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U.S. Department of Energy

Second Annual Report on Nuclear Non-Proliferation

Supplement to
Secretary's Annual Report to Congress

1980

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U.S. Department of Energy

Second Annual Report on Nuclear Non-Proliferation

Supplement to Secretary's Annual Report to Congress

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Preface

This Second Annual Report on Nuclear Non-Proliferation is a supplement to and an integral part of the second DOE Secretary's Annual Report to Congress (DOE/S-0010[80]), transmitted to the President by the Secretary of Energy in January 1980.

This document is submitted to Congress in accordance with the requirements of section 602 of the Nuclear Non-Proliferation Act of 1978.

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Introduction

Section 602 of the Nuclear Non-Proliferation Act of 1978 (NNPA) requires that DOE's Annual Report include views and recommendations regarding non-proliferation policies and actions for which DOE is responsible. The Act also requires a detailed analysis of the proliferation implications of advanced enrichment and reprocessing techniques, advanced reactors, and alternative fuel cycles, including an unclassified summary and a comprehensive version containing relevant classified information. Some of this latter information is provided in the Executive Summary of the Non-Proliferation Alternatives Systems Assessment Program (NASAP) report.

Overview

The goals of U.S. non-proliferation policy are to minimize the spread of nuclear explosives to additional countries and to create a stable international environment for the peaceful uses of nuclear energy.

DOE plays a central role in promoting these goals. Under the Atomic Energy Act of 1954, as amended, and the NNPA, the Department has a number of responsibilities, including:

1. Participating, under the leadership of the Department of State, in negotiating agreements for cooperation with foreign nations and multinational organizations in the peaceful use of nuclear energy.
2. Joining other agencies to reach an executive branch judgment regarding the issuance of export licenses by the Nuclear Regulatory Commission.
3. Assuming the lead role in reaching decisions on subsequent arrangements pursuant to agreements for cooperation, and in controlling nuclear technology exports under 10 CFR 810.
4. Distributing and controlling special nuclear equipment and materials.
5. Participating in bilateral and multilateral cooperation with foreign nations and organizations to promote the peaceful uses of nuclear energy.

Agreements for Cooperation

The NNPA requires DOE to provide technical assistance and concurrence in negotiating new agreements for cooperation in the peaceful uses of atomic energy and in renegotiating existing agreements to incorporate updated non-proliferation provisions. Following the passage of this act, DOE and the Department of State, in consultation with the Arms Control and Disarmament Agency (ACDA), developed a draft model agreement that satisfies the requirements of NNPA. When modified as appropriate to accommodate the individual programs and policies of cooperating countries, this model serves as the basis for negotiations.

The International Atomic Energy Agency (IAEA), the nine-member European Atomic Energy Community (EURATOM), and almost all countries with existing agreements for cooperation with the United States have indicated their willingness to discuss renegotiation of those agreements. Other countries have expressed a desire to initiate cooperation with the United States on the basis of new agreements for cooperation.

DOE joins the Department of State in planning and conducting negotiations of such new or revised agreements. Upon completion, any proposed agreements or amendments must be jointly recommended by the Secretaries of State and Energy to the President for his approval, along with an unclassified Nuclear Proliferation Assessment Statement prepared by ACDA.

After signature by the United States and the country concerned, such amendments or agreements are then submitted by the President for congressional review, as required by the Atomic Energy Act of 1954, as amended. As of the end of 1979, agreements or amendments had been initiated with Australia, Indonesia, Norway, Morocco, Peru, and the International Atomic Energy Agency. The Australian agreement was sent to Congress in 1979. Negotiations on agreements with EURATOM and more than 10 other countries were under way or about to be initiated as 1979 drew to a close.

Technical Exchange

Introduction

Technical cooperation with other nations in the peaceful uses of nuclear energy falls into several categories. Bilateral technical exchanges take place under the provisions of agreements for cooperation and technical exchange agreements. Technical exchange agreements provide for mutual transfers of technical information, visits by personnel, and collaboration in mutually agreed projects. Actual implementation proceeds by mutual agreement.

The objectives of DOE technical exchanges were described in the *First Annual Report on Nuclear Non-Proliferation*.¹

Current Agreements and Activities

At the present time, the United States has technical exchange agreements on reactor development with Canada, the European Communities, the Federal Republic of Germany, France, Japan, Romania, Switzerland, the United Kingdom, and the Soviet Union. DOE participated actively in examining more proliferation-resistant fuel cycle alternatives in the International Nuclear Fuel Cycle Evaluation (INFCE) and has promoted cooperation in this area and related safeguards in its bilateral dealings. Adjustments have been made as necessary in existing bilateral exchange agreements to reflect a joint recognition of the dangers posed by the proliferation of nuclear explosive technology and by facilities producing or using weapons-usable materials. This has led to a mutual interest in exploring alternative breeder fuel cycles that may offer more non-proliferation advantages.

Canada, the Federal Republic of Germany, and Sweden have specific bilateral technical exchange agreements with DOE in radioactive waste management. The first exchanges planned with Germany involve spent fuel storage, including shipping and storage casks; the performance of fuel in storage; and consideration of a plan for testing fuel in dry storage. DOE's liquid-metal-cooled fast breeder reactor exchange agreements with the United Kingdom and Japan provide for possible cooperation in nuclear waste management.

¹U.S. Department of Energy, *First Annual Report on Nuclear Non-Proliferation*, Supplement to Annual Report to Congress (1978) Washington, D.C., 1979: DOE/PE-0014/R1.

In 1979, DOE developed guidelines governing international technical exchanges in waste management in order to ensure that such cooperation is supportive of U.S. non-proliferation objectives. Under those guidelines, aspects of waste technology that are an integral part of light water reactor spent fuel reprocessing plant design or that directly support the separation and purification of uranium and plutonium, are not subject to international cooperation. Exceptions to this exclusion may be made if concerned executive branch agencies agree that overall benefits outweigh the potential adverse effect of perceived U.S. support of foreign reprocessing.

Cooperation in waste management technologies required for treatment of waste from spent fuel reprocessing operations but which are not integral to the reprocessing operation or the separation and purification of uranium and plutonium is permitted under new or existing agreements only after review and approval at the policy level. This review takes into account the non-proliferation credentials of the prospective partner country, the status of the country's work on waste management technology, the programmatic benefit of cooperation to the United States, and the extent to which cooperation could assist or encourage new processing ventures. Technical exchanges in other areas of nuclear waste management are encouraged.

DOE also participates in technology exchanges through multilateral mechanisms such as the IAEA. This agency is a major channel for multilateral cooperation with other countries in the peaceful uses of nuclear energy. The main objectives of its technical assistance program are to promote the transfer of skills and knowledge relating to the peaceful uses of nuclear energy and to aid recipient countries in carrying out their atomic energy activities more efficiently and safely.

Total U.S. voluntary contributions in 1979 included \$2.125 million in cash toward the IAEA's target for voluntary cash contributions for technical assistance and \$3.126 million of contributions-in-kind in the form of expert services, equipment, fellowships, and training. An additional \$6.6 million of contributions-in-kind were made to support its safeguards program. The United States also paid a regular assessment to the IAEA of \$15.8 million.

To promote non-proliferation objectives through the IAEA, the United States announced a new voluntary offer of technical assistance during the 1978 United Nations General Assembly Special Session on Disarmament. Subject to the approval of Congress, up to \$1 million per year for 5 years would be devoted to providing low-enriched uranium fuel (rather than highly enriched uranium) for research reactors. These funds would be allocated on a preferential basis to developing countries that are party to the Nuclear Non-Proliferation Treaty (NPT). There is also an additional provision of up to \$1 million per year for 5 years in fuel cycle services for research reactors, principally for the purpose of fuel fabrication services where it would assist countries in the use of lower enrichment levels in research reactors.

DOE also participates in multilateral exchanges with other advanced countries through the Nuclear Energy Agency of the Organization of Economic Cooperation and Development.

Views and Recommendations

U.S. willingness to participate in and support technical exchange is viewed abroad as evidence of domestic support for implementing Article IV of the Nuclear Non-Proliferation Treaty, which calls on the nuclear weapons states to cooperate with the non-weapons states in making available the benefits of the peaceful uses of atomic energy. Technical exchange is also an important element in maintaining U.S. technological leadership and a cooperative, open, effective working relationship with other advanced industrial nations with respect to nuclear energy issues.

The United States as a Reliable Supplier of Nuclear Fuels

Introduction

Since power programs can be an essential element for many countries in their efforts to reduce dependency on imported oil, reinforcing the credibility of the United States as a reliable and attractive supplier of nuclear fuel and equipment to nations complying with non-proliferation conditions is an

essential component of domestic non-proliferation and overall energy policies. Recognizing that a single mechanism will not serve in all circumstances, the United States has been examining several approaches. These include possible foreign participation in U.S. enrichment facilities, improvements in export licensing, and the establishment of other multinational arrangements to help ensure supply of nuclear fuel.

Possible Foreign Participation in U.S. Enrichment Facilities

The President submitted a report to Congress in October 1979, pursuant to sections 103 and 104 of the NNPA, which examined the potential need for new U.S. enrichment capacity and the desirability of, and possible options for, foreign participation in any new capacity that might be required. The report concluded that foreign participation could set a precedent for multinational approaches to the establishment of sensitive nuclear facilities, while at the same time reducing the spread of individual national facilities and providing improved nuclear fuel assurances to participating countries. The Department of Energy in cooperation with the Department of State will continue to explore the possible interest of other nations regarding multinational approaches to enrichment facilities and measures necessary to resolve related issues such as protection of sensitive technology.

Export Licensing

Procedures for reviewing and issuing export licenses for nuclear fuel were streamlined during 1979 to provide increased assurance with regard to nuclear fuel supply but without increasing the risk of proliferation. The Nuclear Regulatory Commission (NRC) accepted the recommendation of the executive branch that single multiyear licenses for export covering the initial core and three reloads of fuel be issued for new reactors and for five reloads for existing reactors for certain recipient countries that are NPT parties with good non-proliferation credentials (i.e., that meet requirements of sections 127 and 128 of the Atomic Energy Act of 1954, as amended). Thus far, multiyear licenses have been issued for reactors in Japan, the Republic of Korea, Switzerland, Sweden, EURATOM, and Mexico (by virtue of its safeguards arrangements with the

IAEA). Applicants are considered for multiyear licenses on a case-by-case basis.

Multilateral Arrangements

The United States is seeking to develop, with other supplier nations, multilateral arrangements designed to increase secure access to adequate and timely nuclear fuel supplies for buyers prepared to accept non-proliferation commitments. The International Nuclear Fuel Cycle Evaluation identified two potential arrangements (INFCE started in October 1977 and was completed in February 1980). The first was a backup or safety net arrangement that would provide for commercial and/or governmental sharing of supplies (at national, regional, or worldwide levels) where minor, or even major, shortages or disruptions in supply occur. Such arrangements could build on existing commercial arrangements, in particular on existing commercial and national stockpiles to the extent that such arrangements are compatible with the specific requirements of the stockpile holders.

The second arrangement considered by INFCE was an International Nuclear Fuel Bank with participants from both supplier and consumer states. Such a bank would itself hold a stockpile of natural and low-enriched uranium, or claims to such uranium, which could be drawn upon by a consumer state whose supplies were interrupted (but not as a result of a breach of its non-proliferation commitments).

Although INFCE did not reach firm conclusions on the utility of such mechanisms, the United States will continue to evaluate these possibilities and to explore their potential with other countries.

Views and Recommendations

The United States should continue to pursue consultations with other nations on a variety of fuel assurance measures that may be discussed in post-INFCE fora. Efforts need to be made to implement the procedures and provisions of the U.S. export licensing process so that nations abiding by their non-proliferation obligations can be assured that their fuel needs will be met on a timely and reliable basis. Examination of the possible costs and benefits of foreign participation in U.S. enrichment facilities should continue.

The IAEA Expert Group on International Plutonium Storage

During 1979, the Department of Energy supported U.S. participation in the IAEA Expert Group on International Plutonium Storage (IPS). This group is considering such issues as the nature and location of plutonium stores, release procedures and criteria, condition of plutonium use, legal basis and institutional framework.

The first of two established technical advisory groups deals with such issues as the quantitative starting point for an IPS, the form in which plutonium might be stored and transported, the respective responsibilities of the national operator of the store and of international officers, consideration of quantities and timing for international stores and buffer stocks, and time limits for meeting IPS obligations. The second advisory group examines problems and issues associated with the research use of plutonium. The discussions continued into 1980 with a view toward eventual preparation of recommendations to the IAEA Director General concerning the possible establishment of an IPS system.

Implementation of United States Non-Proliferation Policy

Export Controls

Pursuant to the Nuclear Non-Proliferation Act of 1978, the Departments of Energy, State, Defense, and Commerce; the Arms Control and Disarmament Agency; and the Nuclear Regulatory Commission established interagency procedures for reviewing subsequent arrangements involving nuclear materials and exports of nuclear material and equipment licensed by the Nuclear Regulatory Commission. These procedures were published in the *Federal Register* on June 9, 1978.

In 1979, 227 nuclear export license applications were referred to the executive branch by the NRC.

The executive branch provided its view to the NRC on 218 applications. In addition, 353 applications were approved generically by the executive branch and processed by the NRC. As of December 31, 1979, 59 applications were undergoing executive branch review.

The criteria by which the executive branch evaluates export licenses are mandated by the Nuclear Non-Proliferation Act of 1978. Section 128 of the act, which is now in effect, requires (as a condition for continued exports from the United States to any non-nuclear-weapons state of source material, special nuclear material, production or utilization facilities, and any sensitive nuclear technology) that at the time of export IAEA safeguards be maintained in the recipient state with respect to all of its peaceful nuclear activities.

Subsequent Arrangements

As provided in the NNPA, DOE takes the lead in reviewing subsequent arrangements, which are arrangements entered into by any agency or department of the U.S. Government with respect to nuclear cooperation with other nations or groups of nations as defined in section 123 of the act. The *First Annual Report on Nuclear Non-Proliferation* summarizes the issues involved in the review of subsequent arrangements. During 1979, 269 such arrangements were processed by the executive branch. As of December 31, 1979, 34 subsequent arrangements were undergoing review.

In addition to the requirements of the NNPA, as a matter of policy, requests for retransfer and reprocessing of U.S.-origin spent fuel are approved if they meet the criterion of physical need until any new post-INFCE policy is established and if the country concerned is cooperating in expanding its storage capacity. Applications not meeting this standard are considered for approval on a case-by-case basis if they are pursuant to reprocessing contracts entered into prior to April 1977 and if approval would advance specific major non-proliferation objectives.

This policy on reprocessing was established during the period of INFCE and will continue in effect until the United States has fully assessed the results of INFCE and until any new post-INFCE policy is established. In accordance with the foregoing cri-

teria, 10 requests were approved during 1979 to retransfer U.S.-origin material for the purpose of reprocessing in France and the United Kingdom. Five of these requests were from Japan, two from Switzerland, two from Spain, and one from Sweden.

Classification

Introduction

DOE is responsible for establishing and implementing policy for the classification of Restricted Data, Formerly Restricted Data, and National Security Information within DOE's jurisdiction. This is done in accordance with the requirements of the Atomic Energy Act of 1954, as amended, and applicable executive orders. In addition, DOE is responsible for the review of Restricted Data and other classified information to determine what information may be declassified and disseminated without risk to national security.

Classification guidance has been developed and maintained for all of DOE's sensitive nuclear and nuclear-related programs such as weapons, uranium enrichment, inertial confinement fusion, and safeguards. This classification guidance is updated and revised to take into consideration such factors as non-proliferation objectives, technological progress, and foreign developments.

Current Activities

Specific initiatives were undertaken in 1979 to revise the DOE classification guide on nuclear non-proliferation. This document provides guidance for information in programs and studies related to the proliferation of special nuclear material and nuclear weapons. The United States has provided the revised guide to others in an effort to encourage similar protection abroad.

In the belief that international cooperation will enhance the effectiveness of classification, DOE has continued its bilateral discussions and exchanges in this area. Unclassified guidance has been exchanged and further talks with additional countries are anticipated.

Views and Recommendations

The following recommendations are made with respect to the Department's classification program:

1. Continue to update and revise classification policy as applied to the Department's sensitive nuclear programs, carefully balancing the strong U.S. commitment to non-proliferation with the dissemination of information in the interest of scientific and technical progress and the general public welfare.
2. Maintain lines of communication on classification established with other countries involved in nuclear research and development and continue to seek consistent classification policies and procedures.
3. Exchange, where possible and appropriate, unclassified guidance with other nations to enhance and encourage uniform application of classification policy.

Cooperation in Strengthening International Safeguards and Physical Security

Introduction

The United States has provided technical assistance to the IAEA safeguards program since it began in 1961. To assist the agency in maintaining the necessary safeguards capability and effectiveness, the United States established in 1976 an expanded program of assistance. It is funded at several million dollars per year, mostly under the Foreign Assistance Act. DOE, ACDA, and NRC provide technical and managerial support, as well as some funds. Overall guidance is given by the Technical Support Coordinating Committee, which is composed of representatives of the Departments of State and Energy, ACDA, and the NRC. DOE's Office of Safeguards and Security established an International Safeguards Project Office (ISPO)

at the Brookhaven National Laboratory whose exclusive concern is the technical aspects of this work. Assistance is provided by ISPO in response to IAEA requests to improve major safeguards areas.

Current Activities

The U.S.-IAEA cooperative program includes measurement technology, training of IAEA staff and member state personnel, and systems studies of IAEA safeguards, containment and surveillance equipment, including seals, for IAEA use in detecting diversion of nuclear materials. A total of 116 tasks had been completed by the end of 1979, with 118 additional tasks still under way to provide assistance in response to IAEA needs.

DOE physical security review visits abroad assure that physical security for nuclear materials and facilities is at least comparable to that recommended by IAEA, a prerequisite to the issuance of a U.S. export license for significant quantities of nuclear material.

As an adjunct to these reviews, since 1974 DOE and its predecessor agencies have conducted a program of training and related cooperative work in which foreign officials visit the United States to observe security systems at nuclear facilities. Five DOE technical handbooks covering all aspects of physical protection have been distributed to the IAEA and foreign governments. Additionally, in cooperation with the NRC, DOE provides training in safeguards and physical security for foreign personnel.

Convention on the Physical Protection of Nuclear Material

On October 26, 1979, negotiation of the Convention on the Physical Protection of Nuclear Material was completed in Vienna. This achievement, based on U.S. initiative, constitutes a major step in fulfilling the objectives of sections 203 and 403(c) of the NNPA.

This convention establishes standards for the physical protection of nuclear materials during transport. Parties will be obligated to secure assurances that the standards will be applied to their exports. States through which nuclear mate-

rials pass will be obligated to assure their protection. In the event of theft, robbery, or other unlawful taking of nuclear material, or threats to accomplish the same, parties to the convention will be obligated to provide to any state, upon request, cooperation and assistance to the maximum extent feasible. Finally, the convention defines certain serious offenses involving nuclear material, requires parties to make such offenses punishable, and provides for a system of prosecution or extradition.

The United States signed the convention in Vienna and New York on March 3, 1980, and submitted it to the Senate on May 8, 1980, for advice and consent to ratification. Proposed implementing legislation was submitted to Congress by the Department of State on August 22, 1980.

Views and Recommendations

To strengthen the IAEA safeguards system, it is recommended that DOE continue to participate in U.S. financial and technical support to the IAEA. Such support should be provided at a level and pace consistent with the IAEA's ability to absorb and effectively use U.S. assistance. The Department should also continue its research and development efforts to improve physical security measures and to promote international cooperation in this area.

The United States should also ratify and implement the Convention on the Physical Protection of Nuclear Material as soon as possible, and should urge other nations to do the same.

The U.S.-IAEA "Voluntary Offer" Safeguards Agreement

Non-nuclear-weapons states party to the NPT are obligated to accept international safeguards on all their peaceful nuclear activities. Even though nuclear-weapon states are not required to accept these safeguards, the United States announced in 1967 that, when they are being applied under the treaty, the United States would permit the International Atomic Energy Agency to apply its safe-

guards to all nuclear activities in the United States, excepting only those with direct national security significance. This voluntary offer, first announced by President Johnson and reaffirmed by Presidents Nixon, Ford, and Carter, was designed to encourage the widest possible adherence to the NPT and to allay concerns expressed by key non-nuclear-weapon states that the safeguards would place them at a commercial disadvantage. The U.S. offer was an important consideration in West German and Japanese decisions to ratify the NPT.

A proposed U.S.-IAEA agreement to implement the offer, negotiated by DOE's predecessor agencies in collaboration with representatives of the Department of State and ACDA, was approved by the IAEA Board of Governors in September 1976. The Senate gave its advice and consent to ratification as a treaty on July 2, 1980.

The agreement stipulates that the United States will provide the IAEA with a list of facilities eligible for safeguards. The IAEA will then designate the facilities in which it wishes to apply safeguards.

The general parts of subsidiary arrangements for the application of safeguards were initialed *ad referendum* by both sides on June 22, 1978. Discussions are progressing on specific "Facility Attachments" setting forth design information and safeguards procedures, including inspection procedures for individual facilities considered most likely to be designated for safeguards application. DOE is taking other necessary steps to carry out its obligations. NRC has published appropriate regulatory amendments to permit compliance by licensed facilities.

United States Spent Fuel Storage Policy

Introduction

In October 1977, the United States announced that, in conjunction with a program for the storage of domestic spent power reactor fuel, it was prepared to accept for storage limited quantities of foreign spent fuel when such action would serve domestic non-proliferation interests. At the same time, the United States encourages other nations to develop their own storage plans and to support

studies of regional or international spent fuel storage sites.

DOE may not commit funds or enter into subsequent arrangements for return of fuel to the United States prior to complying with the applicable requirements of the NNPA and the Department of Energy Act of 1978—Civilian Applications (Public Law 95-238). DOE submitted legislation early in 1979 requesting authority to receive foreign and domestic spent fuel, to take title to such fuel, and to acquire storage facilities for the implementation of such a program. In 1979, this legislation was still being considered by Congress along with other legislation drafted by Congress to accomplish essentially the same purposes.

Domestic Away-from-Reactor Storage

Meanwhile, DOE has undertaken some essential first steps. Current efforts are centered on meeting National Environmental Policy Act (NEPA) requirements, developing a project licensing process, and examining fuel storage options. In 1979, DOE incorporated comments and changes in draft generic environmental impact statements on the storage of both domestic and foreign fuel, and the establishment of a fee for storage and disposal. Fee estimates were revised and a draft contract prepared in anticipation of completion of the NEPA process and passage of the required legislation.

International Spent Fuel Management

DOE has taken an active role in the International Spent Fuel Management (ISFM) study established by the IAEA. This study is organized into subgroups that examine technical, economic, institutional, legal, and procedural considerations for the storage of spent power reactor fuel. ISFM also evaluates the economic and technical aspects of approaches to spent fuel storage and related institutional issues, and considers as well the worldwide application of internationally recommended standards for safety and transportation. Siting and licensing criteria for regional, multinational, or international spent fuel storage facilities are being examined.

Studies are being made of a possible future IAEA role in spent fuel storage cooperation and international spent fuel management schemes.

Pacific Basin Spent Fuel Storage

During 1979, DOE participated in discussions with Japan concerning the concept of an interim spent nuclear fuel storage capacity for the Pacific Basin area and made some preliminary conceptual studies of the possibilities for establishing such a facility. No decision to build one is anticipated in the near future. A primary consideration in determining whether to proceed with the effort will be the results of thorough study and evaluation of health, safety, environmental, political, social, and cultural factors. The relevant committees of Congress were informed during the year of the status of the discussions with Japan and the nature and extent of the preliminary studies. Those committees will be kept informed of further developments.

With respect to cooperation with India, DOE provided technical advice toward the reracking of the spent fuel storage pools of the Tarapur reactors. The Department of State arranged for the loan of equipment and the provision of consultant services for pool cleanout.

Views and Recommendations

The United States should continue actions to promote international cooperation in the storage of spent power reactor fuel. The Nation should also establish, as soon as feasible, a domestic program of away-from-reactor spent fuel storage with provision to accept limited quantities of foreign spent power reactor fuel when such action advances U.S. non-proliferation interests. This was proposed by the President in October 1977 and reaffirmed in February 1980.

Development of Proliferation-Resistant Fuel Cycle Technologies

Introduction

As part of its non-proliferation responsibilities, DOE has been examining a variety of fuel cycles and nuclear systems to determine if the proliferation risks of existing technologies might be reduced.

The results of the Non-Proliferation Alternative Systems Assessment Program were published in June 1980.²

Reduction of Enrichment in Fuel for Research Reactors

In April 1977, the Administration decided to work toward minimizing the use and distribution of high-enriched uranium fuel. One element in the policy, a program known as the Reduced-Enrichment Research and Test Reactor Program (RERTR), is aimed at developing and encouraging the use of reduced-enrichment fuel in research reactors on a worldwide basis when such changes do not diminish reactor performance and do not affect safety standards.

Progress was made in several areas of the RERTR Program during 1979. Foreign and domestic manufacturers were encouraged to develop and apply the technology required to produce reduced-enrichment fuels. General Atomic (United States), NUKEM (Federal Republic of Germany), CERCA (France), CNEA (Argentina), and possibly others are participating in fuel fabrication and in the development of the required technology. France is also conducting a reduced-enrichment fuel program for research reactors. During INFCE, Germany announced the start of a similar program. Extensive cooperation exists between the United States and various country programs, and international meetings are held periodically to discuss the progress in the development of research reactor fuel utilizing uranium of lower enrichments. Cooperation between domestic and foreign programs is being discussed. As a result of a U.S. initiative, beginning in 1980 international technical expert teams and fellowships for personnel are offered through the IAEA. They are structured to provide the staff and technical resources to those research reactor operators who lack sufficient capabilities to undertake independent conversion programs.

It is expected that prototype assemblies containing low-enriched uranium fuel (enriched to less than 20 percent U-235) for TRIGA reactors will be

² U.S. Department of Energy, *Nuclear Proliferation and Civilian Nuclear Power: Report of the Non-Proliferation Alternative Systems Assessment Program*, Executive Summary plus nine volumes, Washington, D.C., June 1980: DOE/HE-0001/1-9.

introduced into the 14-megawatt electric TRIGA research reactor in Romania under the low-enriched uranium fuel procurement assistance program announced by the United States at the 1978 U.N. General Assembly Special Session on Disarmament and discussed on page 3 of this report. The United States was the host of an information meeting on reduced-enrichment fuel for research reactors in November 1980.

Views and Recommendations

General international acceptance of the use of low-enriched fuels in research reactors in place of high-enriched fuels would represent a highly valuable contribution to reducing the risk of proliferation associated with nuclear research and development activities. INFCE has endorsed the use of such fuels. As indicated above, a number of nations are taking steps to develop and to use such fuels in their research reactors. In the light of these facts, the United States should continue programs designed to encourage the wider use of reduced-enrichment research reactor fuels.

The International Nuclear Fuel Cycle Evaluation

At an organizing conference in Washington, D.C., in October 1977, the United States joined more than 50 nations and 4 international organizations in one of the most comprehensive examinations of the nuclear fuel cycle yet undertaken. This International Nuclear Fuel Cycle Evaluation continued for more than 2 years, concluding its work at its second and final plenary session, held in Vienna, February 25-28, 1980.

A final evaluation of INFCE will not be possible for some time. This is because much of its value will depend on the degree to which participating states consider INFCE's findings in relation to their respective nuclear programs and the degree to which pending issues become the subject of technical studies and negotiations leading to new arrangements for the fuel cycle.

As reported in 1978, INFCE functioned through eight working groups covering all aspects of the

fuel cycle. The reports of these eight groups, together with a summary and overview prepared by the Technical Coordinating Committee, were referred to governments for use in planning and executing their respective nuclear programs. The conference communique stated that the findings of INFCE have strengthened the view that:

1. Nuclear energy is expected to increase its role in meeting world energy needs and should be widely available for that purpose.
2. Effective measures can and should be taken to meet the specific needs of developing countries in the peaceful uses of nuclear energy.
3. Effective measures can and should be taken to minimize the danger of proliferation of nuclear weapons without jeopardizing energy supplies or the development of nuclear energy for peaceful purposes.

From the U.S. perspective, INFCE was successful in many respects. All participants now more widely share the view that substantial risks are associated with the use of weapons-usable materials in the fuel cycle and the technology required to produce them. The collective acceptance of this premise should now help to steer nuclear power in safer directions.

DOE will be involved in the continuing efforts of the U.S. Government to implement new protective measures associated with the next steps in the nuclear fuel cycle, including technical changes, institutional arrangements, and improved safeguards.

Views and Recommendations

Now that INFCE has concluded, the United States should be prepared to pursue areas of agreement through appropriate post-INFCE fora leading to new institutional arrangements and technical decisions regarding the fuel cycle. DOE should also be prepared to support these efforts with an appropriate capability to undertake studies, provide for technical exchange, and implement such steps as spent fuel storage cooperation.

LIST OF ACRONYMS

ACDA	Arms Control and Disarmament Agency
DOE	Department of Energy
EURATOM	European Atomic Energy Community
IAEA	International Atomic Energy Agency
INFCE	International Nuclear Fuel Cycle Evaluation
IPS	International Plutonium Storage
ISFM	International Spent Fuel Management
ISPO	International Safeguards Project Office
NASAP	Non-Proliferation Alternative Systems Assessment Program
NEPA	National Environmental Policy Act
NNPA	Nuclear Non-Proliferation Act
NPT	Nuclear Non-Proliferation Treaty
NRC	Nuclear Regulatory Commission
RERTR	Reduced-Enrichment Research and Test Reactor Program

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