BNL-63866
SSN-97-02
CONF-970744-18

U. S. TECHNICAL ASSISTANCE TO THE IAEA AND THE CWC - A REVIEW AND LOOK TO THE FUTURE

Joseph Indusi, R.J. Parsick and A.W. Reisman

Presented at the
38th Annual Institute of Nuclear Materials Management (INMM) Meeting

July 20-24, 1997
Phoenix, AZ

Brookhaven National Laboratory
P.O. Box 5000; Building 197C
Upton, New York 11973-5000
516/344-2975, 516/344-4893 & 344-2666
FAX 516/344-7533

DISCLAIMER

SSN #97-02

U.S. TECHNICAL ASSISTANCE TO THE IAEA AND THE CHEMICAL WEAPONS CONVENTION (CWC) - A REVIEW AND LOOK TO THE FUTURE*

Joseph Indusi, R.J. Parsick and A.W. Reisman,
Brookhaven National Laboratory, Upton, N.Y. 11973

Abstract

This paper reviews the Safeguards mandate of the International Atomic Energy Agency (IAEA) and describes U.S. technical support programs. We also review the mandate of the Chemical Weapons Convention (CWC) and speculate on the technical areas where U.S. assistance may prove useful.

The IAEA was organized in 1957 in response to President Eisenhower's "Atoms for Peace" initiative presented to the UN General Assembly on December 8, 1953. The Organization for the Prohibition of Chemical Weapons (OPCW) has been organized by a Preparatory Commission (PREPCOM) to prepare for the entry-into-force of this new convention which prohibits the development, production, stockpiling and use of chemical weapons and on their destruction.

The safeguards mandate of the IAEA is to carry out verifications of nuclear material pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and other voluntary but legally binding agreements. U.S. technical support programs have provided and continue to provide assistance in the form of Cost-Free Experts (CFE's), systems studies on new safeguards approaches, training, computerized information systems, and equipment for nuclear materials measurements and containment and surveillance systems.

Because the CWC just recently entered into force (April 29, 1997), verification procedures of the OPCW are not yet fully developed. However, it is expected, and can already be seen for many aspects of the technical task, that there are many similarities between the verification activities of the OPCW and those carried out by the IAEA. This paper will discuss potential technical support areas that can help strengthen the OPCW.

* This work is sponsored by the Department of Energy under contract DE-AC02-76CH00016. The views expressed are those of the authors and do not necessarily reflect the position of the Department of Energy. Review of this material does not imply Department of Energy endorsement of factual accuracy or opinion.

Introduction

The IAEA is a specialized agency of the United Nations and is a part of the functioning of the existing world order. Those agencies that verify compliance with specific international treaties will be more important in the future. Two such agencies carry out activities in the area of disarmament and have received special attention:

1. the International Atomic Energy Agency (IAEA) in Vienna, Austria;
2. the Organization for the Prohibition of Chemical Weapons (OPCW) in The Hague, Holland.

The first was organized in 1957 in response to President Eisenhower's 'Atoms for Peace' initiative presented to the UN General Assembly on December 8, 1953. The second was organized by a Preparatory Commission in preparation for the entry-into-force of the new international Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction. Both organizations have important responsibilities and difficult technical tasks.

The IAEA is responsible for carrying out verifications of nuclear material pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons and other voluntary but legally binding agreements. In 1993 and 1994 the IAEA received intensive public attention as a result of its inspections in Iraq and in the Democratic Peoples Republic of Korea. It is U.S. policy to be a member of the IAEA, to have a voluntary agreement under which U.S. nuclear facilities are selected and inspected by the IAEA in a way similar to, but not as extensive as, the inspections in other countries and to provide technical assistance to the IAEA for further development of its world-wide inspection system.

The OPCW will be responsible for carrying out the verifications required by the new convention on chemical weapons. The U.S. Senate ratified the CWC in 1997 and this requires U.S. adherence to the convention. This will lead to inspections of chemical facilities in the U.S. in the same manner as in other countries party to the convention. Similar to the IAEA, it is possible that the OPCW may receive technical assistance from the U.S. to help the new organization design, establish and implement its world-wide verification system both effectively and efficiently.

International Atomic Energy Agency (IAEA)[1]

Origin

The IAEA was established in 1957 as an independent intergovernmental organization in the United Nations family[2]. As of May 1997 it had 126 Member States.

The aim of the IAEA as set out in Article II of the Statute[3] is to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world." Article III.A.5 of its Statute authorized the IAEA "to establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the

parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy."

The first section of Article III.A.5 refers to the original concept of the IAEA as a major supplier of nuclear material and equipment. However, IAEA safeguards are based largely on the second part of Article III.A.5. They are, broadly speaking, a set of activities by which the IAEA seeks to verify that a State is not using nuclear material or equipment to develop or produce nuclear weapons. IAEA safeguards includes neither nuclear safety nor the physical security of nuclear material. In both of these areas the States themselves have the primary interest and responsibility, even though the IAEA has a role in these matters, e.g., in issuing standards, providing assistance and services, and arranging for the exchange of experience.

Early Safeguards Agreements

A large number of safeguards agreements came into force before 1970. The legal basis for such safeguards, which are applied to specific material and equipment only and not to the entirety of the State's nuclear activity, is described in an IAEA Information Circular identified as INFCIRC/66/Rev.2[4]. Many of the States which have concluded INFCIRC/66/Rev.2-type safeguards agreements with the IAEA did so because another State would supply particular nuclear material or equipment only if IAEA safeguards were applied to the material or equipment in the recipient State. However, unless required by some other political or legal agreement, the recipient State has no obligation to make known all its nuclear activities and to submit them to IAEA safeguards. Because this is not widely known, the IAEA is sometimes falsely accused of failing to look for and detect undeclared nuclear material or facilities in such States.

Comprehensive Safeguards Agreements

The successful conclusion in 1968 of the negotiations on a treaty designed to prevent the further spread of nuclear weapons - the Treaty on the Non-Proliferation of Nuclear Weapons[5] (NPT) - was a landmark in the history of non-proliferation. The Treaty entered into force in March 1970 and 186 States are party to it as of May 1997. These include all five declared nuclear weapon States (China, France, the Russian Federation, the United Kingdom and the United States of America) as defined in the NPT.

Each non-nuclear-weapon State that becomes party to the NPT agrees not to acquire nuclear weapons or other nuclear explosive devices (Article II). It also agrees to conclude a comprehensive safeguards agreement with the IAEA for the application of safeguards to all its peaceful nuclear activities, present or future, with a view to verifying the fulfillment of its obligations under the Treaty (Article III). In return, the Treaty recognizes (in Article IV) the right of all parties to participate in the fullest possible exchange of equipment, materials, and scientific and technological information for the peaceful uses of nuclear energy. The parties also undertake to pursue negotiations in good faith towards nuclear disarmament (Article VI) and re-affirm their determination to achieve the discontinuance of all tests of nuclear weapons (Preamble).

Although not obliged to conclude safeguards agreements, the nuclear weapon States have agreed that IAEA safeguards may be applied to all or part of their civil nuclear activities. The nuclear weapon States have done this, inter alia, to demonstrate that they will not derive any commercial advantage by not making their civil facilities subject to international inspection. Additionally, the U.S. has made available for IAEA verification certain surplus defense related materials.

In addition to the NPT, two regional treaties which have the objective of preventing the spread of nuclear weapons have been concluded: the Treaty for the Prohibition of Nuclear Weapons in South America[6] (the Treaty of Tlatelolco, actually concluded before the NPT) and the South Pacific Nuclear Free Zone Treaty[7] (Treaty of Rarotonga). Both require safeguards agreements with the IAEA.

To implement the safeguards requirements of the NPT, the IAEA needed to devise a safeguards system suitable for application to the complex nuclear fuel cycles of the advanced industrial countries that were expected to join the Treaty, i.e. a safeguards system applicable to reactors and to the conversion, enrichment, fabrication and reprocessing plants which supply and process the reactor fuel. This comprehensive safeguards system, devised in 1970, is set out in IAEA document INFCIRC/153(corrected)[8]. The NPT, the Tlatelolco Treaty and the Rarotonga Treaty require that all of the nuclear material in a signatory State be declared and submitted to IAEA safeguards shortly after ratifying the treaty. The Treaties also require that any nuclear material which the State subsequently acquires be also declared and safeguarded.

Technical Measures

The IAEA Board of Governors requested the Director General to use INFCIRC/153 as the basis for negotiating safeguards agreements between the Agency and non-nuclear-weapon States party to the Treaty on the Non-Proliferation of nuclear weapons. Part II of INFCIRC/153 specifies the procedures to be applied for the implementation of the safeguards provisions of Part I of that document. Paragraph 29 specifies the use of material accountancy as a safeguards measure of fundamental importance, with containment and surveillance as important complementary measures. Paragraph 30 specifies that the technical conclusion of the Agency's verification activities shall be a statement, in respect of each material balance area, of the amount of material unaccounted for over a specific period, giving the limits of accuracy of the amounts stated.

In effect, this calls for a normal engineering procedure often referred to as material balance accounting. Such a balance compares the amount of nuclear material calculated to be present against measurements of the nuclear material found to be present during an inspection, thus yielding an objective determination of the amount, positive or negative, which appears to be unaccounted for. A negative amount means that more material is present than was expected. Such a result is possible because of the varying accuracies of the many measurements which contributed to the calculations and of those made at such an inspection. Each result is evaluated, inter alia, by comparison with the limits of accuracy of the measurements involved, thus incorporating a fair and objective standard for IAEA conclusions.

To meet the obligations of paragraphs 29 and 30, a safeguards approach is necessary for every nuclear facility subject to IAEA safeguards. Each safeguards approach describes the inspection activities to be conducted; the measurements to be made and the equipment, instruments and techniques to be used so that the inspection goals for the facility can be attained at the required intervals. If the inspection goals at a facility cannot be routinely or efficiently attained, a comparison of the safeguards implementation practices to the requirements of the inspection goals is important in identifying remedial actions.

Chart A depicts the principal elements of the IAEA safeguards system which flow from the legal basis, including the technical verification activities, the conclusions, the post-hoc evaluation of effectiveness, and the internal and external reporting of achievements and problems.

The political and legal requirements lead to various verification activities by the IAEA, such as records examinations, comparison of records and reports, measurements, sampling, analyses and comparisons of data performed by the IAEA as part of routine, ad hoc and special inspections in the State and data processing, analyses, comparisons and evaluations performed at IAEA Headquarters.

U.S. Program of Technical Assistance to IAEA Safeguards (POTAS)

Initiation of POTAS

The U.S. Program of Technical Assistance to IAEA Safeguards (POTAS) was proposed by U.S. President Gerald Ford in February 1976 and was sponsored by Senator John Glenn in the Senate. The IAEA had already been performing inspections for about 15 years. This included inspections for about four years pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). It was important at that time to initiate major technical assistance because the IAEA's responsibilities and activities were rapidly increasing owing to the entrance of Japan and the European Community into the NPT. This brought a large number of new and complex nuclear facilities quickly under IAEA safeguards.

The resulting Congressional act (the Foreign Assistance Act of 1976) provided $5 million over 5 years for the program. A supplemental amount was provided shortly into the first year. The program was later extended beyond the initial 5 year-period. The annual amount was also increased, reaching $9.1 million per year in 1997.

Objectives of POTAS

The primary purpose of POTAS is to transfer technology available in the U.S. to enhance the effectiveness and efficiency of IAEA safeguards. The U.S. program is intended to strengthen, make more visible and coordinate the U.S. extra-budgetary technical assistance to the IAEA for its work in verifying compliance with the terms of safeguards agreements concluded by each State with the IAEA.

The IAEA was to bear no direct costs for the technical assistance provided by the U.S. program. This included the cost of employing experts provided by the U.S. program to serve on the staff of the IAEA for agreed specific tasks. Thus, such experts are called 'Cost-Free Experts' (CFEs).

Main Contributions by POTAS

POTAS has contributed in many ways to the development and implementation of IAEA safeguards. In the early years, the emphasis was on research and development of equipment and on options for safeguards approaches. Subsequently, POTAS added support for measurements and associated technology; training of IAEA staff and national authorities; system studies; procedures; computerized information processing; containment and surveillance devices; evaluation and administrative support. More recently, support in the procurement, deployment and maintenance of equipment has been given additional emphasis. POTAS also helps the IAEA to identify new needs and new methods for improvement. Thus POTAS has become broad technical support for IAEA safeguards.

In general, the provision of Cost-Free Experts (CFEs) is one of the key contributions by POTAS. These CFEs are a diversified group of technical experts. Although they can not carry out IAEA inspections under Safeguards agreements, they are used by the IAEA to address important technical issues. The experts cover a range of IAEA needs, including random sampling techniques, measurement technology, training, equipment development, technical procedures, evaluation methods, quality assurance, data processing, creating specialized software, and specific knowledge needed for safeguarding new nuclear facilities.

Organization for the Prohibition of Chemical Weapons (OPCW)

Origin

The new chemical weapons convention goes far beyond the Geneva Protocol of 1925, which essentially only prohibited the first use in war of chemical and certain other weapons. The new convention[9] (often referred to as the Chemical Weapons Convention (CWC)) also prohibits other State actions and in addition creates and empowers an international organization to verify compliance by each State with the terms of the convention. This organization was recently organized by a Preparatory Commission and has its headquarters in The Hague, Holland.

Objective and Basic Provisions of the Chemical Weapons Convention

Simply speaking, the objective of the CWC is to eliminate chemical warfare and rid the world of chemical weapons. States which become parties to the CWC commit themselves not to develop, produce, acquire, stockpile, retain, or transfer chemical weapons (CWs); not to use CWs; not to prepare militarily to use CWs; and not to assist, encourage or induce others in prohibited activities. In addition, a State agrees to destroy any chemical weapons it possesses at the time it becomes a party to the convention, to destroy chemical weapon production facilities and not to use riot control agents as a method of warfare.

The CWC specifies the chemicals to be banned or controlled in terms of guidelines and schedules of chemical types. The CWC also specifies the regime for each schedule of chemicals and facilities related to such chemicals. Schedule 1 comprises the prohibited direct-military-use chemicals such as Lewisites, sulfur and nitrogen mustards, nerve agents and certain immediate precursors. Small facilities are permitted for very limited production of Schedule 1 chemicals for non-prohibited purposes, for example, for developing protective measures or for medical purposes. Schedule 2 comprises a few potential chemical warfare agents and the larger number of precursors which are not produced in large commercial quantities. Schedule 3 comprises toxic chemicals and precursors which may be produced in large commercial quantities for purposes not prohibited under the CWC.

To permit verifications of a State's compliance, the CWC contains provisions for data reporting by the State, conduct of inspections by the OPCW and review of requests for challenge inspections. The scope of the CWC is quite broad since it includes existing chemical-weapon facilities and munitions, as well as commercial and industrial chemical facilities. Because of the provisions for challenge inspections, other facilities such as laboratories and other military facilities may be involved in an inspection. To protect confidential business information and data regarding sensitive defense facilities which are not CWC-related, special arrangements are allowed which seek verification of compliance while limiting intrusiveness.

For several years, the Preparatory Commission worked on defining details not specified in the CWC (for example, thresholds for reporting exports and imports) and on arrangements for establishing the OPCW (for example, organization, staff, procedures).

Verification Activities

Because the CWC recently entered into force at the time of writing, verification procedures of the OPCW are not yet fully developed and there is only limited test experience for such activities. However, it is expected, and can already be seen for many aspects of the technical task, that there are many similarities between the verification activities of the OPCW and those carried out by the IAEA.

As in the safeguards system for nuclear material, States must submit reports about production, processing, consumption, importation, and exportation of covered chemicals. In addition, both organizations must prepare facility agreements concerning the reporting and inspection arrangements. In the case of the OPCW, these agreements specify areas to be inspected, where photographs may be taken, which records may be examined, and details regarding sampling procedures and locations. In such agreements, the rights of the inspected party to protect confidential business information and other sensitive or classified information not related to the CWC are important.

Thus, submission and processing of reports, inspections of locations, examination of records, comparison of records and reports, and verification of the presence of material are basic and similar requirements for both organizations. However, the differences in the involved

materials will mean many differences in the technical approaches and equipment used.

Technical Areas

Clearly, the OPCW will require technical capabilities in a number of areas to effectively carry out its mandate under the CWC. A few areas are discussed below.

Equipment

This area of technical need involves safety equipment, sampling and measuring equipment, detection equipment, various types of OPCW equipment placed on-site (seals, cameras, etc.), and communications equipment. Specialized equipment will most certainly be required for certain challenge inspections where confidential business information or other sensitive information needs to be protected during the course of an inspection. Work is in progress for some of the already identified needs. For example, Brookhaven National Laboratory has recently completed a prototype system for providing the inspector a 'virtual presence' inside a challenged facility. The system, called Managed Access by Controlled Sensing (MACS), consists of a mobile unit and a base unit. The mobile unit is operated by a facility employee under the control of the inspector at the base unit. The system provides visual data via cameras and monitors, position data, distance and interior volume data, and outputs from specialized sensors placed on the mobile unit. Initial testing at a facility operated by the Department of Defense was recently conducted.

Training

This requirement is far reaching, with certain obvious needs in the area of chemical engineering, data processing skills and instrumentation. Skilled engineers and technicians will be required to carry out the projected inspections each year. Since it is not expected that even chemical engineers can carry out all the aspects of a site inspection, certain training in additional skills will be required for inspectors. Training may also be required for data processing specialists at OPCW headquarters where the State's data will be processed. International organizations have a high turn-over rate, so training has to be provided often.

Experts

A significant factor in the success of the IAEA safeguards system is the skill and commitment of nuclear safeguards experts on the regular IAEA staff as well as specialists provided by member State support programs. To carry out its mission, the CWC probably will also require both a regular staff and a cadre of experts. Some of these experts would be required only for a limited time while a technical system is designed, installed and tested. These could be provided under a member State support program. Thereafter, persons with different skills would become part of the normal staff to operate the system.

System Studies and Research and Development

As more States become parties to the CWC, there will be a need for more and improved verification approaches, instrumentation and data handling capabilities. In addition, there will always be a need to develop the most cost-effective means to carry out each of the verification activities. This will involve research and development efforts to achieve these improvements. However, research and development activities require a supporting infrastructure and may have to be done under member State support programs.

Member States Support Programs

The technical areas described above are integral parts of the CWC. The OPCW must be, and must be seen to be, effective in its verifications under the CWC. It is reasonable to expect that in their desire to promote the effectiveness and efficiency of the OPCW, member States will choose to establish member States support programs, such as was done in the case of the IAEA.

Conclusion

The verification activities by the IAEA under the various safeguards agreements have been developed and implemented over several decades. There are always lessons being learned and improvements sought. The U.S. has strongly supported this healthy process of improvement through its Program of Technical Assistance to IAEA Safeguards. This U.S. program has also learned lessons, most importantly about how to efficiently support the kind of international secretariat which is required by the Non-Proliferation Treaty.

The new international Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction has not yet resulted in significant experience in verification activities. Therefore, the details of the new international secretariat and the specific experience of implementation under the new convention are not yet widely available. However, many of the lessons learned by the IAEA and by the U.S. are already proving valuable in preparing for implementation under the new convention. More importantly, experience from the U.S. program of technical assistance to IAEA safeguards can be used to enhance the U.S. ability to assist the OPCW in the start-up phase of its verifications and over the long term.

ENDNOTES AND REFERENCES

1. Much of the information about the origin of the International Atomic Energy Agency and safeguards agreements was obtained from the IAEA Departments of Public Information and of Safeguards; see for example, Against the Spread of Nuclear Weapons: IAEA Safeguards in the 1990's, IAEA/PI/A38E, (Austria: IAEA, December 1993).

2. Report of the Preparatory Commission of the International Atomic Energy Agency, GC.1/1, (New York: 1957).

3. International Atomic Energy Agency, Statute, as amended up to 28 December 1989, (Vienna: IAEA, 1989).

4. International Atomic Energy Agency, The Agency's Safeguards System (1965, as provisionally extended in 1966 and 1968), INFCIRC/ 66/Rev.2, (Vienna: IAEA, 16 September 1968).

5. Treaty on the Non-Proliferation of Nuclear Weapons [entered into force on March 5, 1970], see in U.S. Arms Control and Disarmament Agency, Arms Control and Disarmament Agreements; Texts and Histories of the Negotiations, (Washington, D.C.:ACDA, 1990).

6. Treaty for the Prohibition of Nuclear Weapons in Latin America [now in force for many countries in the region], see in U.S. Arms Control and Disarmament Agency, Arms Control and Disarmament Agreements; Texts and Histories of the Negotiations, (Washington, D.C.:ACDA, 1990).

7. The South Pacific Nuclear Free Zone Treaty [in force since 1986], see in Jozef Goldblat, Arms Control, A Guide to Negotiations and Agreements, (Oslo, Norway: International Peace Research Institute, 1994).

8. The Structure and Content of Agreements between the Agency and States required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/153 (Corrected), (reprinted in Austria by the IAEA, February 1983).

9. Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction, January 13, 1993 and entered into force April 29, 1997.

SAFEGUARDS PURPOSE AND OBJECTIVE FOR INFCIRC/153-TYPE AGREEMENTS (WITH INFCIRC/153 PARAGRAPH REFERENCES)

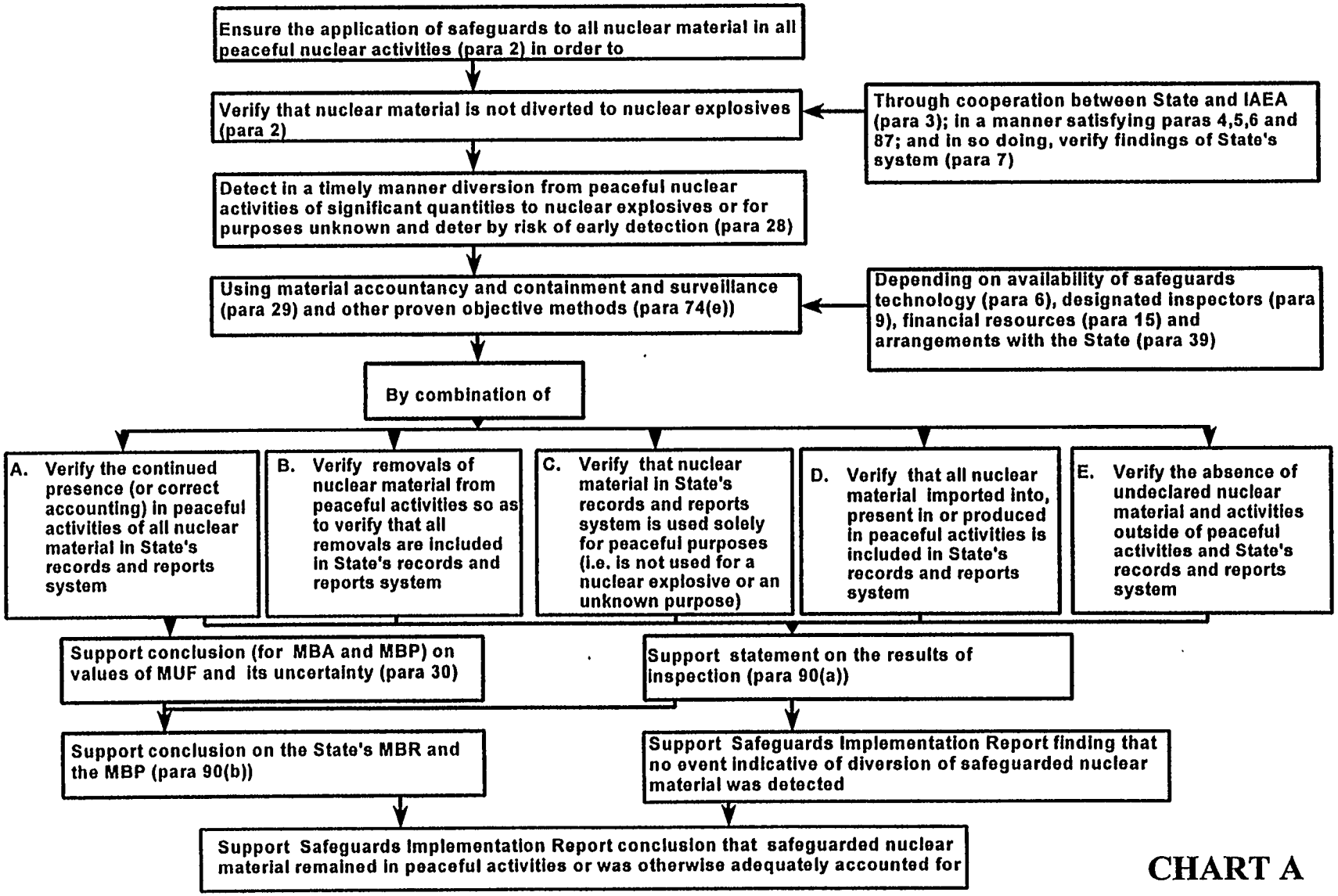

CHART A