminary study of the economic benefits that might result from regional centers for reprocessing and waste management. The results of this study were published by the Agency in September of 1975 (32) and suggested that the economic benefits were sufficient to justify a further detailed study.

Figure 3 is an organization chart of the present, detailed IAEA study on Regional Nuclear Fuel Cycle Centers (RFCC). The comprehensive nature of this undertaking can be seen from the project elements which include mathematical modeling, fuel reprocessing, waste management, mixed oxide fuel fabrication, fuel storage, transport, and the questions of legal and institutional matters. The first of the many reports to be issued by the IAEA was released in July, 1976, (33) on the Institutional-Legal Framework Aspects of the RFCC Study. An outline of the RFCC's Study Project Summary Report is given in Annex M. Publication of the remaining reports are expected in time for distribution at the Saltzburg Conference in May of 1977. A status report on the IAEA study project was issued in September 1976 (34). The status report is reproduced in Annex N.

Project Elements

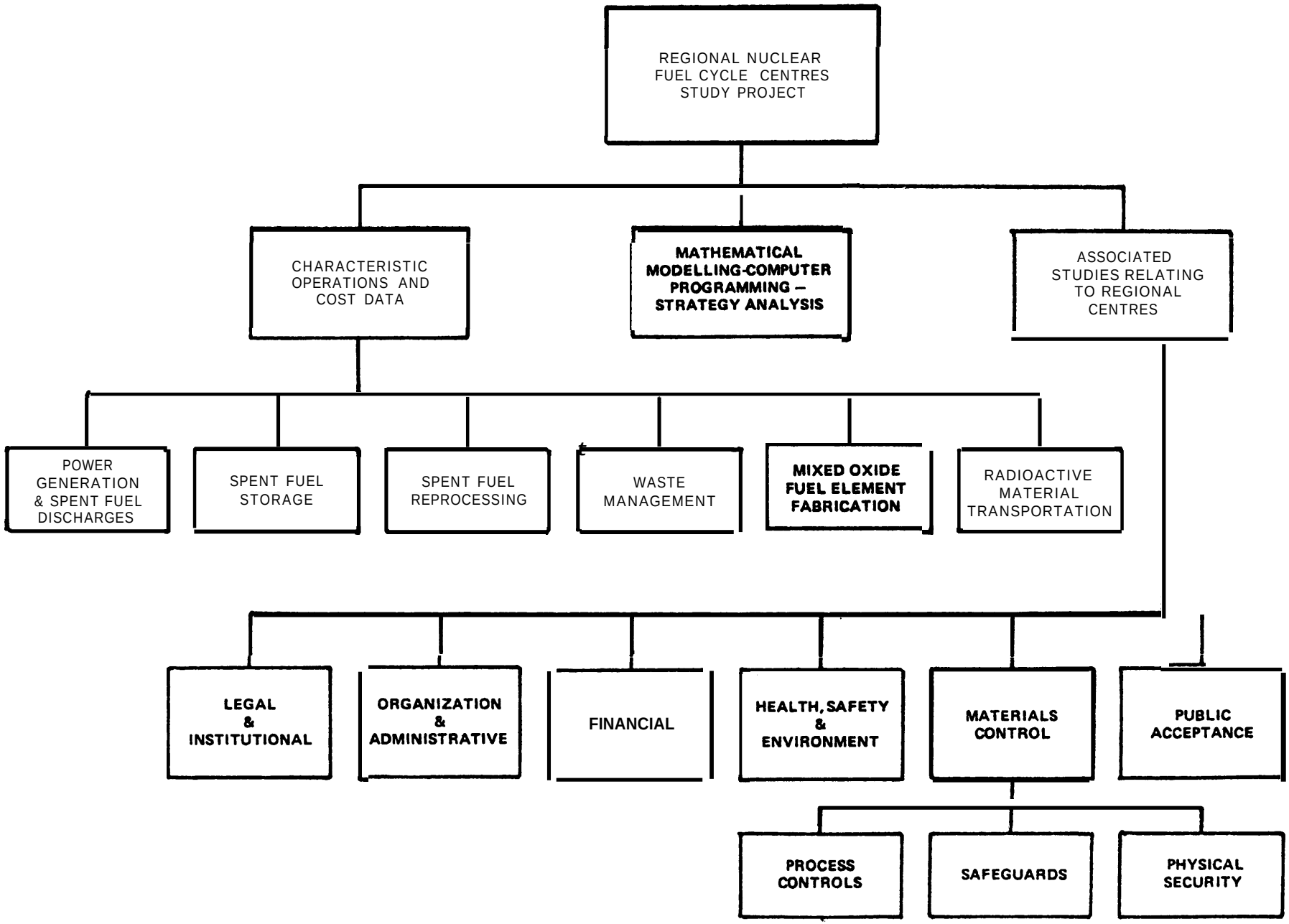

Figure 3

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The report on Institutional-Legal Framework Aspects reviews some of the advantages and the disadvantages of the RFCC approach. The advantages include economy of scale, the rational use of technological and financial resources, improved assurances that safeguards and physical protection would be achieved in the interests of all States, and improved management for the safe disposal of high activity radioactive waste. The drawbacks cited include a further spread of sensitive technology, the reduction of freedom for unilateral action by states, concerns about the effects of inter-country frictions on the dependability of fuel supply and the substantial commitment of capital and resources that would be required for individual fuel cycle centers in each of the countries of the region. The report also reviews the organization and experience in the nuclear field of three operating multinational activities, EURODIF and Eurochemic, and URENCO. The main topics covered are legal status and structures, governmental/non-governmental roles, internal administrative structures, commercial/service roles, industrial arrangements, technology (use, control, etc.), basic financial policy considerations, privileges and guarantees, membership, duration, etc., and international agreements.

A more detailed analysis of the multi-national or regional fuel cycle centers have identified the following: potential problems and limitations:

- the interpretation of Article IV of the NPT by signators of the Treaty, i.e., “the right of all Parties to the Treaty to participate in the, fullest possible exchange of equipment, materially and scientific and technological information for the peaceful uses of nuclear energy.”

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- **the RFCC's would not necessarily stop participating States from building small indigenous reprocessing plants**

- **the possibility of abrogation and take over of the RFCC**

- **the large RFCC's would unavoidably encounter problems of precision and accuracy of measurements of material unaccounted for associated with large throughput and material flow,**

the RFCC might/would speed rather than contain the spread the transfer of sensitive technology.

- **the plutonium obtained from a RFCC and used in mixed oxide fuels (MOX) could still be easily separated prior to irradiation of the fuel in a reactor and diverted.**

In addition to the economies of scale. improved safeguards and enhanced physical protection noted above, RFCC's could have tile following advantages:

- **the reduction of regional rivalries and the incentive for small, inefficient national reprocessing plants.**

- **the reduction of incentives for premature reprocessing of spent fuel.**

- **the reduction of safeguards costs.**

- **the limitation of the spread of sensitive technology**

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- an enhanced role for the IAEA
- the early establishment of regional spent fuel storage sites to reduce requirements for early reprocessing.

The Director General in his statement to the General Conference in September said "'The Secretariat's study tends to indicate that such projects would be advantageous from an economic, safety, physical security, and safeguards point of view*'. There are many critics who would take exception to this statement. The question of the economics of reprocessing is still a subject of intense debate. There does, however, appear to be an important role for the IAEA in the supervising the storage of spent fuel and in the management of separated plutonium, two possible functions for a RFCC. It is possible that Article XII(A5) of the Statute which provides for the deposit with the Agency of any excess of any special fissionable material recovered or produced as a product over what is needed for immediate use may provide the legal basis for a solution to dangerous situations.