REPORT TO THE ATOMIC ENERGY COMMISSION

**By the Ad Hoc Advisory Panel on Safeguarding
Special Nuclear Material**

MARCH 10, 1967

MASTER

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This report represents the conclusions and opinions of the seven Panel members but was, in fact, dependent upon the efforts of a great many people. Considerable assistance was given by Mr. J. V. Vinciguerra, Assistant General Manager for Administration, and Mr. C. L. Henderson, Assistant Director of Regulation for Administration. Most helpful were the efforts of the Executive Secretary, Mr. V. C. Vespe, and Mr. R. G. Page, Panel Secretary. Many other individuals, too numerous to single out, within AEC and in private enterprise contributed considerable time and effort providing useful information to the Panel. The Panel is deeply indebted to all those who assisted in this complex study.

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REPORT OF THE ADVISORY PANEL

ON

SAFEGUARDING SPECIAL NUCLEAR MATERIAL

I. Introduction and Abstract of Recommendations

With the inception of the nuclear age, the foreign policy of the United States crystalized on the objective of limiting the number of nuclear powers. The Baruch Plan to control nuclear weapons and to assure that special nuclear materials would be used principally for peaceful purposes was submitted to the United Nations in 1946, though it was never adopted. The Atoms for Peace Program was conditioned on, and recognized the need for, assurances that the materials transferred under the program would not be diverted to military pursuits. The incorporation of safeguards requirements in bilateral agreements for cooperation, and the systematic transfer by the United States of its bilateral safeguards responsibilities to the International Atomic Energy Agency is consistent with this objective. The United States ratification of the Moscow Treaty of 1963, the so-called "Limited Nuclear Test Ban Treaty," was the lineal descendant of this policy objective. Thus it has been, and continues to be, a basic foreign policy objective of the United States to strictly limit the proliferation of nations with nuclear weapons capability.

The accelerating introduction of nuclear power on an economically competitive basis in this country and abroad during the last two years has resulted in dramatic forecasts of nuclear power growth during the next decade or two. While the benefits of abundant and economic nuclear power are many and generally well-known, this development will inevitably result in the availability of large quantities of special nuclear materials. If uncontrolled, nuclear weapons development and production programs could be initiated in many countries. By 1980, it has been forecast,⁹ plutonium will be produced throughout the world at a rate of more than 100 kilograms a day. Such quantities of material contain the potential for production of a substantial amount of the world's electric power. Alternatively, however, they are sufficient for the daily production of many nuclear weapons.

While it is unreasonable and unrealistic to terminate the nuclear power program because of its potential for contributing to the spread of nuclear weapons, the forecast by-product production of plutonium makes it essential that an effective world-wide international safeguards system be established quickly.

There are obviously a number of ways for non-nuclear nations to obtain a nuclear weapons capability, e.g.,

- . the indigenous development of a technology capability;
- . the acquisition of materials or finished weapons supplied for such purpose by a nuclear power;
- . the theft of finished weapons components or assembled weapons; and
- . the diversion of materials developed in, or supplied for, peaceful application of nuclear energy.

Attainment of the objectives of the non-proliferation policy accordingly involves a multifaceted program of formal and informal understandings, including:

- . restricting the transfer of nuclear weapons and nuclear weapons technology to non-nuclear nations;
- . inducements to such nations to refrain from independently developing nuclear weapons; and
- . a safeguards program to protect against the diversion of materials to unauthorized purposes.

The safeguards program is designed to detect promptly, and thereby deter, diversions of special nuclear materials from peaceful programs to weapons applications. In the United States, the "safeguards" program is also expected to detect any diversion to

unauthorized purposes of military materials, weapons, and weapons components, at least until they are transferred by the AEC to the Department of Defense.

The objectives of the safeguards program, properly implemented, can compel nations seeking nuclear arsenals to follow more expensive, and therefore less attractive, routes to nuclear weapons than would be the case if plutonium, for example, were acquired for military purposes as a by-product of a civilian nuclear power program.

Safeguards programs should also be designed in recognition of the problem of terrorist or criminal groups clandestinely acquiring nuclear weapons or materials useful therein. Although such illegal groups are more likely to steal finished components or weapons than divert materials from peaceful programs, criminal organizations may be attracted to divert such materials if a black market develops, as it is likely to. It should be recognized that political and social restraints would not influence terrorist, insurrectionist or criminal groups. Therefore, criminal sanctions, e.g., fines and prison terms, are essential elements of an effective safeguards program.

An international safeguards program can help reduce tensions and perhaps contribute useful precedents for effective disarmament and other peace keeping arrangements.

The Panel recognizes that even if successfully put into practice on a world-wide basis, the safeguards program by itself cannot effectively assure that this country's non-proliferation objectives will be attained. Nonetheless, for the reasons discussed above, the safeguards program is worthy of the active support of all interested governmental agencies.

The Panel believes that the AEC generally has been responsive to its obligations, under the Atomic Energy Act, for safeguarding special nuclear materials. Over the past twenty years there has evolved a safeguards system applicable to AEC cost-type contractors which incorporates most of the essential elements for safeguarding special nuclear materials. The Panel notes that the AEC has recognized the need for modification of its safeguards program in the light of changing activities. The Panel generally concurs with the actions taken and contemplated.

The Panel has noted and recommends steps which the AEC can take to improve its programs. These recommendations are intended to promote a well coordinated, comprehensive safeguard system capable of coping with the rapid escalation in the distribution of nuclear technology and special nuclear materials.

Recommendations

1. The Atomic Energy Act of 1954 and the Atomic Weapons Rewards Act of 1955 should be modified to provide severe criminal penalties for unauthorized diversions of special nuclear materials and to provide rewards for information about such diversions. AEC regulations should require that these provisions be publicized and prominently posted at all installations handling significant* quantities of special nuclear materials.

2. a. Responsibility for policy making and overseeing the safeguards program should be vested in a single AEC office at a level sufficiently high that it can efficiently and economically coordinate this nation's domestic and international safeguards program.
- b. An Interagency Committee composed of representatives of sufficiently high stature from the AEC and such agencies as the Departments of Justice, State, Defense, Commerce, Treasury - as well as the Central Intelligence Agency and Arms Control and Disarmament Agency - should be established to formally involve these agencies in the safeguards program.

*As used herein, significant quantities of special nuclear materials refer to quantities in excess of 5000 grams of contained uranium 235, uranium 233, plutonium, or any combination thereof.

(At the Commission's request, the Panel transmitted on January 20, 1967, its specific and detailed suggestions for an organizational structure designed to achieve these objectives.)

3. All persons having access to significant quantities of unclassified*special nuclear materials should have a clearance equivalent to "L" clearances which are used in the AEC Classified Information Access Program.

4. The AEC, in cooperation with its licensees, should develop minimum physical protection standards applicable to licensees for the safeguarding of special nuclear materials. These standards should take into consideration the strategic importance of special nuclear materials as well as their high dollar value.

5. There should be provisions made for a review by the AEC of the design and construction of facilities that handle significant quantities of special nuclear materials to determine their adequacy for safeguards purposes.

6. Criteria should be established for acceptable limits for shipper receiver differences, materials unaccounted for, quantities discarded or lost, and maximum quantities of special nuclear materials permitted on inventory in forms unmeasurable or which can be measured only with a very large

*For classified materials, special clearances are required by AEC.

error, with due regard for the quantities, form and accessibility of the materials involved. In the event these limits are exceeded, the AEC should require an investigation and report.

7. The quantities and forms of special nuclear materials handled should be principal determinants in establishing the safeguards program. There should be established minimum quantities below which no special safeguards provisions are made.

8. Increased emphasis should be given to systems of internal management control within all organizations handling special nuclear materials in order to minimize the risk of diversions to unauthorized purposes.

9. The United States should intensify its efforts to establish an effective universal safeguards system under the International Atomic Energy Agency. Toward this end the U.S. should encourage:

- a. Euratom and IAEA to arrange for appropriate surveillance by IAEA of the Euratom safeguards program, including active participation as appropriate in inspection of facilities;
- b. Voluntary acceptance by other nations, especially the major powers, of the IAEA safeguards inspections;
- c. The assignment by member nations of qualified personnel to the IAEA safeguards program for terms of at least five to seven years;

- d. International pooling through the IAEA of information regarding diversions (actual, attempted, or potential) of special nuclear materials to unauthorized purposes.
10. a. The AEC should continue the present safeguards policy as provided for in the US-Euratom agreement for cooperation until Euratom and IAEA agree to surveillance by IAEA of the Euratom safeguards system.
- b. The AEC should improve its evaluation of the effectiveness of the Euratom safeguards program.
11. The AEC should increase its research and development effort on safeguards techniques and should encourage and support other national and international efforts to improve safeguards.
12. The United States should encourage the International Atomic Energy Agency and other interested nations to establish an International School of Safeguards to train inspectors, develop research programs, and accumulate and distribute information relating to safeguards.
13. There should be an independent review of the safeguards currently applicable to materials and weapons transferred to the Department of Defense under Section 91b. of the Atomic Energy Act of 1954.

II. Appointment and Charter

While seeking to implement its non-proliferation policy, the United States has encouraged the growth of the peaceful uses of nuclear energy. The nuclear power program has been a success in the United States and in a number of other nations, many of which have participated in cooperative nuclear development programs with the United States. The achievement of economically attractive nuclear power will inevitably result in increasing quantities of special nuclear materials. The general availability of large quantities of special nuclear materials, the likelihood of an increasing number of material enrichment plants, and the widespread competence in nuclear technology which will accompany economic nuclear power could facilitate the development of nuclear weapons capabilities in many countries.

With this prospect becoming imminent, the Atomic Energy Commission has undertaken a review of the safeguards program. In July, 1966, the Commission established an ad hoc Advisory Panel on Safeguarding Special Nuclear Material to conduct an independent review and appraisal of AEC safeguards policies and procedures for special nuclear materials used domestically and distributed by the United States internationally. The following were named to the Panel:

Ralph F. Lumb, Chairman

Director, Western New York
Nuclear Research Center,
Incorporated
Buffalo, New York

Francis P. Cotter

Vice President, Washington Office
Westinghouse Electric Corporation
Washington, D. C.

Gerald Charnoff

Partner, Shaw, Pittman, Potts,
Trowbridge & Madden
Washington, D. C.

Paul Grady

Partner, (ret.),
Price Waterhouse & Co.
New York, New York

Ashton J. O'Donnell

Manager of Development
Bechtel Corporation
San Francisco, California

Louis H. Roddis, Jr.

President, Pennsylvania
Electric Company, a subsidiary
of General Public Utilities
Corporation
Johnstown, Pennsylvania

Fred H. Tingey

Manager, Operations Analysis
Idaho Nuclear Corporation
Idaho Falls, Idaho

Vincent C. Vespe,
Executive Secretary

Director, Division of Operational
Safety
USAEC, Albuquerque Operations Office

Ralph G. Page, Secretary

Chief, Indemnity and Export Control
Branch
Division of State and Licensee
Relations
USAEC, Regulation

In appointing the Panel, the Commission emphasized that the safeguarding of special nuclear materials has always been of high importance to it. Because of the growth of the nuclear industry, particularly the quickening pace of nuclear power commitments, and the advent of private ownership of special nuclear materials, the Commission requested

- . an independent assessment of whether its policies and procedures for safeguarding material are consistent with the needs of national security;
- . the Panel's views and conclusions as to the effectiveness of these policies and procedures in promoting the common defense and security;
- . recommendations for improvements; and
- . the Panel to give special attention to the actions recently taken* and those already under consideration** by the AEC to improve its safeguards program.

III. Approach

The Panel reviewed safeguards procedures applicable to special nuclear materials within the AEC's responsibility and distributed internationally for peaceful purposes.*** The Panel did not independently review the implementation or execution of these policies and procedures; nor did it inquire into the safeguards applicable to materials and weapons transferred to the Department of Defense under

*See references 11, 13, 31, 33, 34, 37, 40 in Bibliography

**See references 16, 19, 20, 21, 22 and 23 in Bibliography

***See Appendix 1 for a list of the organizations represented by persons who were interviewed by the Panel. Also, Appendix 2 lists the nuclear sites visited by the Panel during its study.

section 91b. of the Atomic Energy Act of 1954, as amended. Because these materials and weapons could be in a form more attractive to divertors, the Panel recommends a review of the safeguards currently applicable to such materials and weapons.

Early in its deliberations the Panel recognized that if nuclear energy is to serve mankind, no fool-proof system can be devised to prevent diversion. Material control procedures alone are not sufficient; because of measurement uncertainties associated with complex processes, significant quantities of materials could be diverted within those uncertainties without detection. Other techniques must be sought, found and applied to reduce the probability of diversion.

The Panel has identified the essential elements of a safeguards program.* The programs of the AEC, Euratom and IAEA were examined to see if these elements were present and whether the implementation was credible. This report summarizes the results of that examination.

IV. The Domestic Program

Until safeguards are accepted on a reasonably broad international basis and all peaceful programs in the United States are made subject to such international safeguards,

*See Appendix 3

an effective domestic safeguards program compatible with an accepted international program should be maintained.

A domestic safeguards program should have these elements:*

- . security measures including fences, locks and guards where appropriate;
- . a review of plant designs and construction;
- . an accountability system which includes appropriate records, independent measurement of transfers between operational units, routine physical inventories, routine reporting of material balances for unit operations;
- . written procedures;
- . competent personnel;
- . routine independent reviews of the accountability system, including audits of records, tests of the physical inventory and evaluation of the measurement techniques and the implementation of the procedures;
- . an appropriate intelligence system to warn of the potential and actual diversion of materials, including adequate coordination among such

*See Appendix 3

responsible agencies as the Departments of Commerce, Defense, State, Justice and Treasury, the Central Intelligence Agency and the Arms Control and Disarmament Agency;

- . appropriate criminal penalties for diversion to unauthorized purposes;
- . utilization of an incentive program to encourage improved safeguards practices; and
- . an appropriate reward system for information leading to the detection of diversion and apprehension of the divertors.

The AEC's domestic safeguards program* generally incorporates or recognizes all of the foregoing elements with certain exceptions.

The Panel has been assured and believes that there is no evidence that special nuclear materials used in domestic programs have been diverted to unauthorized use in this country or abroad. But what has been good enough in the past may not meet the test of the future.

Safeguards procedures have not always received adequate attention at senior management levels within

*See Appendix 4

the AEC and within contractor and licensee organizations. On occasion, in pursuit of other programmatic objectives, safeguards implementation has received secondary consideration.

This country should restate its commitment to a single international safeguards system. Concurrently, we should build a model program at home. Organizational changes within the AEC may be required to underscore this importance of the safeguards program and to assure that conflicts with other program objectives are resolved with higher regard for the safeguards objectives.

Recently there has been a determined but informal effort to coordinate the safeguards programs administered by the Division of International Affairs, the Division of Nuclear Materials Management and the Office of the Director of Regulation.^{11, 13} We understand that the coordination in recent months has been reasonably successful. Nevertheless, the Advisory Panel believes that a more formal mechanism is required for directing and coordinating the AEC's safeguards programs and to assure the relative importance of the program as compared with other programs. There is a need to coordinate and direct the development and application of safeguards standards; safeguards related research and

development programs; and domestic and international education programs on the need for, and techniques of, safeguards programs. Informal coordination can only be relied upon for a temporary period. Pressures of other formal responsibilities and changes of personnel ultimately diminish the value of informal coordinating mechanisms.

Similarly, because of the important role of other federal agencies (the Departments of Commerce, Defense, State, Justice and Treasury, the Central Intelligence Agency and the Arms Control and Disarmament Agency) in the over-all safeguards program, the present informal coordination between such agencies should be formalized.

Until recently, in the case of licensees the AEC has primarily relied upon the high intrinsic value of special nuclear materials and criminal penalties for safeguards. As a world commercial market, and perhaps a black market, develops for special nuclear materials, there may develop financial incentives (to criminal elements, if not responsible corporate organizations) working contrary to the objectives of safeguards programs. Thus, the intrinsic value of the material should no longer be primarily relied upon to provide safeguards. The AEC, accordingly, has recently improved its accountability controls over leased and privately owned special nuclear materials.

The improved accountability controls should be supplemented with more severe criminal penalties and with offers of rewards for information leading to the arrest of persons engaged in illegal transactions involving special nuclear materials. While the penalties for misusing special nuclear materials with an "intent to injure the United States or gain advantage to a foreign power" are severe (persons convicted of such crimes are punishable by death), persons diverting such materials with any other intent are only punishable by five years confinement and a fine of \$10,000. This may not be a sufficient deterrent to illicit transactions involving materials valued in excess of millions of dollars. While the Atomic Weapons Rewards Act provides a reward for certain information, it does not provide a reward for information concerning the diversion of special nuclear materials to unauthorized use.

Both the Atomic Energy Act of 1954 and the Atomic Weapons Rewards Act may require amendment to increase the severity of the penalty for illegal transactions of special nuclear materials and to establish the recommended rewards program. When and if enacted, the criminal and rewards provisions should be posted prominently at locations where significant quantities of special nuclear materials are used.

The threat of detection and more severe criminal penalties should help deter organizations and individuals from attempting to divert materials to unauthorized uses. In most cases, detection will be aided by the interrelationship of procedures for accountability control, production control, manufacturing control and quality control. Nevertheless, diversions may be attempted and may succeed without immediate detection. After such a diversion is detected, pre-established procedures for identifying and apprehending the divertor(s) and recapturing the material must be promptly implemented. This will require provisions for informing police departments, the Federal Bureau of Investigation, the Central Intelligence Agency and customs officials, and for identifying diverted materials.

V. The International Program

However effective the domestic safeguards program may be, it will not materially contribute to limiting the proliferation of nuclear powers unless it is complemented by an equally effective international program. Accordingly, the Panel reviewed the AEC's international safeguards program* which currently is directed at

*See Appendix 5

- . implementing the safeguards provisions of the bilateral agreements for cooperation which have not been transferred to the IAEA safeguards system.
- . enlarging and enforcing the safeguards program and responsibilities of the International Atomic Energy Agency, and
- . accepting, at least for the time being, and encouraging the effective development of the European Atomic Energy Community (Euratom) safeguards program.

A. The Bilateral Program

Subsequent to the enabling legislation for the Atoms for Peace Program, the U.S. has entered into many bilateral agreements for cooperation which provide for the transfer of special nuclear materials to foreign nations. Each of these agreements provides for the application of safeguards to the special nuclear materials. These safeguards include the AEC review of procedures for accounting for the materials, the reporting of transactions involving the materials, and an inspection of the materials in the foreign nation.

In recent years, the U.S. has been transferring these safeguards functions to the IAEA by agreement. Today there are sixteen bilaterals still in force under which the safeguards provisions are implemented by the AEC, and eleven or twelve of these are expected to be transferred to the IAEA this year. The remaining four or five should be transferred in the near future if all parties can reach mutual agreement. Consequently, the recommendations of this report do not address themselves directly to the bilateral safeguards program. However, so long as this program is perpetuated, the essential elements of an adequate safeguards system are generally applicable.

B. The IAEA Program

It is significant and salutary that the IAEA safeguards program has been accepted, in principle, by so many nations. It would be a safer world indeed if all nations subscribed. Conceptually, the acceptance of IAEA safeguards, including the provision of inspection, represents vital and significant progress towards an effective system of international control.

The IAEA safeguards system, applicable to research and power reactors, has been defined and developed during the past six years. It is being extended to

chemical reprocessing plants and ultimately should extend to other sensitive areas of the nuclear fuel cycle. It now requires expansion to cover a larger number of facilities and countries, consistent with the availability of a sufficient number of trained personnel. The current United States policy of transferring its safeguards rights and responsibilities under bilateral agreements for cooperation to the IAEA is progressing satisfactorily and should encourage greater world confidence in the IAEA. All nations should be encouraged to place their peaceful facilities and nuclear materials under IAEA safeguards.

While the IAEA safeguards program is directed at detecting diversions of special nuclear materials, the system fails to provide any mechanism for determining, after a diversion is detected, whether the diversion was undertaken by a terrorist or insurrectionist group, a black marketeer, or a government unit intent on developing a nuclear weapons capability.

A small but competent staff appears to have been developed by the IAEA to administer its safeguards program. By employing international teams of qualified inspectors, IAEA inspection findings should continue to gain in credibility and acceptability. It is obviously essential to encourage the IAEA to maintain

employment opportunities which will attract competent inspectors to the IAEA staff. A vigorous international research and development program directed at improving measurement tools and inspection techniques could contribute to the satisfaction and rewards of such employment and would help optimize the utilization of the large number of inspectors needed to accommodate the predicted growth in peaceful nuclear applications.

C. The Euratom Program

Until there is broad acceptance of the IAEA safeguards program, regional safeguards systems such as that of Euratom's must be accommodated, although care should be exercised that such accommodation not be misunderstood as being contradictory to the long term goal of a single international system of detection and control by an international body like the IAEA.

Obviously, an international system is more credible than a regional system. Nevertheless, in the light of the long-term historical rivalries, the Euratom regional system can contribute some confidence that the member state peaceful programs are not being subverted to weapons objectives.

The Euratom safeguards program as applied to U.S.-supplied special nuclear materials is required to be compatible with the IAEA program. The Panel believes that the Euratom program in fact is generally compatible with that of IAEA.* The AEC has acquired considerable confidence in the Euratom program as a result of the technical competence of the Euratom staff. However, because the U.S. has no direct evidence of the implementation of the Euratom safeguards procedures, in the opinion of the Panel there is not an adequate basis for the United States to formulate an independent opinion as to the effectiveness of implementation of the Euratom safeguards program.

Under the Euratom safeguards system all peaceful activities within the Euratom community are subject to safeguards control. While this is more comprehensive than the IAEA system, which applies only to those peaceful activities that member nations elect to place under IAEA safeguards as provided for in Article III.A.5. of the IAEA statute, it does allow for the withdrawal, albeit on notice, of facilities or material that a Euratom member nation may elect to convert to defense purposes.

*See Appendices 6 and 7.

Unlike the United States, the Euratom program does not require the application of safeguards to special nuclear materials exported by the member countries to non-member countries. This is not consistent with the internal Euratom safeguards program and allows the observation that U.S. material supplied to Euratom permits member countries to transfer out of Euratom equivalent quantities of special nuclear materials free of safeguards. Transfers by Euratom of U.S. supplied material, however, must be made in accordance with the U.S.-Euratom agreement which requires that the material be appropriately safeguarded.

U.S. exports of special nuclear materials to Euratom should be conditioned upon the U.S. acquiring more direct evidence of effective implementation of the Euratom safeguards program, upon a Euratom commitment to require IAEA safeguards controls on special nuclear materials exported by its member countries, and upon a determination by the United States that the exports will not result in the release of equivalent quantities of special nuclear materials from peaceful programs in the Euratom community to military purposes.

The urgency to promote the IAEA system should not be accompanied by efforts to dismantle the Euratom system, if it otherwise is contributing to the non-proliferation objectives. Rather, the Panel favors the evolution of a cooperative relationship between the Euratom and IAEA programs, under which the latter would audit or inspect the efficacy of the Euratom program. Such a relationship would offer the increased assurance provided by dual multilateral inspections and would reduce the required increase in IAEA manpower needs.

VI. Special Considerations

Prior to and concurrent with the Panel's activities, a large number of studies were conducted of special aspects of the safeguards problem. The results of these studies were invaluable to the Panel and many answered specific questions. Certain topical studies warrant further discussion.

A. Recent Amendments to 10 CFR 70

On February 3, 1967, the Commission issued amendments to its regulations in 10 CFR Part 70 requiring each licensee, who is authorized to possess a quantity exceeding 5000 grams of contained uranium 235, uranium 233, plutonium, or any combination thereof, to:

- a. establish and maintain written material control and accounting procedures to account for the special nuclear materials in his possession;
- b. submit a full description of his procedures for control of and accounting for special nuclear materials (required only for activities other than those involved in the operation of a nuclear reactor or as sealed sources);
- c. identify to AEC the fundamental controls which he considers essential for assuring that special nuclear materials in his possession are adequately safeguarded (as in (b) above not required for certain activities); and
- d. perform an inventory not less often than annually.

In accordance with the Commission's request, the Panel reviewed the proposed amendments, discussed them in detail with the staff of the Director of Regulation, and transmitted written comments to the Director of Regulation on November 8, 1966. These comments are discussed in AEC-R 38/13 dated January 16, 1967.²³ The Panel generally concurred in the proposed amendments to 10 CFR 70 but noted the need for specific criteria with regard to those

fundamental control procedures which will be incorporated into a license, and the need for publication of such criteria. The Panel noted that "the staff intends to utilize appropriate standards as interim criteria in determining the adequacy of the licensee's material control accounting system."²³ The Panel suggested that such standards be published for information of licensees, and concurs that "work needs to be done in refining these criteria and in the development of more definitive standards."²³ It is important that this work be expedited.

B. Strategic Importance

The results of the "Study of Strategic Importance of Nuclear Materials"¹⁵ prepared by the AEC, December 5, 1966 (classified) has been made available to the Panel. It has been invaluable in providing a proper perspective. The Panel highly recommends it to those individuals responsible for implementing the AEC safeguards program as an excellent basis for reaching judgments with regard to the degree of effort needed in specific situations, such as frequency of physical inventory, frequency of inspections, precision and accuracy of measurements, etc. In this regard, the Panel believes this report generally

supports the IAEA schedule of inspection frequency which is determined by the quantities of materials in inventory, through-put, or production capability of the facility.

After considerable deliberation, the Panel concludes that there is justification for the concept of a de minimis quantity from a safeguards point of view. Recognizing the hypothetical possibility of diverting many small inventories and thus accumulating sufficient material to construct a weapon, the Panel considers that the extent of the collusion necessary, together with the criminal penalties, rewards, and present health and safety regulations, reduces this risk considerably below the risk of diversions which may be attempted within normal measurement uncertainties at power reactor installations and at fuel reprocessing and fabrication plants. Efforts can far better be directed toward reducing these limits of error rather than accounting for small quantities of materials.

C. Resident Inspectors

The Panel has been provided with the results of the AEC study relating to the use of resident inspection in the domestic program.¹⁶ It has discussed the concept of resident inspection at length

with the management and operational staff at many facilities, both licensees and non-licensed contractors.

The Panel concludes that resident inspection is one of many techniques which can be employed to provide assurance that materials are not being diverted to unauthorized use. For certain types of facilities, and under certain circumstances, resident inspectors may be necessary but alone are not sufficient for adequate safeguards. Like all other techniques, there is an optimum return for a given investment in time or effort. Judiciously used, resident inspectors can make a contribution to safeguarding special nuclear materials. In the Panel's opinion the most effective inspector is a well qualified technical man with experience providing him background in the disciplines associated with safeguards practices, such as auditing and accounting, statistics, nuclear chemistry and physics, intelligence, etc. The inspector should have complete and free access to all parts of the facility. Random visits by such an inspector to various sections of the plant, combined with his random acquisition of data and testing of measurements could act as a deterrent to illicit operations.

D. Certified Public Accountants

As a consequence of industry comments on proposed amendments²¹ to 10 CFR 70, the AEC undertook a study²² to determine the feasibility of independent audits by public accountants to verify licensee accountability systems and inventories of special nuclear materials. The AEC study group concluded²² that, in the absence of AEC special instructions, independent audits for the purpose of expressing an opinion on financial statements included in reports to stockholders are not sufficiently extensive to verify special nuclear material controls in a safeguards system, but that the capability for such audits could be established if a requirement were promulgated. Additionally, the American Institute of Certified Public Accountants, in cooperation with the AEC staff, is studying the question.

The concept of the AEC utilizing the independent audit by CPA firms as a facet of the AEC safeguards program merits intensive study. To be effective, auditing programs must be carefully developed and applied in order to permit the independent accountant to render the specific type of report required by the AEC. Of special importance is the inclusion on the audit staff of competent technical personnel. Further, there must be developed a review system to establish the dependability

of the audit opinions to meet AEC requirements. Appropriately planned, independent audit reports in support of the AEC safeguards program can result in increased effectiveness of the system with substantial economies to the AEC. The Panel was interested to note that precedent for reliance on independent audit firms exists in the AEC uranium concentrate procurement program.

E. Standards and Criteria

On December 16, 1966, the General Manager convened a special meeting of AEC's Advisory Committee for Standard Reference Materials and Methods of Measurement to obtain advice, guidance and recommendations on the feasibility of developing more definitive standards and criteria for safeguarding special nuclear materials. A copy⁴⁶ of the subsequent report of that Advisory Committee was furnished the Panel on January 27, 1967. Similar views will be found in the discussions and recommendations of this report. The Panel believes that recommendations 1-5 and 8 of that report⁴⁶ warrant AEC study and appropriate implementation. Because the Panel has not had an opportunity to discuss recommendations 6 and 7 of that report with the Advisory Committee, it has not independently formulated any opinion thereon.

At the 1966 annual meeting of the Institute of Nuclear Materials Management, Mr. John Conway, Executive Director, Joint Committee on Atomic Energy, challenged the Institute to seriously consider the problem of policing a non-proliferation agreement and seek ways to aid the government in achieving its safeguards objectives.¹² The Institute did give serious consideration to the problem during ensuing months and transmitted* to the Panel a proposed standards program to be pursued by the Institute, as well as some suggestions as to steps the government may take to reinforce its safeguards program.

The Panel believes that the AEC should continue its efforts to develop more definitive standards and criteria for safeguarding special nuclear materials, and especially suggests that such organizations as the American Society of Testing Materials, the USA Standards Institute, and the Institute of Nuclear Materials Management should be encouraged by the AEC to participate in this activity.

VII. Recommendations

Recommendation 1

The Atomic Energy Act of 1954 and the Atomic Weapons Rewards Act of 1955 should be modified to provide severe

*See Appendix 8.

criminal penalties for unauthorized diversions of special nuclear materials and to provide rewards for information about such diversions. AEC regulations should require that these provisions be publicized and prominently posted at all installations handling significant* quantities of special nuclear materials.

Commentary

The criminal provisions of the Atomic Energy Act may be inadequate to deter and sufficiently punish illegal sales of special nuclear materials. The present provisions of the Atomic Energy Act describe illegal transactions in special nuclear materials as two crimes of separate gravity.

If there is "intent to injure the United States or gain advantage to a foreign power," the crime is punishable by death if the jury so recommends. This specific intent is pointed at a political motivation rather than a financially rewarding criminal purpose. For example, a sale to an undisclosed principal or even to a terrorist organization not bent on injuring the United States could lack this intent.

The second crime is one where there is only general intent and is punishable only by five years confinement and a fine of \$10,000.

*As used herein, significant quantities of special nuclear materials refer to quantities in excess of 5000 grams of contained uranium 235, uranium 233, plutonium, or any combination thereof.

The punishment for the non-political crime seems inconsistent with the seriousness of the wrong doing and its potentially grave consequences. The punishment would seem to be an inadequate deterrent if the anticipated profits were in the order of millions of dollars. This penalty provision should be more severe.

During the period of our study, a Federal District Court held that a provision calling for jury recommendation of a death sentence in the Lindbergh Law made the Law unconstitutional. The criminal provisions of the Atomic Energy Act are similar.

The Atomic Weapons Rewards Act of 1955 only authorizes rewards for original information relating to the introduction of special nuclear materials or nuclear weapons into the United States, or the unauthorized construction of a nuclear weapon within the United States. We believe that the diversion of special nuclear materials to unauthorized purposes is also a grave matter, and a system of rewards should be established.

Deterrence and detection would be promoted by conspicuous posting of notices about penalties and rewards at locations where there are significant quantities of special nuclear materials.

A study should be conducted of our Extradition Treaties with the many nations to see if safe havens are readily available for violators of the special nuclear materials control laws.

Recommendation 2

- a. Responsibility for policy making and overseeing the safeguards program should be vested in a single AEC office at a level sufficiently high that it can efficiently and economically coordinate this nation's domestic and international safeguards program.
- b. An Interagency Committee composed of representatives of sufficiently high stature from the AEC and such agencies as the Departments of Justice, State, Defense, Commerce, Treasury - as well as the Central Intelligence Agency and Arms Control and Disarmament Agency - should be established to formally involve these agencies in the safeguards program.

(At the Commission's request, the Panel transmitted on January 20, 1967, its specific and detailed suggestions for an organizational structure designed to achieve these objectives.)

Commentary

The Atomic Energy Commission in its role as a producer and promoter is responsible for developing and manufacturing nuclear weapons, pursuing other military uses for nuclear energy, adapting atomic energy to peaceful uses, and conducting basic research. Another rapidly growing responsibility is in the "Fourth Branch of Government" - regulating the private atomic power sector.

In these functions, and in its international activities under Agreements for Cooperation, the Commission has vested safeguards responsibilities in three separate management organizations. To date, the AEC safeguards experience has been good, but as we look to the future and the sharp increase in the production and distribution of special nuclear materials, this diffusion of responsibility will bring about increased diversity of objectives, policies, procedures and standards.

It is the Panel's opinion that the Commission should consolidate in a single office the responsibility for establishing (but not implementing) objectives, policies, procedures, standards and for promoting efficiency and economy. Programs of research and development, and education and training in safeguards should also be managed by this office. This office would also conduct reviews of the effectiveness of implementation of the policies and

procedures and an assessment of the degree to which standards are being met. We recognize this could cause duplication, but good managers can minimize it.

The Panel noted that frequently when other programmatic objectives were being pursued, the problem of safeguarding special nuclear materials has not received high level management attention. A single office, reporting at a high level and charged with the safeguards responsibility would assure that decisions are made with due consideration.

The Panel believes that, as private ownership becomes widespread, it is quite probable that all regulatory functions of the AEC will be organized independently of the operating and research functions, and that the safeguards function then appropriately will be divorced from operational pressures.

It appears obvious to the Panel that many government agencies have a part to play in a good safeguards program. Not only may the special talents and knowledge of these agencies be useful, but their communication channels, prestige, and influence can be brought to bear on safeguards problems to good advantage.

It is recognized that informal liaison currently exists among these agencies, but the Panel believes that a formal involvement, at an appropriate level, will enhance their contribution to the safeguarding of special nuclear materials.

Obvious areas of necessary involvement include, in addition to the promotion of a single universal safeguards system, procedures and techniques for detecting clandestine export and import of special nuclear materials. Another area of involvement is that of intelligence - for example, information concerning a potential diversion may first come from the intelligence community.

Every effort should be made to insure timely notification of the opening of blackmarkets in the world for special nuclear materials. It is not clear that such markets exist today, although the Panel understands that a "fence" was involved in the recent theft of fuel elements (containing natural uranium) from the Bradwell Reactor in England.

In the Panel's opinion, effective coordination and cooperation of these agencies with the AEC can make a major contribution to an effective safeguards program.

Recommendation 3

All persons having access to significant quantities of unclassified* special nuclear materials should have a clearance equivalent to "L" clearances which are used in the AEC Classified Information Access Program.

*For classified materials, special clearances are required by AEC.

Commentary

We believe, because of the risks involved, that the Commission should assure itself with respect to licensee operations, as it does in its own programs, that persons having working access to significant quantities of special nuclear material are of good character and loyal citizens of the United States.

The Panel noted that this is the practice, on a voluntary basis, in some licensee facilities; however, many licensee facilities only check names at local police agencies to see if a person has a criminal record.

Because of the high mobility of today's work force, only the examination of central Federal records makes it possible to determine, with any assurance, that a person does not have a criminal or other high risk background.

Recommendation 4

The AEC, in cooperation with its licensees, should develop minimum physical protection standards applicable to licensees for the safeguarding of special nuclear materials. These standards should take into consideration the strategic importance of special nuclear materials as well as their high dollar value.

Commentary

At present licensees are not required to follow any specific physical protection standards. On the other hand, AEC contractors who are not financially responsible for the special nuclear materials they possess are required to provide such physical protection in complying with AEC Manual Chapter 2401. This manual chapter recognizes degrees of accessibility as to form, quantity and material, and specifies minimum security protection therefor.

A recent report²⁴ by the Division of Compliance indicates that there are a total of 39 licensed major processors of special nuclear materials. A survey of 21 of these locations was made. Nine of these currently employ practices comparable to AEC Manual Chapter 2401 and three more would have been comparable if "L" clearances had been in effect for certain personnel as is separately recommended by this Panel. Most of the rest of the departures would appear to be comparatively minor and their correction not an onerous task. The suggestion is therefore made that minimum physical protection standards applicable to licensees handling special nuclear materials be developed and applied. Manual Chapter 2401 would certainly represent a point of departure for such standards.

Recommendation 5

There should be provisions made for a review by the AEC of the design and construction of facilities that handle significant quantities of special nuclear materials to determine their adequacy for safeguards purposes.

Commentary

Although some facilities are reviewed in the design stage for health and safety features by the AEC, inspections for safeguards features have not been required in the past. The construction of new plants or substantial modifications of old facilities may significantly influence two facets of safeguards - physical security and the ability to account for the materials. Hence, construction plans should be reviewed to insure that these aspects of safeguards are adequately included in the planned construction and on-site inspection should be conducted to insure that the safeguards features are appropriately built into the facility. While no such requirement for plant approval and verification can guarantee that some clandestine diversion features are not built into the plant, it would insure that such features are more difficult to build in and would furthermore insure that some degree of management attention is given to the safeguards

problem in the design of the facility just as is done in connection with criticality or health and safety problems.

In establishing these requirements the AEC must be prepared to handle the review and inspections expeditiously and unobtrusively so as to cause no unnecessary delay in the engineering and construction of facilities.

Recommendation 6

Criteria should be established for acceptable limits for shipper-receiver differences, materials unaccounted for, quantities discarded or lost, and maximum quantities of special nuclear materials permitted on inventory in forms unmeasurable or which can be measured only with a very large error, with due regard for the quantities, form, and accessibility of the materials involved. In the event these limits are exceeded, the AEC should require an investigation and report.

Commentary

Shipper-receiver differences, materials unaccounted for, measured discards and losses are the principle indicators of the degree of control being exercised over materials. To be valid indicators, shipper and receiver must independently measure the quantities transferred,

and materials unaccounted for must be based upon a physical inventory which has a small uncertainty associated with it; i.e., a small fraction of the inventory in the form of unmeasured quantities or quantities measured with large errors. The absolute value of these indicators reflect the potential for diversion. Consequently, to be useful, criteria must be established for acceptable limits.

The AEC presently is reviewing criteria for shipper-receiver differences. The Panel believes that these criteria are appropriate and should be adopted generally.

In the case of materials unaccounted for, discards and losses, the Panel does not believe it is practical to establish acceptable limits applicable uniformly to all facilities. However, the AEC should review each unique operation and establish what it believes to be reasonable quantities above which an investigation should be initiated. It should rely not only on past history of such operations, but upon its technical judgment of the degree of control achievable, considering the type of operation and the equipment available. Through long experience at non-licensed AEC contractor facilities, informal criteria of this nature have been developed. The Panel believes that such criteria should be formalized and applied to facilities processing

significant quantities of special nuclear materials. When these acceptable limits are exceeded, the organization holding the material should be required to conduct an investigation into the circumstances surrounding the excessive uncertainty and to report its findings to the AEC. Based on these reports, the AEC can then make an intelligent judgment as to whether or not a special investigation by the AEC is warranted.

In connection with the transfer of materials, the Panel noted that in many instances in the AEC licensee program there is a lengthy delay between the shipment of the material and the receipt of notification of its arrival at the destination. Where significant quantities of special nuclear materials are involved, special procedures should be developed to confirm receipt or establish whether or not in-transit materials have been diverted.

The degree to which an inventory of special nuclear materials can be confirmed by measurement or test will determine the accuracy of a stated inventory. Thus the accumulation of significant quantities of special nuclear materials in forms which are unmeasurable or measurable only with a large error introduces a large uncertainty in the inventory value.

The accumulation of large quantities of special nuclear materials in unmeasured forms defeats safeguards purposes in two ways. First, the need for timely knowledge concerning potential diversion is compromised when such quantities remain on hand for long periods of time. Second, equivalent quantities of special nuclear materials could be diverted and the values assigned to the unmeasured material.

In the past, there have been large quantities of special nuclear materials accumulated as scrap and stored for periods as long as ten years. During the early years of the atomic energy program the shortage of manpower and facilities, and the urgency of programs, required that difficult to recover materials be stored. The Panel believes that manpower is now in sufficient supply and facilities are or can be made available to keep scrap inventories to a minimum.

Recommendation 7

The quantities and forms of special nuclear materials handled should be principal determinants in establishing the safeguards program. There should be established minimum quantities below which no special safeguards provisions are made.

Commentary

The Panel believes it is self-evident that the amount of effort involved in the safeguards program should be consistent with the risks associated with the materials at particular facilities. The Panel notes that the International Atomic Energy Agency has a schedule relating the frequency of inspections to the quantity of materials in inventory, the annual through-put at the facility, or the production capability of the facility, whichever is the larger. The Panel recommends that the AEC develop a similar schedule. However, in implementing the program, the Panel suggests that in addition to the quantities involved, consideration should be given to the relative accessibility of the materials. Hence, though a power reactor may have a larger inventory of special nuclear materials, physical inventory requirements and inspections might be less frequent than at a chemical processing plant with smaller quantities of materials, but a higher degree of accessibility. Certainly the risk of diversion of irradiated fuel in the form of identifiable items is much less than the risk of diversion of unirradiated materials in the form of unidentifiable solutions or chemical compounds.

The Panel has reviewed the AEC's study on strategic quantities of materials¹⁵ and has addressed itself to the

appropriateness of a de minimis quantity for safeguards purposes. In view of the value of the material, the criminal penalties, and the health and safety provisions of the AEC regulations, the Panel believes it is reasonable to exempt from any special safeguards provisions all facilities which have an inventory, an annual throughput, or a production capacity of less than 350 grams of special nuclear materials.

The rationale for choosing the 350 gram quantity is based on the opinion that it would take an unreasonable amount of collusion to put together enough material from a number of such facilities to constitute the same degree of risk as is nominally associated with the measurement uncertainties at such facilities as fuel fabrication plants or reprocessing plants. Further, 350 grams is the maximum quantity which may be licensed by an agreement State for use at any location.

Recommendation 8

Increased emphasis should be given to systems of internal management control within all organizations handling special nuclear materials in order to minimize the risk of diversions to unauthorized purposes.

Commentary

Safeguards programs involve at least three general areas of responsibility:

- a. Establishment of regulatory requirements to protect public health, safety and security;
- b. Implementation of these requirements by the organization performing the work with special nuclear materials; and
- c. Surveillance and evaluation of the adequacy of all procedures.

In recommending that in each of these there should be increased emphasis on the adequacy of the system of internal control, the Panel emphasizes that there is a real danger, even among persons directly concerned with safeguards problems, that internal control may be viewed too narrowly and that too little attention may be given to the interrelationship of all elements of the system.

The broader concept of internal control was expressed by the Committee on Auditing Procedure of the American Institute of Certified Public Accountants in a special report,* which defined internal control as comprising the plan of organization and all of the coordinate methods and measures adopted within a business to safeguard its assets, check the accuracy and reliability of its accounting data, promote operational efficiency and encourage adherence to prescribed managerial policies.

*See Appendix 9.

The Committee indicated that a satisfactory system would include:

- . appropriate plan of organization;
- . adequate system of authorization and records procedures;
- . sound practices; and
- . qualified personnel

The physical and chemical nature of the various forms of special nuclear materials require specialized plant and equipment facilities for the processing, storage, use and protection of the materials. Accordingly, in considering safeguards programs, physical plant and equipment facilities suitable to the specific purposes should be added to the four general elements of internal control listed above.

It is obvious that the primary responsibility for implementing the materials control elements of the safeguards system must rest upon the organization engaged in the handling of special nuclear materials. It is important that surveillance agencies be continuously aware that weaknesses in the implementation of the materials control programs by the entity performing the operation cannot be patched-up by simply adding layers of surveillance, examination and inspection.

The policy of requiring licensees and contractors to submit written plans of organization, flow of production, description of physical facilities, record control procedures and forms, personnel data and plans for physical inventories for review and appraisal by the AEC is of key significance in the safeguards programs. This is the point at which the AEC must decide whether the applicant has sufficient resources in management capabilities, physical facilities, scientific technology and economic resources to be entrusted with the tasks to be undertaken in the processing and use of special nuclear materials.

After the license or contract has been granted, it is important that the plans are effectuated in such a manner as to provide effective internal control in all phases of operations. Even after this stage of accomplishment has been attained, there must be continuous attention by all levels in management of the enterprise to see that a satisfactory system is maintained and, of course, suitable programs of surveillance, examination and inspection by the AEC are required to meet its safeguards responsibilities.

The comments regarding this recommendation have purposely dealt with the broader aspects of internal control. In order to be somewhat more specific and without representing that the list is all-inclusive, the

Panel has summarized in Appendix 3 an outline of essential elements of a safeguards system for special nuclear materials.

Although implicit in the foregoing remarks, the panel explicitly notes that these considerations are equally applicable to the international safeguards programs; past and present practices are somewhat deficient with respect to the amount of attention given the broad aspects of internal control.

Recommendation 9

The United States should intensify its efforts to establish an effective universal safeguards system under the International Atomic Energy Agency. Toward this end the U.S. should encourage:

- a. Euratom and IAEA to arrange for appropriate surveillance by IAEA of the Euratom safeguards program, including active participation as appropriate in inspection of facilities;
- b. Voluntary acceptance by other nations, especially the major powers, of the IAEA safeguards inspections;
- c. The assignment by member nations of qualified personnel to the IAEA safeguards program for terms of at least five to seven years; and

- d. International pooling through the IAEA of information regarding diversions (actual, attempted, or potential) of special nuclear materials to unauthorized purposes.

Commentary

The longstanding policy of the United States to pursue a course leading to a single international safeguards system requires constant attention and specific actions if that goal is to be attained. The actions recommended above would constitute further evidence of U.S. intentions, and additional strengthening of IAEA safeguards.

The perpetuation of independent safeguards systems outside the purview of IAEA should be discouraged and means sought to encompass them within the IAEA system. In the case of Euratom, efforts should be exerted to accelerate a joint Euratom-IAEA agreement arranging for surveillance by IAEA of the Euratom safeguards program. Such surveillance should include not only review of work papers and reports, but also active participation in occasional inspections of facilities.

The United States has succeeded in demonstrating to the world the significance it attaches to an international safeguards system through acceptance of IAEA safeguards

on various facilities and operations in this country. The transfer of bilateral safeguards to the IAEA has given further evidence of our confidence in such a system. To a lesser but still significant extent, the United Kingdom and Canada have taken similar actions.

It is not enough that so few countries demonstrate their support of and belief in the IAEA. The acceptance of IAEA safeguards and the active support of the Agency's activities in this area must be encouraged on the part of all member states, particularly by the major powers. The community of nations watches with interest the extent to which actions by the Western nations are matched by the Soviet and Eastern European countries. The significance of even modest steps indicating further extension of IAEA safeguards must not be discounted.

Recent indications by several nations of Eastern Europe of their willingness to accept IAEA safeguards either on certain national facilities, or as the consequence of the sale of a nuclear power reactor, are most encouraging. The U.S. should utilize every reasonable means at its disposal to effectuate such a transaction. Only through such actions will international safeguards become a viable concept.

The IAEA has about one dozen professional employees on its safeguards and inspection staff. Few are long-term employees, and if present practice applies in the future, a two or three-year tour of duty is normal. If the Agency is to meet the anticipated workload, resulting from the rapid increase in utilization of nuclear power, means must be found to increase the staff with qualified personnel, and to extend their normal tour of duty to a term of sufficient length to permit the staff to be informed and effective. A minimum term of 5 - 7 years is suggested.

The responsibility for increasing the staff and improving its effectiveness lies first with the member states of the IAEA. They must first provide for an increased budget. They must then be prepared to furnish qualified personnel from their own domestic programs to serve on the Agency's staff. Arrangements must also be made for extended leaves of absence for these individuals, with appropriate re-employment rights assured.

In the context of the Agency it seems desirable to employ safeguards and inspection staff on long-term (5-7 years) renewable employment contracts, rather than permanent contracts. A program should be undertaken to

ensure high morale, a sense of responsibility and importance, and a moral as well as professional commitment on the part of the staff.

With the growth of a worldwide open market in special nuclear materials there will be increasing opportunity for diversion of these materials to unauthorized uses. Of utmost importance to effective international safeguards will be the prompt flow of information regarding impending, attempted, and actual unauthorized diversions. Means should be sought to facilitate the transfer of pertinent information to a central body, probably the IAEA. With such information it would be possible to better utilize personnel and procedures to thwart a threatened diversion, or to recover material actually diverted.

Recommendation 10

- a. The AEC should continue to implement the present safeguards policy as provided for in the U.S.-Euratom agreement for cooperation until Euratom and IAEA agree to surveillance by IAEA of the Euratom safeguards system.
- b. The AEC should improve its evaluation of the effectiveness of the Euratom safeguards program.

Commentary

The Division of International Affairs has summarized for the Panel steps taken to assure adequate Euratom safeguards and the cooperative measures AEC, Euratom, and IAEA have employed.* The Panel is encouraged by this evidence of cooperation, as well as the intent for improved cooperation between IAEA and Euratom which was evident in discussions with both agencies. The demonstrated technical competence of Euratom safeguards personnel provides a degree of confidence in the Euratom program, and the political heritage of the cooperating nations ensures that national programs will come under close scrutiny and render as rather improbable a conspiracy to divert peaceful materials to military purposes. Nonetheless, the Panel believes that the U.S. does not have an adequate basis for an independent opinion regarding the effectiveness of Euratom safeguards. The Panel believes that the agreement,**which provides the U.S. with permission to verify by mutually approved scientific methods the effectiveness of Euratom safeguards, is a basis for initiating the audit of Euratom work-papers and the observation of Euratom inspections. Such techniques will further improve our confidence in Euratom safeguards, pending the surveillance of Euratom safeguards by the IAEA.

*See Appendices 6 and 7.

**See Appendix 6

Recommendation 11

The AEC should increase its research and development effort on safeguards techniques and should encourage and support other national and international efforts to improve safeguards.

Commentary

An important factor in the achievement of an adequate safeguards program is the existence of techniques which facilitate the application of safeguards. A program to develop safeguards techniques and procedures is essential.

In the first ten years of its operation, the Division of Nuclear Materials Management established no research program, had no research budget and initiated no studies aimed at the development of improved safeguards techniques. During this period it relied exclusively upon research and development activities of the AEC's major contractors to improve measurement techniques and only indirectly was able to encourage research and development in a few areas aimed specifically at improved control of materials. In 1957, it undertook an extensive program to develop and maintain a material standards program in cooperation with the National Bureau of Standards, which by 1963, had cost two million dollars. Subsequent to 1963, the National Bureau of Standards has undertaken complete support of the standard materials program. In the ensuing years the Division of

Nuclear Materials Management has allocated nearly a million dollars in additional funds to activities of benefit to safeguards. About \$325,000 has been devoted to an inter-comparison of laboratories in the measurement of special nuclear materials; about \$400,000 was devoted to the development of improved control techniques; and the balance was devoted to studies aimed at improving material control procedures.

Since 1956 the Division of International Affairs has obligated approximately two million dollars, of which the majority is devoted to studies of safeguards procedures for a variety of nuclear facilities. It is estimated that approximately \$400,000 was allocated to research and development aimed at new information and techniques for safeguarding special nuclear materials. The International Atomic Energy Agency in the same period invested approximately \$350,000 in research and development aimed at improving techniques for surveillance. Euratom has no budget and no organized research and development program in safeguards. However, member states are encouraged to develop improved safeguards techniques within their regular operating programs.

In reviewing the activities sponsored by the Atomic Energy Commission, the Panel notes that there has been little overlap in the program sponsored by the Division of

International Affairs and the Division of Nuclear Materials Management, and further that the programs sponsored were mutually useful. In the case of the International Atomic Energy Agency we also note little duplication of U.S. efforts. However, in analyzing the efforts by the Division of International Affairs, the Division of Nuclear Materials Management, and the International Atomic Energy Agency in the last decade, it is noted that each organization has invested an average of only \$40,000 a year in research and development devoted to improved safeguards techniques. In the opinion of the Panel, this is an extremely low budget for research and development on a subject as important as safeguards.

It is recognized that the amounts stated above are probably a significant understatement of the total research and development effort which has been of benefit to the safeguards program. Through the years AEC major contractors have continued to develop new and improved measurement techniques for special nuclear materials. Nonetheless the Panel believes that an imaginative and intensive coordinated research and development program needs to be developed, appropriately funded and implemented.

A corollary benefit to a safeguards research and development program will be the increase in manpower available to carry out safeguards work. The continued

growth of domestic and international nuclear activities will result in a shortage of knowledgeable safeguards personnel. If safeguards programs are to be effective, an adequate supply of manpower trained in safeguards work must be available. A continuing research and development program in safeguards will provide a supply of trained manpower. Further, the development of new techniques will contribute to optimum effectiveness of the available manpower.

Recommendation 12

The United States should encourage the International Atomic Energy Agency and other interested nations to establish an International School of Safeguards to train inspectors, develop research programs, and accumulate and distribute information relating to safeguards.

Commentary

The Panel believes that the current practice of on-the-job training is inefficient and unsuitable for the future safeguards program. It is particularly poor for IAEA inspectors because of the current practice of short (two to three year) appointments. The forecast increase in nuclear facilities will require an increasing number of safeguards inspectors, many of whom, for credibility purposes alone, must be nationals of some of the less sophisticated countries. What is needed is a formal

training program, involving "appreciation courses" covering all pertinent disciplines and their interactions, as well as laboratory exercises involving practical applications of techniques and instrumentation useful in safeguards inspections.

The safeguards program is sufficiently important to justify establishing a school such as the Oak Ridge School of Reactor Technology, or Oak Ridge Institute of Nuclear Studies. Its faculty should include all pertinent disciplines and represent experience in the safeguards program. The faculty should be encouraged to develop research interests in the area of safeguarding special nuclear materials and such research should be supported.

The Panel believes that a School of Safeguards will not only improve the quality of safeguards inspectors, but that by training personnel for national programs of the participating states, a large pool of qualified safeguards inspectors can be available in a relatively short time to cope with the rapidly growing need of the IAEA. The Panel also believes that it is appropriate to consider using such a School of Safeguards to train personnel for private audit firms so that their talents might be utilized in reinforcing the domestic safeguards program.

The School of Safeguards can also make a significant contribution toward improved communications. It can become a center for the accumulation of safeguards information and for its distribution to all interested organizations. As a focal center for safeguards techniques, it should markedly stimulate the improvement of techniques as well as reduce the time span between the development of new techniques and their application in the field.

In the last analysis the success in the application of safeguards will largely depend on the quality of personnel available to implement the program. The supply of individuals having the necessary skills and experience is presently quite limited. The Panel believes that a School of Safeguards will insure that personnel with appropriate skills and interests are available to meet the rapidly escalating needs of the safeguards program.

Recommendation 13

There should be an independent review of the safeguards currently applicable to materials and weapons transferred to the Department of Defense under Section 91b of the Atomic Energy Act of 1954.

Commentary

- a. The charter of the Panel excluded materials transferred to the Department of Defense under Section 91b of the Atomic Energy Act of 1954. However, the Panel notes that these materials, and the weapons and weapons components, are much more attractive from the diversion point of view than most of the materials involved in the peaceful use of nuclear energy. Consequently, in the absence of any recent independent review the Panel recommends that such a review of the applicable safeguards be conducted.

APPENDIX 1

ORGANIZATIONS REPRESENTED BY PERSONS INTERVIEWED BY PANEL

Arms Control and Disarmament Agency

Atomic Energy Commission

Office of the General Manager

Division of Inspection

Division of Intelligence

Division of International Affairs

Division of Military Application

Division of Nuclear Materials Management

Division of Production

Division of Security

Director of Regulation

Division of Compliance

Division of Materials Licensing

Department of State

European Atomic Energy Community (EURATOM)

General Electric Company

Idaho Nuclear Corporation

Institute of Nuclear Materials Management

International Atomic Energy Agency (IAEA)

Joint Committee on Atomic Energy

Nuclear Fuel Services, Inc.

Nuclear Materials and Equipment Corporation

Stanford Research Institute

Union Carbide Nuclear Company

Yankee Atomic Electric Company

APPENDIX 2

NUCLEAR SITES VISITED BY PANEL

	<u>Type of Plants</u>
General Electric Company San Jose, California	Fuel Processing and Fabrication Plant
Idaho Nuclear Corporation Idaho Falls, Idaho	Chemical Processing Plant
Nuclear Fuel Services Inc. Erwin, Tennessee	Fuel Processing Plant
Nuclear Fuel Services Inc. West Valley, New York	Chemical Processing Plant
Nuclear Materials and Equipment Corporation Apollo and Leechburg, Pennsylvania	Fuel Processing Plant
Union Carbide Nuclear Company Division of Union Carbide Corporation Oak Ridge, Tennessee	Weapon Processing and Fabrication Plant

APPENDIX 3

ESSENTIAL ELEMENTS OF AN ADEQUATE SAFEGUARDS SYSTEM

In the Panel's comments under Recommendation 8, emphasis has been placed on the broader concept of internal control as a foundation to an adequate safeguards system. All of those comments, therefore, are incorporated by reference as a prefatory statement to the following summary of some of the essential elements of an adequate safeguards system in the management and control of special nuclear materials. Essential elements include:

1. A written description of procedures to be used and measurements to be made by the possessor of special nuclear materials, whereby his material inventory, transfer and process losses would be currently recognized, measured and recorded, and whereby his material would be protected against theft or diversion, should be submitted to the safeguarding agency (AEC, IAEA, or Euratom) for review and approval prior to the receipt of material.

Commentary

Prior to receiving strategic quantities of special nuclear materials an organization must reduce to written form an

appropriate program or procedures for safeguarding the material. These plans and procedures will then serve as a basis for hiring appropriate personnel and procuring necessary equipment so that the materials can be adequately safeguarded. These written procedures must be reviewed by the safeguarding agency to insure itself that adequate safeguards provisions have been made. The written procedures are evidence that the organization receiving special nuclear materials has given adequate thought and planning to the problem, and adequately understands methods whereby the materials will be safeguarded. Recent amendments to 10 CFR 70 will generally bring all domestic activities under this requirement. Both Euratom and IAEA incorporate a requirement for prior review of the accounting control procedures.

2. The safeguarding agency should have the right to review construction plans and to conduct physical inspection during construction of proposed plants that will use, store or produce special nuclear materials.

Commentary

The construction of new plants or substantive modification of old facilities may significantly influence the ability to physically secure and to account for the materials. Hence, construction plans should be reviewed to ensure that these aspects of safeguards are adequately included in the planned

construction. Also, on-site inspections should be made to ensure that the safeguards features are appropriately built into the facility.

Current AEC regulations provide for pre-construction review of utilization and production facilities only, and then solely for health and safety purposes. The Euratom and IAEA safeguards systems provide for a review of construction plans and include inspection during construction.

3. Physical transfers of special nuclear materials between possessors must be documented. The shipper and the receiver in each case should independently measure the quantities transferred and provide the safeguarding agency with the transfer data on a current basis.

Commentary

An independent measurement of transfers eliminates the need for the safeguarding agency to rely entirely on the data provided by a single facility. Both domestically and internationally, the need for independent shipper and receiver measurements is recognized and incorporated in the various safeguards programs.

4. A material balance, including a statement of inventory, transfers, production, losses, and other data affecting the material balance,

should be reported periodically to the safeguarding agency. The required frequency of such reports should depend upon the material quantities in inventory, and the form and through-put of the materials.

Commentary

A material balance statement appropriately developed and supported reflects the degree of control being achieved over special nuclear materials much as the profit and loss statement reflects the economic health of an organization. The frequency of such reports should bear a relationship to the degree of risk for diversion associated with the operation. For the major installations, any frequency less often than monthly would seem to be inappropriate.

With adoption of proposed amendments to 10 CFR 70, all domestic materials will be covered by a requirement for a material balance statement. The frequency of reporting should be reviewed with a view to optimizing the utility of the information. Internationally, both IAEA and Euratom require routine material balance statements.

5. Physical inventories must be taken periodically by the possessor to verify the existence of the material and the validity of his records, and where indicated, adjustments must be made to the inventory records. The results of such

inventories should be reported to the safeguarding agency and the data should be retained for audit. The frequency of such inventories should depend upon the form of the material and the ease with which the material may be diverted.

Commentary

If the material balance statement is to appropriately reflect the degree of control being achieved, it must be based upon a physical inventory of the materials on hand. If independent shipper and receiver measurements have been made, and a physical inventory has been taken which can be tested and verified by the safeguarding agency, then the materials discarded, measured losses, and materials unaccounted for become true indicators of the degree of control achieved by the organization, and the safeguarding agency is in a position to make a judgment as to the adequacy of the control.

With recent changes in the regulatory program, virtually all domestic materials will be covered by a physical inventory requirement. Internationally, while physical inventories are not explicitly required, all inventories are physically verified periodically by the IAEA and Euratom.

6. Unmeasured quantities, or quantities estimated only with large potential errors, should not be permitted to accumulate to significant amounts in the physical inventory.

Commentary

The material balance statement is highly sensitive to the statement of physical inventory. The degree of control achieved at any facility is directly dependent upon the validity of the physical inventory. Consequently, confidence in control is inversely proportional to the unmeasured quantities or quantities with large limits of error. At the present there are no formal criteria either domestically or internationally with respect to action limits for such quantities nor are there any general policies or procedures specifically relating to this problem in the international programs.

7. The safeguarding agency must have the right to examine and inspect all facilities using, storing or producing special nuclear materials at all times to currently appraise all elements of internal control and to examine and verify to the extent deemed appropriate: records and reports, inventories, losses, physical protection, authorized use of material and any other matters related to special nuclear materials safeguards.

Commentary

Without free access to all facilities, materials and data relating to the utilization of special nuclear materials, the safeguarding agency is in no position to render an independent

judgment as to the adequacy of the safeguards or the appropriateness of the utilization of the materials. Both the domestic and international safeguards programs make provision for this right of access and examination.

8. The safeguarding agency must make independent tests of measurement procedures and inventory. Consequently, it must have available to it an independent laboratory to prepare standard samples and process inventory samples.

Commentary

Without an independent test of the measurement procedures and a physical inventory, the safeguarding agency is in no position to render an independent opinion concerning the adequacy of control of the materials. Domestic and international safeguards programs currently provide for such tests. An AEC analytical qualification program is currently underway which should expand the number of laboratories available to support the domestic testing program.

9. In implementing the safeguards system, the effort applied should take cognizance of the quantities in inventory, through-put, the different forms and combinations of material and its suitability for weapons use. Where quantities, forms or through-put of materials

are not of strategic importance, the plant or site should be exempt from safeguards.

Commentary

It is inappropriate to waste manpower and effort applying detailed safeguards procedures to small quantities of materials or to forms of material having little strategic importance. It is equally inappropriate to apply casual surveillance and infrequent material balance requirements to massive quantities of strategically valuable materials. A proper balance must be struck and the application of the safeguarding effort should be optimized in a manner appropriate for the form and quantities of materials safeguarded.

In the past, the policy and procedures of the AEC did not take sufficient cognizance of minimum quantities especially in providing for exemptions from safeguards requirements. Recent amendments to the regulations, which extended more definitive safeguards coverage to privately owned material, recognize differences in quantities (requirements are imposed if the quantity is in excess of 5,000 grams of contained special nuclear materials) and form (materials incident to the operating of a reactor or in the form of sealed sources are exempted from certain requirements).

Both the IAEA and Euratom procedures provide for special handling in the case of small quantities of materials. Inspections are scheduled in accordance with the quantities and form of the materials handled at the facilities.

10. The safeguarding agency must insist on the maintenance of, and continually evaluate, safeguard control indicators such as shipper-receiver differences, material unaccounted for, and process losses. These are integral parts of the safeguards system. Unusual quantities in these categories must be reported and investigated, and follow up actions taken to correct deficiencies.

Commentary

A continuing review of these indicators of control will place the safeguarding agency in a position of recognizing unusual circumstances. An immediate follow-up when such unusual circumstances are recognized will ensure timely detection of diversions or early recognition of circumstances which might contribute to a potential diversion.

In the case of non-licensed contractors, AEC procedures require the maintenance of the necessary information and provide for routine AEC review of the safeguard control indicators. With recent amendments to the regulations, all licensees are also required to maintain the necessary information, and under the April, 1966 agreement between the Director of Regulation and the General Manager, a review of these indicators was extended to all licensees.³⁷

Such data are routinely supplied to IAEA and Euratom by each significant nuclear facility. Special reports are required whenever the quantities become exceptional. However, the lack of a requirement by these agencies for a physical inventory to be associated with the material balances reduces the utility of material unaccounted for data. Nonetheless, it should be noted that periodic verification of physical inventories by these agencies minimizes the reliance they place on such indicators. Future demands on manpower may force more reliance on these indicators and, hence, impose physical inventory requirements.

11. Physical protection to guard against the theft, diversion and unauthorized use of special nuclear materials is needed. Guards, fences, vaults, locks, seals, or use of sophisticated electronic, mechanical or other protective sealing or alarm devices are all protective measures which should be applied where appropriate.

Commentary

Unauthorized physical movement of material can be deterred and detected by such means. Domestically such physical protection is important because once moved outside of authorized channels there are no other physical barriers to protect against transfer out of the country.

The AEC has depended in large measure upon the financial value of the material and the criminal penalties of the Atomic Energy Act of 1954, to assure that licensees establish adequate protection for the materials, except that physical protection standards have been prescribed for AEC contractors handling materials without financial responsibility. Although the Panel understands that experience to date under these policies and procedures has been good, the Panel recommends that minimum standards for physical protection be developed and applied.

There is no requirement under either of the international safeguards programs for physical protection of the materials, although each nation is required to guarantee that the materials will not be transferred into the hands of unauthorized parties.

12. All personnel having access to significant quantities of special nuclear materials should be subject to a security check equivalent to the present "L" clearance procedures.

Commentary

One means of minimizing the probability of criminal diversion of special nuclear materials is to ensure that the individual is loyal and has no prior record of criminal activities. The type of security check equivalent to the present "L" clearance procedures provides this type of

assurance. Obviously with respect to the international systems this type of assurance has no merit as regards protection against the diversion of materials for national objectives of the country granting these clearances.

In the case of cost-type contractors, such procedures are in effect. However, there is no requirement that licensees follow such procedures, although many licensees have voluntarily provided such security checks.

Neither the IAEA nor the Euratom programs formally require a security clearance of employees in the plants subject to safeguards. However, national interests generally will assure such clearances, and the practice of many countries to maintain complete dossiers on individuals will automatically provide such a check.

13. Appropriate penalties and sanctions should be available, and the organizational structure of the safeguarding agency should be such as to assure that appropriate and timely action will be taken, in the event of recognized deficiencies in nuclear materials handling and accountability systems, and in the event of deficiencies in the safeguards detection program.

Commentary

It is essential that when such deficiencies are recognized that the safeguarding agency be in a position to move rapidly

and have available appropriate sanctions so that an early correction of the deficiency can be achieved. Otherwise, control can be lost, a potential for diversion developed, and actual diversions obscured.

The responsibility for safeguards policy establishment and implementation is presently divided between the General Manager and the Director of Regulation. Within the Office of the General Manager, two Assistant General Managers have responsibility for safeguards, one in the area of domestic safeguards and one in the area of international safeguards. With such a diffusion of responsibility, overlaps, omissions, varying standards and varying objectives have resulted. Similarly, and perhaps as a consequence, it appears that in some licensee and contractor organizations safeguards have not had the high level management attention appropriate for the problem.

Responsibility for the safeguards program in IAEA and Euratom is clearly defined and appropriately placed in the structure of each organization. The available sanctions as applied to nations appear to the Panel to be appropriate. There are no criminal sanctions provided in the IAEA and Euratom programs.

14. Penalties for improper use of special nuclear materials must be severe enough to be a significant deterrent to diversion.

Commentary

An individual or organization contemplating diversion will not only weigh the risks of detection, but also the consequences of detection. If the penalty is large enough, it will act as a significant deterrent to diversion.

Under the Atomic Energy Act of 1954, severe penalties (including death) are applicable to the diversions intended to injure the U.S. or to provide advantage to a foreign power. However, where the intent is simple personal gain, such as the theft of material for intended sale in the black market, the five years and/or \$10,000 fine appear to be inadequate.

The penalties for improper use of special nuclear materials established under the IAEA and Euratom systems include the interruption of cooperation with the nation and the recovery of the IAEA and Euratom distributed materials. The severity of such penalties is highly dependent upon the credibility of their implementation. With regard to the penalties employed by nations against its peoples, there are no provisions for establishing standards or for evaluating current national programs.

15. There should be provision for a reward for information regarding diversions of special nuclear materials to unauthorized use.

Commentary

If diversion is about to take place or has taken place, information relating to it from persons having personal

knowledge of the circumstances is vital to the safeguards program. Personal gain, political gain, patriotism are all motives which may result in the provision of such information. Of these, perhaps personal gain is the strongest, although all possible motives should be reinforced.

There presently is no provision for reward for such information. The Atomic Weapons Rewards Act does provide for rewarding an individual for information with regard to the importation of a nuclear weapon or the construction within the continental limits of a nuclear weapon, but it is completely silent on the diversion of special nuclear materials for unauthorized use.

Neither of the international agencies have any such reward provisions.

16. There should be provision for incentive awards for exercising good safeguards over special nuclear materials.

Commentary

When work is performed for the AEC under contract, such contracts should provide financial incentives for good safeguards practices. For example, graduated fees based upon quantities of lost or unaccounted for special nuclear materials would stimulate better material control measures. Also, penalties could be imposed for material not returned to AEC in acceptable forms at the conclusion of the contract.

17. There should be a mechanism for prompt notification of the safeguarding agency by the investigative and intelligence agencies regarding potentials for diversion, suspected, attempted or planned diversions, or the fact of a diversion, as well as coordinated programs for recovery of diverted material and apprehension of divertors whenever politically possible.

Commentary

Properly coordinated information from the intelligence community can potentially forewarn the agency of the potential diversion, and hence, provide for the reinforcing of the many safeguards features to deter or detect a diversion. Once detected, a properly coordinated intelligence community will materially assist in the pursuit of the material and apprehension of the divertors.

There presently is an informal relationship between the AEC and most of the interested government agencies, but there is no formal mechanism established at a sufficiently high level in the interested organizations to assure that the safeguards program gets the attention it warrants.

There is no indication that the international agencies have access to intelligence information except on an informal voluntary basis.

APPENDIX 4
DOMESTIC SAFEGUARDS PROGRAM

AEC-Owned Plants

AEC contractors are required to describe the procedures they will follow in accounting for special nuclear materials. Procedures manuals are subject to the approval of the manager of the AEC Regional Office. Certain basic accountability requirements are common to all contractors; they vary only in degree. These basic requirements are: the recording and reporting of transactions, inventories and losses; maintenance of adequate internal control, measurement, and physical inventory procedures (at the option of the manager of the AEC regional office a physical inventory may be required each month; however, in no case may the interval between inventories exceed 12 months); prompt and accurate detection and estimation of special nuclear materials losses and evaluation of loss mechanisms; and the institution of corrective measures to reduce special nuclear materials losses.

In addition to the requirements for accountability control of material, AEC contractors who are not financially responsible for the special nuclear materials that they possess are required to apply certain minimum physical security standards to their operations. In the case of contractors possessing as much as 1 kilogram (kg) of uranium 233 or plutonium, or 5 kgs. of uranium 235 in the form which may be used directly as nuclear

explosives or can be prepared for such use by simple metallurgical, chemical or mechanical processing steps, the following requirements apply:

In Storage: Continuous armed guard control; or combination locked repositories, or apparatus or equipment offering equivalent protection, located in areas under hourly armed guard patrol or automatic alarm protection.

In Transit: In custody of armed escort.

In Use: Within a limited security area such that unauthorized persons could not remove, without detection, a significant quantity of material from the area.

Clearance: "L" clearances or access authorizations for guards, escorts, accountability representatives and custodians.*

Less stringent requirements apply to special nuclear materials in forms which may not be used directly as nuclear explosives.

The General Manager discharges the functions of recommending, implementing and assuring the implementation of Commission policy and procedures for the safeguarding of special nuclear material in AEC contract operations. The organizational components under the General Manager responsible for discharging

*For classified materials, special clearances are required by AEC.

these functions are the Divisions of Nuclear Materials Management and Security, and Managers of Operations.

Licensee

Under present AEC regulations, all licensees are required to maintain records of receipts, transfers and inventories of material, and to report losses other than normal operating losses. Licensees who possess material distributed under Section 53 of the Act are required to submit transfer and periodic status reports. The Commission has issued for public comment proposed amendments to its regulations which, if adopted, would require such reports to be filed for all special nuclear materials which are privately owned.

In addition to the above, on February 3, 1967, the Commission issued amendments to its regulations to codify in the regulations certain accountability requirements heretofore imposed on licensees by lease or contract provisions with respect to Government-owned material. Under the new amendments each licensee, who is authorized to possess a quantity exceeding 5000 grams of contained uranium 235, uranium 233, plutonium, or any combination thereof, is required to:

- (a) establish and maintain written material control and accounting procedures to account for the special nuclear materials in his possession;
- (b) submit a full description of his procedures for control of and accounting for special

nuclear materials (required only for activities other than those involved in the operation of a nuclear reactor or as sealed sources);

- (c) identify to AEC the fundamental controls which he considers essential for assuring that special nuclear materials in his possession are adequately safeguarded (as in (b) above not required for certain activities); and
- (d) perform an inventory not less often than annually.

Licensees are not required by present regulations to apply prescribed physical security standards to protect special nuclear materials in their possession. The health and safety regulations of AEC, however, require that access to special nuclear materials be adequately controlled by licensees so that materials stored in any unrestricted area be secured against unauthorized removal.

The Director of Regulation has been delegated the Commission's licensing and related regulatory responsibilities for the protection of the public health and safety and the common defense and security. The organizational components responsible for discharging these functions are the Divisions of Materials Licensing, Reactor Licensing, Reactor Standards, Compliance, Radiation Protection Standards, and State and Licensee Relations.

Under a working agreement between the Director of Regulation and the General Manager, the expertise of the General Manager's nuclear materials management organization is utilized by the Director of Regulation in implementing and administering safeguards controls over the special nuclear materials in the hands of licensees.

APPENDIX 5

INTERNATIONAL DISTRIBUTION OF SPECIAL NUCLEAR MATERIALS

Section 123 of the Atomic Energy Act provides that special nuclear materials, and production and utilization facilities, may not be transferred to any nation (or group of nations) unless an agreement for cooperation, approved by the President and submitted to the Joint Committee on Atomic Energy, has been executed. Each agreement for cooperation for peaceful uses of atomic energy is required to include a guarantee that any material transferred pursuant to the agreement will not be used for atomic weapons or for research on or development of atomic weapons, or for any other military purpose. In addition, each agreement is required to include a guarantee that the material will not be transferred to unauthorized persons or beyond the jurisdiction of the cooperating nation or group of nations, except as specified in the agreement.

The Atomic Energy Act does not require that the U. S. exercise any effort to assure that the specified guarantees in agreements for cooperation are fulfilled by the cooperating nations. The Atomic Energy Commission has, however, as a matter of policy, included in all comprehensive agreements (except those with Canada, the United Kingdom, the European Atomic Energy Community and the International Atomic Energy Agency) "safeguards" provisions that give the U. S. the right to send

U. S. inspectors into the cooperating nations. Inspectors have access at all times to all places and data as necessary to account for the special nuclear materials, and to determine that the guarantees are in fact being observed. In addition to the right of inspection, important supplementary rights are provided, including

- . the right to approve the design of facilities from the standpoint of effective application of safeguards;
- . the right to require the maintenance of appropriate records; and
- . the right to approve the means for reprocessing special nuclear materials.

In recent years as each agreement for cooperation has been renewed, the U. S. has sought to secure agreement with the cooperating nation that safeguards should be implemented by the International Atomic Energy Agency, (IAEA) rather than by U. S. inspectors.

In addition to bilateral agreements between the U. S. and individual nations, and between the U. S. and the IAEA, the U. S. several years ago entered into an agreement with the European Atomic Energy Community (Euratom). Under this agreement the Euratom organization is responsible for implementing safeguards over special nuclear materials supplied by the U. S. to the Euratom Supply Agency for use in the Euratom nations of Belgium, France, Italy, Luxemburg, the Netherlands, and West

Germany. The U. S. - Euratom agreement for cooperation requires that the Euratom safeguards system shall be reasonably compatible with that of IAEA. Euratom is obliged to consult with AEC in formulating and implementing its safeguards system. The U. S. has the right to verify by mutually approved scientific methods the effectiveness of the safeguards being applied by Euratom to U. S. supplied special nuclear materials.

The safeguards systems applied to special nuclear materials transferred by the U. S. to other nations have the following common elements:

- . An examination of the design of facilities to assure that special nuclear materials will not be used for any military purpose and that effective safeguards controls can be applied;
- . the maintenance and inspection of operating records to assure that special nuclear materials are properly accounted for;
- . the periodic filing of reports on special nuclear materials received, produced and on hand, from installations where special nuclear materials are used;
- . the right to approve the means to be followed in reprocessing irradiated fuel;
- . periodic on-site inspection of plants where special nuclear materials are used and periodic

- independent verification of the inventories
of special nuclear materials; and
- . access rights at all times to all persons,
places and data that are relevant to the
use of special nuclear materials.

AEC's Division of International Affairs is responsible for administering the program of safeguards under agreements for cooperation, including (1) development of the systems to be employed, (2) implementation of "bilateral" safeguards, including the maintenance of records and receipt of reports, and conducting on-site inspections, and (3) liaison with IAEA and Euratom. Continuing efforts are made to achieve compatibility between the U. S. bilaterals, Euratom and IAEA systems.

APPENDIX 6
EURATOM SAFEGUARDS

Euratom is responsible for assuring that its safeguards system is reasonably compatible with that used by IAEA.

Article XII. A., of the U.S.-Euratom Agreement for Cooperation states "... In establishing and implementing its safeguards and control system, the Community is prepared to consult with and exchange experiences with the International Atomic Energy Agency with the objective of establishing a system reasonably compatible with that of the International Atomic Energy Agency..."

Euratom is also obliged to consult with the U. S. in formulating and implementing its safeguards system. The U. S. has the right to verify by mutually approved scientific methods the effectiveness of the safeguards being applied by Euratom to U.S.-supplied material. This right is based on Article XII. C. of the Agreement which states "The Parties agree that there will be frequent consultations and exchanges of visits between the Parties to give assurance to both Parties that the Community's safeguards and control system effectively meets the responsibility and principles stated in paragraph A of this Article and that the standards of the materials accountability systems of the Government of the United States of America and the Community are kept reasonably comparable." By an exchange of letters in June 1958, the understanding of

the Euratom Commission was confirmed to be that the consultations and exchanges of visits agreed upon in that section include permission by each Party for the other Party to verify by mutually approved scientific methods the effectiveness of the safeguards and control system applied to special nuclear materials received from the other Party or to fissionable material derived from these fissionable materials. There have been frequent consultations between U.S. and Euratom safeguards groups starting in 1959 and the U.S. not only has been kept informed of all aspects of the Euratom safeguards system but also has influenced the actual development of the system to meet standards acceptable to the United States.

With the increasing quantities of U.S.-supplied materials being placed under Euratom safeguards, arrangements were started in 1964 to obtain more detailed information as to the effectiveness of the implementation of safeguards by Euratom. In January 1965 it was decided to establish a U.S.-Euratom Joint Technical Working Group to explore at the technical working level what mutually approved scientific methods could be employed to verify the effectiveness of the safeguards and control systems. From three to four individuals from the U.S. and about the same number from Euratom have constituted the working group. The working group has met four times and visited two facilities under Euratom safeguards control to

familiarize the U.S. with the practical application of safeguards by Euratom. One of the working group meetings held in February, 1966, was devoted to the application of continuous inspection by Euratom at the Eurochemic chemical processing plant at Mol, Belgium. An exercise at Ispra, Italy, in July, 1966, provided the U.S. with accounting data on U.S.-supplied special nuclear materials for comparison with U.S. data. Also, samples of special nuclear materials were provided for analysis in U.S. and Euratom laboratories. At Karlsruhe, West Germany, in November, 1966, U.S. members visited the Euratom Transuranium Institute, a plant that had just completed the fabrication of about 170 kilograms of plutonium for a French fast critical assembly. Accountability plans were demonstrated and the Euratom safeguards inspection procedures were described. As at Ispra, samples of U.S.-supplied plutonium were provided for analysis in U.S. and Euratom laboratories. A future meeting of the Technical Working Group has been planned for the spring of 1967, in the United States. The application of safeguards procedures to fuel fabrication plants will be discussed at that meeting.

There has been an increasing number of contacts between the Euratom and IAEA safeguards staffs during the past two years. For example, in August, 1965, at the invitation of IAEA, Euratom inspectors attended an IAEA symposium on Nuclear Materials Management. In February, 1966, IAEA inspectors, at the invitation of Euratom, visited the Eurochemic chemical

processing plant at Mol, Belgium. In December, 1966, a two-day safeguards meeting held in Salzburg, Austria, was attended by safeguards inspectors from the U.S., Euratom, IAEA and Canada.

**COMPARISON OF THE IAEA SAFEGUARDS SYSTEM AND
THE EURATOM SAFEGUARDS SYSTEM**

January 13, 1967

United States Atomic Energy Commission

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COMPARISON OF THE EURATOM SAFEGUARDS SYSTEM AND THE IAEA SAFEGUARDS SYSTEM

IAEA SAFEGUARDS	EURATOM SAFEGUARDS		COMMENT
	EURATOM TREATY	EURATOM-U. S. BILATERAL	
1. <u>Objective of Organization</u>			
"The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world." (Statute, Article II)	"It shall be the aim of the Community to contribute to the raising of the standard of living in Member States and to the development of commercial exchanges with other countries by the creation of conditions necessary for the speedy establishment and growth of nuclear industries." (Article I)	"The Parties (U. S. and Euratom) will cooperate in programs for the advancement of the peaceful applications of atomic energy." (Article I, original Agreement which Entered into Force August 27, 1958)	IAEA and Euratom -U.S. Bilateral restrict to peaceful use only. EURATOM TREATY does not restrict to peaceful use only.
2. <u>Aims of Safeguards System</u>			
"It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such such a way as to further any military purpose." (Statute, Article II)	"The Community shall guarantee, by appropriate measures of control, that nuclear materials are not diverted for purposes other than those for which they are intended." (Article 2.e)	"The Community undertakes the responsibility for establishing and implementing a safeguards and control system designed to give maximum assurance that any material, equipment or devices made available pursuant to this Agreement and any source or special nuclear material, equipment and devices, shall be utilized solely for peaceful purposes." (Article XII)	The Euratom Treaty establishes as the aim of safeguards assurance that materials are not diverted to uses other than those to which they are intended without placing any limitation on permissible intended purposes. As far as U. S. supplied material is concerned, however, the U. S.-Euratom Bilateral limits the use to peaceful purposes.
3. <u>General Principles</u>			
"To establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities,	"The Commission shall satisfy itself that in the territories of Member States:	"The Community guarantees that: No material, including equipment and devices, transferred pursuant to this Agreement to the Community or	IAEA safeguards are applied only to facilities and material covered by an agreement between the IAEA and a Member State.

IAEA SAFEGUARDS

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." (Statute, Article XIII.A.5)

The principal factors to be considered by the Board in determining the relevance of particular provisions of the safeguards system to various types of materials and facilities shall be the form, scope and amount of assistance supplied, the character of each individual project and the degree to which such assistance could further any military purpose. (INFCIRC/66, paragraph 10)

Safeguard Inspection Arrangements

IAEA arrangements for inspection of facilities containing safeguarded material are made through and with the participation of the government of the Member State. Under certain conditions the IAEA may make unannounced inspections. (See item

EURATOM SAFEGUARDS

EURATOM TREATY

- a. ores, source materials and special fissionable materials are not diverted from their intended uses as stated by the users; and
- b. the provisions concerning supplies and any special undertaking concerning measures of control entered into by the Community in an agreement concluded with a third country or an international organization are observed." (Article 77)

"No discrimination shall, in the exercise of control, be made on the ground of the purpose for which ores, source materials and special fissionable materials are intended.

"Control may not extend to materials intended for the purposes of defense which are in course of being specially prepared for such purposes or which, after being so prepared, are, in accordance with an operational plan, installed or stocked in a military establishment". (Article 84)

EURATOM arrangements for inspection of facilities containing safeguarded material are made directly with the appropriate personnel at the facilities. There is no intervention by the State governments, but government representatives may

EURATOM-U. S. BILATERAL

to persons within the Community, will be used for atomic weapons, or for research on or development of atomic weapons, or for any other military purpose." (Article XI)

Similar to EURATOM TREATY obligations.

COMMENT

IAEA safeguards are made applicable to U. S. supplied materials and equipment by a "safeguards transfer agreement".

EURATOM TREATY covers all facilities (except weapons establishments) and materials in the Community except those "intended for the purpose of defense."

EURATOM safeguards apply to material and equipment supplied to EURATOM Supply Agency under the U. S.-EURATOM additional agreement and the exceptions mentioned above cannot be arranged.

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EURATOM SAFEGUARDS

COMMENT

EURATOM TREATY

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12. See also ENFCIRC/66, paragraph 57 and GC(V)/ENF/39, paragraph 4.)

accompany the inspectors. Thus, in practice the governments must be advised of the visits. (See Article 81).

5. Design Review

The Agency shall have the right and responsibility "To examine the design of specialized equipment and facilities, including nuclear reactors, and to approve it only from the viewpoint of assuring that it will not further any military purpose, that it complies with applicable health and safety standards, and that it will permit effective application of the safeguards provided for in this article." (Statute, Article XII.A. 1)

"The Agency shall review the design of principal nuclear facilities, for the sole purpose of satisfying itself that a facility will permit the effective application of safeguards." (ENFCIRC/66, paragraph 30)

"It shall complete the review promptly after the submission of this information by the State and shall notify the latter of its conclusions without delay." (ENFCIRC/66, paragraph 32)

"Anyone setting up or exploiting facilities for the production, separation or use of source materials or special fissionable materials, or for the processing of irradiated nuclear fuels, shall make a declaration to the Commission setting out the basic technical characteristics of such facilities to the extent that such information is necessary"... to assure they are not diverted from their intended use. (Article 78) The above-mentioned declaration is implemented by a regulation (57) and attached questionnaire which lists in detail the specific technical information to be submitted.

"The Euratom Commission will: Examine the design of equipment, devices and facilities, including nuclear reactors, and approve it for the purpose of assuring that it will permit the effective application of safeguards, if such equipment, devices and facilities:

- are made available pursuant to this agreement; or
- use, process or fabricate any of the following materials received from the United States: source or special nuclear material, moderator material or any other material relevant to the effective application of safeguards; or
- use any special nuclear material produced as the result of the use of equipment or material referred to in subparagraphs a and b." (Annex B, paragraph 1)

The significance of "anyone" is that Euratom deals directly with pertinent person involved with the activity.

6. Records

"The State shall arrange for the keeping of records with respect to

"The Commission shall require the maintenance and production of

The Euratom Commission will require "the maintenance and production of

In practice the records kept under Euratom safeguards are very similar

IAEA SAFEGUARDS

principal nuclear facilities and also with respect to all safeguarded nuclear material outside such facilities. For this purpose the State and the Agency shall agree on a system of records with respect to each facility and also with respect to such material, on the basis of proposals to be submitted by the State in sufficient time to allow the Agency to review them before the records need to be kept." (INFCIRC/66, paragraph 33)

7. Reports

The Agency shall have the right and responsibility "to call for and receive progress reports;" (Statute, Article XII.A.4)

"The State shall submit to the Agency reports with respect to the production, processing and use of safeguarded nuclear material in or outside principal nuclear facilities". (INFCIRC/66, paragraph 37)

Special procedures apply to the reports pertaining to reactors. "The frequency of submission of routine reports shall be agreed between the Agency and the State, taking into account the frequency established for routine inspections. However, at least two such reports shall be submitted each year and in no case shall more than 12 such reports be required in any year. (INFCIRC/66, paragraph 55)

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operating records in order to permit accountability for ores, source materials and special fissionable materials used or produced. The same shall apply to the transport of source materials and special fissionable materials". (Article 79) The above requirements are implemented by a regulation (#8) which states that records must be maintained which will enable the producers or users to submit suitable reports to the Euratom Commission.

Producers of ores and producers and users of source materials or special fissile materials shall report to the Commission detailed information regarding material production, inventories, transfers, locations and losses. (Regulation #3)

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operating records to assure accountability for source or special nuclear material made available, or source or special nuclear material used, recovered, or produced as a result of the use of source or special nuclear material, moderator material or any other material relevant to the effective application of safeguards, or as a result of equipment, devices and facilities made available pursuant to this Agreement."

The Euratom Commission will require "that progress reports be prepared and delivered to the Euratom Commission with respect to projects utilizing material, equipment, devices and facilities referred to in paragraph 2 of this Annex." (Item 6 above) (Annex E, paragraph 3)

COMMENT

to those kept under IAEA safeguards.

The EURATOM TREATY specifies when certain reports shall be submitted; this requirement applies to all Member States. IAEA and the States reach agreement individually on the reporting frequency; for CFP the routine reports shall be submitted monthly to the IAEA.

The IAEA and the EURATOM-U. S. BILATERAL require use reports; the EURATOM TREATY does not.

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8. Approval of CPP Processes

The IAEA Statute states that the Agency shall have the right and responsibility "to approve the means to be used for the chemical processing of irradiated material." (Statute, Article XII.A.5)

"The processes to be used for the chemical processing of irradiated material shall be subject to the approval of the Commission." (Article 78)

These provisions are comparable.

9. Stockpile Storage

The IAEA Statute states that the Agency shall have the right "To require deposit with the Agency of any excess of special fissionable materials recovered or produced as a byproduct over what is needed...in order to prevent stockpiling of these materials." (Statute, Article XII.A.5)

The Euratom Treaty states that "The Commission may require that any excess of any special fissionable materials recovered or produced as a byproduct, not being actually in use or ready for use, be deposited with the (Euratom Supply) Agency or in storage premises which are or can be controlled by the Commission." (Article 80)

The Euratom Commission will "require the deposit and storage, under continuing safeguards, in Euratom facilities of any special nuclear material referred to in paragraph 2 of this Annex which is not currently being utilized for peaceful purposes in the Community or otherwise transferred as provided in the Agreement for Cooperation between the Government of the United States of America and the Community." (Annex B, paragraph 4)

These provisions are comparable.

10. Inspectorate and Duties

The IAEA Statute states that "The Agency shall as necessary, establish a staff of inspectors." (Article XII.B) The staff of inspectors shall have the responsibility of accounting for the material supplied and verifying that facilities and materials subject to safeguards are not used in furtherance of any military purpose. (Statute, Article XII.A.6)

The Euratom Treaty states that "Inspectors shall be recruited by the Commission". The inspectors shall have the responsibility of obtaining and verifying the accountability for ores, source materials and special fissionable materials used or produced. (See Article 82)

The Euratom Commission will establish an inspection organization as "necessary to assure accounting for source or special nuclear material... to determine whether there is compliance with the guarantees of the Community. The inspection organization will also be in a position to make and will make such independent measurements as are necessary to assure compliance with the provisions of this Annex and the Agreement for Cooperation." (Annex B, paragraph 5)

Under the IAEA and the EURATOM-U. S. BILATERAL the inspectors must verify material and facility use.

Under EURATOM TREATY the inspectors have material accountability responsibilities.

1. Appointment of Inspectors

"The Director General of the IAEA shall inform the State in writing of the name, nationality and grade of the Agency inspector proposed, shall transmit a written certification of his relevant qualifications and shall enter into such other consultations as the State may request." (GC(V)/INF/39, paragraph 1)

"If a State, either upon proposal of a designation or at any time after a designation has been made, objects to the designation of an Agency inspector for that State, it shall inform the Director General of its objection." (GC(V)/INF/39, paragraph 2)

The Commission shall, "prior to the first visit of an inspector to the territories of any State, enter into consultations, which shall cover all future visits of this inspector, with the Member State concerned." (Article 81)

2. Access by Inspectors

The IAEA shall have the right and responsibility "to send into the territory of the recipient State or States inspectors, designated by the Agency after consultation with the State or States concerned, 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, as necessary to account for source and special fissionable materials supplied and fissionable products and to determine whether there is compliance with the undertaking against use in furtherance of any military purpose." (Statute

"On presentation of their credentials, inspectors shall at all times have access to all places and data and to any person who by reason of his occupation deals with materials, equipment or facilities subject to the control provided for in this Chapter, to the extent necessary to control ores, source materials and special fissionable materials, and to satisfy themselves" that the items are not diverted from their intended uses as stated by the users. (Article 81)

The Euratom Commission will establish "an inspection organization which will have access at all times:

- a. to all places and data, and
- b. to any person who by reason of his occupation deals with materials, equipment, devices or facilities safeguarded under this Agreement, necessary to assure accounting for source or special nuclear material subject to paragraph 2 of this Annex and to determine whether there is compliance with the guarantees of the Community." (Annex B, paragraph 5)

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XII.A.6) (See also GC(V)/INF/39, paragraph 9)

13. Accompaniment of Inspectors

"Inspectors designated by the Agency shall be accompanied by representatives of the State concerned, if that State so requests, provided that the inspectors shall not thereby be delayed or otherwise impeded in the exercise of their functions." (Statute, Article XII, paragraph 6)

"Inspectors appointed by the Commission shall be accompanied by representatives of the authorities of the State concerned, if that State so requests, provided that the inspectors shall not thereby be delayed or otherwise impeded in the exercise of their functions." (Article 81)

The IAEA may make unannounced inspections when the Agency has the right of access at all times.

14. Notice of Inspections

"The State shall be given at least one week's notice of each inspection, including the names of the Agency's inspectors, the place and approximate time of their arrival and departure, and the facilities and materials to be inspected. Such notice need not exceed 24 hours for any inspection to investigate any incident requiring a 'special inspection'." (GC(V)/INF/39, paragraph 4)

Euratom Treaty does not specifically state that any notice need be given prior to an inspection. However, since "Inspectors appointed by the Commission shall be accompanied by representatives of the authorities of the State concerned, if that State so requests", some notice is, obviously, necessary. Under certain conditions the IAEA may make unannounced inspections.

15. Privileges and Immunities of Inspectors

"Agency inspectors shall be granted the privileges and immunities necessary for the performance of their functions. Suitable provision shall be included in each project or safeguards agreement for the application, in so far as relevant to the execution of that

"In the territory of each Member State and whatsoever their nationality, the officials and other employees of the Community... shall be immune from legal process for acts performed by them in their official capacity, including their words spoken or written; they shall

Euratom inspectors are covered by immunities as specified in the EURATOM TREATY.

The IAEA obtains agreement individually from each State on the privileges and immunities of inspectors.

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agreement, of the provisions of the Agreement on the Privileges and Immunities of the International Atomic Energy Agency excepting Articles V and XII thereof, provided that all parties to the project or safeguards agreement so agree." (GC(V)/INF/39, paragraph 13)

16. Inspection Report

"After an inspection has been carried out, the State concerned shall be duly informed by the Agency of its results. In case the State disagrees with the report of the Agency's inspectors, it shall be entitled to submit a report on the matter to the Board of Governors." (GC(V)/INF/39, paragraph 12)

17. Written Inspection Procedures

The IAEA specifies the general procedures to be used in routine, initial and special inspections. (See INF/CIRC/66, paragraph 45-60)

The inspections include an audit of records and reports, verification of the amount of material by physical inspection, measurement and sampling, examination of facilities and instruments and a review of the facility operations.

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continue to benefit from such immunity after their functions have ceased." (Article 11, Protocols)

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Euratom has advised that the practice is to allow the inspected facility to review the report in draft prior to its issuance.

Similar to EURATOM TREATY obligations.

Euratom plans inspections on a case-by-case basis and makes whatever reviews are necessary to verify the material and facilities are not being diverted from their intended use.

The inspections include audit of of records, piece count of fabricated plates and elements when possible, sampling of material, radioactivity check of material, chemical and spectrometry analyses when feasible, review of internal control methods at the facility and a check of measurement instruments.

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18. Inspection Frequency

The frequency of inspections is based upon whichever is the largest of: (a) facility inventory; (b) annual throughput; (c) maximum potential annual production of special fissionable material. For reactors the maximum number of inspections per year is one for every 5 kilograms of nuclear material up to a total of 60 kilograms. Above 60 the Agency has right of access at all times. (See INFCIRC/66, paragraph 57)

Reprocessing plants having an annual throughput not exceeding 5 effective kilograms may be routinely inspected twice yearly; plants exceeding 5 kilograms may be inspected at all times. (See GC(X)/INF/86, paragraph 3)

Special inspections may be made under certain circumstances. (See INFCIRC/66, paragraph 53)

The Euratom Treaty provides for access at all times. (See Article 81)

Similar to EURATOM TREATY obligations.

19. Noncompliance

"In the event of noncompliance and failure by the recipient State or States to take corrective steps within a reasonable time", the Board of Governors may "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. The Agency may also suspend any noncomplying member

In the event of noncompliance, the Commission may withdraw from the offending persons or enterprises "financial or technical assistance", may place the enterprise "under the administration of a person or board appointed by the Commission and the State" and may order "the complete or partial withdrawal of source materials or special fissionable materials." (Article 83)

"It is understood by the Parties that a continuation of the cooperative program between the Government of the United States of America and the Community will be contingent upon the Community's establishing and maintaining a mutually satisfactory and effective safeguards and control system which is in accord with the principles set forth in Annex "B" to this agreement". (Article XII, paragraph E)

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from the exercise of the privileges and rights of membership."

"The Board shall report the non-compliance to all members and to the Security Council and General Assembly of the United Nations". (Statute, Article XII)

20. Circumstances Requiring Safeguards

Nuclear material shall be subject to Agency safeguards if it is being or has been:

- a. supplied under a project agreement
- b. submitted to safeguards under a safeguards agreement by the parties to a bilateral or multilateral agreement
- c. unilaterally submitted to a safeguards agreement
- d. produced, processed or used in a principal nuclear facility to which any of the above three items apply
- e. produced in or by the use of safeguarded nuclear material
- f. substituted for safeguarded nuclear material

(See INFCIRC/66, paragraph 19)

21. Exemptions From Safeguards Application

The Agency permits the exemption from safeguards at the request of

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"Forced execution shall be governed by the rules of civil procedure in force in the State in whose territory it takes place." (Article 164)

"The Commission shall satisfy itself that in the territories of Member States: ores, source materials and special fissionable materials are not diverted from their intended uses as stated by the users". (Article 77)

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"The Community undertakes the responsibility for establishing and implementing a safeguards and control system designed to give maximum assurance that any material, equipment or devices made available pursuant to this Agreement and any source or special nuclear material derived from the use of such material, equipment and devices, shall be utilized solely for peaceful purposes". (Article XII)

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EURATOM has not specified any de minimus quantities to be

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the State concerned of nuclear material provided it does not at any time exceed:

- a. 1 kilogram total of special fissionable material consisting of one or more of the following:

Plutonium
U-235 (calculated from the uranium enrichment)

- b. 10 metric tons of natural and depleted uranium (above 0.5%)
- c. 20 metric tons of depleted uranium (0.5% or below)
- d. 20 metric tons of thorium

With regard to reactors, produced or used nuclear material shall be exempted from safeguards if:

- a. it is plutonium produced in the fuel of a reactor whose rate of production does not exceed 100 grams of Pu annually;
- b. it is produced in a reactor having a maximum power of 3 Mw.

(See ENFCIRC/66, paragraph 21)

22. Suspension of Safeguards

Safeguards may be suspended while nuclear material is transferred within the State, to another Member State or to an international organization provided the total at any times does not exceed:

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exempted from the active implementation of safeguards. The IAEA exemption is concerned only with exempting the application of safeguards and not the peaceful use guarantee relating to the material in question.

The Euratom safeguards system does not employ the concept of suspension.

Similar to EURATOM TREATY obligations.

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- a. 1 effective kilogram of special fissionable material
- b. 10 tons of natural and depleted uranium enriched above 0.5%
- c. 20 metric tons of depleted uranium below 0.5%
- d. 20 metric tons of thorium

Safeguards may be suspended on special nuclear material in irradiated fuel transferred for reprocessing if other nuclear material is substituted for it. (See INFCIRC/66, paragraph 24)

23. Termination of Safeguards

Safeguards will be terminated on nuclear material returned to the State that originally supplied it provided:

it was not improved while under safeguards;

special fissionable material produced in it has been removed;

it was subject to safeguards only by reason of its use in a principal nuclear facility;

it has been diluted or consumed so it no longer has safeguards significance;

it has been replaced by substitute material;

EURATOM TREATY safeguards terminate when the material is transferred out of the Community.

Similar to EURATOM TREATY obligations.

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it has been transferred out of the States to the State that originally supplied it, safeguards have been suspended, it will be subject to safeguards other than those of the Agency but accepted by the Agency;

the applicable safeguards agreement has expired.

(See INFCIRC/66, paragraph 26)

In addition, safeguards may be terminated by State-Agency agreement on material to be used for nonnuclear purposes. (See INFCIRC/66, paragraph 27)

24. Transfer of Material Out of State

No safeguarded nuclear material shall be transferred outside the jurisdiction of the State in which it is being safeguarded unless:

- a. the material is being returned to the State that originally supplied it; or
- b. the material is being transferred subject to substitution provisions; or
- c. the material will be subject to Agency safeguards in the State to which it is being transferred; or
- d. the material was not subject to safeguards pursuant to a project agreement and will be subject to other safeguards acceptable to the Agency in the State to which it is being transferred.

(See INFCIRC/66, paragraph 28)

EURATOM safeguards follow all material transferred between any establishments in the Community if not for a military use. If any material is transferred out of the Community, EURATOM safeguards cease to apply. (See Articles 77 and 79)

"No such material will be transferred to unauthorized persons or beyond the control of the Community, except as the Government of the United States of America may agree to such transfer and then only if the transfer of the material is within the scope of an Agreement for Cooperation between the Government of the United States of America and another nation or group of nations". (Article XI)

APPENDIX 8

February 10, 1967

INSTITUTE OF NUCLEAR MATERIALS MANAGEMENT

PROGRAM FOR THE SAFEGUARDING OF SPECIAL NUCLEAR MATERIALS

The prevention of proliferation of special nuclear materials for unauthorized uses may be broadly divided into two general problem areas: (1) prevention against diversion, and (2) detection of diversion.

Prevention is concerned primarily with physical security of special nuclear materials, while detection concerns accounting systems for special nuclear material, technical measurement systems for such material, inspection and audit systems, as well as intelligence activities.

The Institute has surveyed both the areas of prevention and detection of diversion of special nuclear materials for unauthorized uses with the objective of arriving at a safeguards program for the Institute, the results of which would contribute to the overall safeguards program of the United States.

The Institute believes that physical security, while important, will not deter the well trained agent. While some improvements in physical security protection are possible and desirable, the Institute believes that the more dependable means of detecting (and, by threat of detection, deterring) the diversion of special nuclear materials is through accurate material balances. The Institute will direct a major portion of its activities toward improving material balance techniques.

The Institute has concluded that its major contributions can be made in the area of systems for detection of diversion as opposed to the general subject of prevention of diversion. To this end, the Institute contemplates the following program:

- (1) The Institute will prepare a series of standard (or recommended) systems for accounting for strategic special nuclear materials. It is recognized that details of systems of accounting for nuclear materials will vary with the type of operation and therefore it is proposed to prepare a separate standard system of accounting for:

- (a) Enrichment plants
- (b) Conversion plants
- (c) Fuel Fabrication plants
- (d) Reactors
- (e) Reprocessing plants
- (f) Shipments

- (2) The Institute will develop a series of standard measurement systems for use in the activities listed in (1) above to establish the quantities of special nuclear materials involved, such that complete and accurate material balances around each of these activities can be accomplished. These measurement systems will involve both weight/volume determinations as well as sampling and analysis.
- (3) The Institute will prepare standard systems for the inventorying of special nuclear materials in the various types of activities outlined in (1).
- (4) The Institute will establish standard inspection and audit systems for policing the above described accounting, measurement and inventory systems.
- (5) The Institute will revise its procedures for the certification of nuclear materials managers to incorporate a comprehensive written test concerning special nuclear material measurements, inventory techniques, accounting techniques, inspection and audit techniques, the economic significance of loss of special nuclear material, and the national security significance of the loss of special nuclear material.
- (6) The Institute will undertake to establish what constitutes a reasonable loss of special nuclear material in the various operations set forth in (1). This reasonable loss should be established in the light of what is economically practical for a given production operation and an estimate should be made of the expense involved in reducing such loss.

The Institute does not envision the above standards preparation effort as being purely original work at the outset. The establishment of the standards as described in (1)-(4), above, will be directed towards getting down on paper, techniques which are being used presently which reflect the best practice of the industry, suitably modified to take into consideration the safeguards objectives. The Standards Committee of the Institute will establish the format for these standards and assign each of the tasks to individuals for prompt development of an initial draft.

COMMENTS

In addition to the safeguards program recommended, the Institute recommends that the government consider establishing the following requirements as deterrents against proliferation of special nuclear materials:

- (1) All persons handling or processing significant quantities of special nuclear materials, or having access to accountability records or reports, or having any responsibility in connection therewith should possess AEC "L" Clearances as a minimum.
- (2) All plants and facilities in which significant quantities of special nuclear material are handled or processed should have posted at all accesses to such facilities the legal penalties for diversion of special nuclear material for unauthorized uses. All employees of such facilities should be required to read and have explained to them these penalties and should sign an acknowledgement of their understanding of such penalties.
- (3) All unattended storage facilities of significant quantities of special nuclear material should be kept locked and should be equipped with a suitable alarm system. A record should be kept of all persons entering and leaving these facilities.
- (4) All facilities in which significant quantities of special nuclear material are stored, handled, or processed should have 24-hour armed guard surveillance or suitable alarm system.

APPENDIX 9

EXCERPTS FROM REPORT OF THE COMMITTEE ON AUDITING PROCEDURES

AMERICAN INSTITUTE OF CERTIFIED PUBLIC ACCOUNTANTS

The views of the Committee on the basic characteristics of a satisfactory system of internal control are set forth in the following excerpts:

"The characteristics of a satisfactory system of internal control would include:

- a. A plan of organization which provides appropriate segregation of functional responsibilities,
- b. A system of authorization and record procedures adequate to provide reasonable accounting control over assets, liabilities, revenues and expenses,
- c. Sound practices to be followed in performance of duties and functions of each of the organizational departments, and
- d. Personnel of a quality commensurate with responsibilities.

"These elements, as important as each is in its own right, are all so basic to adequate internal control that serious deficiencies in any one normally would preclude successful operation of the system. For example, no system of authorization and record procedures for accounting control may be considered adequate without personnel capable of performing the procedures designed to make such a system work. While each element is discussed separately in the following sections, the interrelationship of all elements must be borne in mind...."

"A satisfactory system must include media: first, for the records control of the operations and transactions (source data and its flow) and, second, for the classification of data within a formal structure of accounts (a chart of accounts). A carefully prepared chart of accounts facilitates preparation of financial statements. If the chart of accounts is supplemented by an account manual which clearly defines the accounts and the entries to be made therein, greater uniformity can be achieved in recording accounting transactions."

"Media for the original records control of the operations and transactions are created through the designing of appropriate records and forms and through planning the logical flow of the recordkeeping and approval procedures. Such forms, and the instructions regarding the flow of recording and approval procedures, are often incorporated in procedure manuals."

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