BY THE COMPTROLLER GENERAL

Report To The Congress

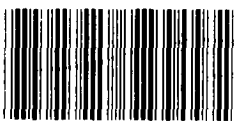
OF THE UNITED STATES

Evaluation Of Selected Features Of U.S. Nuclear Non-Proliferation Law And Policy

Because other nations now have uranium enrichment facilities, no nation can use nuclear fuel services to dictate actions to others. The United States, therefore, should avoid undue reliance on its uranium enrichment capability as a tool to prevent the spread of nuclear weapons.

The 1978 nuclear non-proliferation law requires the United States to ensure the availability of U.S. enrichment services to meet foreign demand, but it is not apparent that a new enrichment plant authorized in 1975 is needed to meet this demand.

The 1978 law has proven to be administratively workable as a means of exercising control over nuclear exports, but more needs to be done to make Government reviews of nuclear exports predictable and timely. A comprehensive interagency reassessment is needed of the controls the Department of Energy administers over foreign activities of U.S. firms and individuals.



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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report discusses selected features of U.S. nuclear non-proliferation law and policy aimed at curbing the proliferation risks of nuclear power. It concludes, among other things, that the Congress should look very closely at executive branch requests for construction funding of additional U.S. enrichment capacity. The report also contains recommendations to the Secretaries of Energy and State.

This report arises out of work we are conducting to respond to the requirement of section 602(e) of the Nuclear Non-Proliferation Act of 1978, which requires the Comptroller General to study and report to the Congress after March 10, 1981, on the law's implementation and impact. It was not, however, prepared to fulfill that requirement, but rather was prepared to bring to the attention of the Congress issues which should be of interest regarding the difficult task of carrying out both the law and related executive branch non-proliferation policies.

We are sending copies of this report to the Director, Office of Management and Budget, the Secretaries of Commerce, Energy, and State; the Chairman of the Nuclear Regulatory Commission; and the Director, Arms Control and Disarmament Agency.

Comptroller General
of the United States

perceptions of ore availability appear to be derived after consideration of previously announced national nuclear strategies. Differing perceptions of the uncertainties in uranium supply and demand, coupled with political uncertainties that could affect its availability, appear sufficient to justify diametrically opposed nuclear power strategies. (See p. 26.)

Can the United States use its enrichment capability to promote non-proliferation?

U.S. nuclear cooperation policies have been predicated on the belief that the United States can use its dominant position in the international enrichment market to influence other nations to accept or adopt more stringent non-proliferation measures. With the emergence of foreign enrichment capabilities, the U.S. share of the market is diminishing. U.S. reliance on its uranium enrichment capability as a non-proliferation tool has therefore become an outdated and unrealistic idea.

The United States is committed to being a reliable supplier of enrichment services to nations adhering to effective non-proliferation policies. While the United States should continue to link the supply of enrichment services with the non-proliferation behavior of the recipients, future non-proliferation policies should recognize that the emergence of foreign uranium enrichment facilities means that no individual nation, including the United States, is in a position to use uranium enrichment services to dictate the actions of others.

Is more U.S. enrichment capacity needed to meet foreign demand?

From the standpoint of ensuring the availability of U.S. enrichment services to meet foreign demand--as required by the 1978 nuclear non-proliferation law--it is not apparent that construction of a new

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

EVALUATION OF SELECTED FEATURES OF U.S. NUCLEAR NON-PROLIFERATION LAW AND POLICY

D I G E S T

Recent changes in U.S. nuclear non-proliferation law and policy focus heavily on curbing the capability of nations to produce weapons-usable materials--plutonium and highly enriched uranium. 1/

Some nations are seeking energy security by developing their own nuclear fuel-cycle capabilities. The 1978 nuclear non-proliferation law, in combination with other congressional and executive branch policy initiatives, attempts to provide a balance of denials, controls, and incentives directed toward discouraging other nations from premature development of fuel-cycle capabilities that would provide independent access to plutonium and highly enriched uranium. (See p. 3 to 12.)

GAO evaluated selected features of U.S. nuclear non-proliferation law and policy aimed at curbing the proliferation risks of nuclear power as they related to the following questions.

Are uranium supplies adequate to defer developing reprocessing technologies and breeder reactors?

No one knows how much uranium is or will be available or how much will be needed to meet future energy needs. National

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1/Although plutonium and highly enriched uranium have benefits for the production of nuclear power, they are not essential to it, at least in the near term. In contrast, plutonium or highly enriched uranium are indispensable ingredients of nuclear weapons.

enrichment plant is justified at this time. Circumstances have changed since a new plant was authorized in 1975 and decisions were made to use energy-efficient centrifuge technology in 1977. A slowdown in the growth of nuclear power and the emergence of foreign enrichment capabilities have created a "buyers market" for enrichment services. A worldwide glut in enrichment capacity is expected in the mid-1980s. DOE is operating its enrichment complex at about 40 percent of capacity and has delayed construction of 75 percent of the new enrichment capacity. (See p. 31.)

DOE believes that completing construction of the first increment of centrifuge capacity in 1989 is justified because it will enable DOE to meet projected increases in demand and to eventually replace certain high cost, energy-intensive diffusion capacity with more energy-efficient centrifuge capacity. GAO believes that DOE has not fully and objectively considered available options that would allow it to meet demand and delay the current construction program until more is known about advanced enrichment technologies under development. (See p. 44.)

The Secretary of Energy should, in future budget requests for the construction of uncommitted increments of enrichment capacity, specifically demonstrate that the

--need for the new capacity is based on realistic demand forecasts that cannot be met by DOE's recently upgraded existing facilities; or

--new capacity will further U.S. nonproliferation goals by enhancing U.S. reliability as a nuclear supplier and/or by providing a disincentive for other nations to acquire enrichment technologies; or

--new capacity is economically justified and the economic justification fully and objectively considered options involving the use of advanced enrichment technologies for the new capacity. (See p. 43.)

MATTERS FOR CONSIDERATION BY THE CONGRESS

In view of changes in demand for enrichment services and the $5.7 billion estimated cost of constructing the new enrichment plant first authorized by the Congress in December 1975, GAO believes the Congress should look very closely at executive branch requests for construction funding. The Department of Energy needs to develop and present sufficient documentation demonstrating that the additional capacity is needed. If convincing documentation is not presented, the Congress should consider not appropriating additional funds for construction of uncommitted increments. (See p. 42.)

How well are U.S. controls over exports of nuclear material and equipment working to remove doubts about U.S. reliability?

Foreign concerns over U.S. reliability as a nuclear trading partner generally center around U.S. non-proliferation policies, and delays and uncertainties associated with the nuclear export control system. If the United States is to remove doubts about its reliability, it must conduct non-proliferation reviews of nuclear material and equipment exports in a manner which allows for the predictable performance of commercial contracts. Although the 1978 nuclear non-proliferation law has proved to be an administratively workable means of exercising controls over nuclear exports, more needs to be done to make Government reviews more predictable and timely. For the most part, GAO believes that remedial actions can be taken within the constraints of the law. (See pp. 70 to 71.)

Commercial reprocessing in the United States has been "indefinitely deferred." Most major U.S. nuclear trading partners, however, view reprocessing as the best or only option

available to manage or use spent nuclear fuel. Several have contractual commitments with the only two countries offering reprocessing services for the international market--the United Kingdom and France. As a result there is substantial opposition to the requirements of the 1978 nuclear nonproliferation law which would extend U.S. rights to approve foreign reprocessing of U.S.-supplied nuclear fuel and to the way the United States exercises its reprocessing approval rights. (See pp. 54 to 62.)

The executive branch has not publicly clarified when the United States will claim reprocessing approval rights. The resulting uncertainty has been cited as a factor impeding acceptance of U.S. reprocessing approval rights by some European countries, and influencing decisions not to purchase U.S. supplies and services. (See pp. 55 to 57.)

The Secretary of State should announce the U.S. position on when the United States will claim reprocessing approval rights and clarify

--what happens when U.S. exports are "co-mingled" with exports of other nations,

--what happens when more than one nation claims approval rights on the same commodity, and

--whether the executive branch will condition component exports on reprocessing approval rights. (See p. 70.)

GAO believes the United States should continue its case-by-case review of nuclear arrangements involving reprocessing and plutonium use and strictly implement the 1978 nuclear non-proliferation law's standards governing U.S. approvals. Much of the foreign concern on how the United States exercises its reprocessing approval rights stems from executive branch policy of considering some foreign reprocessing requests

only as a "last resort" for the disposition of spent fuel. GAO believes the executive branch could remove much of the uncertainty about how U.S. reprocessing approval rights are exercised by considering and acting on foreign requests without trading partners having to demonstrate an imminent physical need (i.e. spent fuel congestion). (See pp. 61 and 62.)

The Secretary of Energy should seek the necessary top-level policy approvals to allow the executive branch to do this. (See pp. 71 and 72.)

GAO strongly endorses the administration's policy to reduce the enrichment levels of highly enriched uranium exports. However, the executive branch should, after appropriate consultations, decide and tell foreign governments which reactors merit continued supplies, and the quantity and the level of enriched fuel to be supplied. (See p. 68.)

The Secretary of State should improve the predictability of the export licensing process for highly enriched uranium by

--telling foreign governments after appropriate consultations which reactors merit continued supplies of highly enriched uranium pending commercial availability of more proliferation-resistant fuels, and

--expediting the executive branch processing of export requests for Presidential review. (See p. 71.)

How well are other forms of U.S. assistance to foreign nuclear programs controlled?

A comprehensive interagency reassessment is needed of the controls the Department of Energy administers over nuclear technology exports and all other foreign nuclear activities of U.S. firms and individuals. (See p. 87.) These controls contain

significant loopholes and are not well coordinated with the controls the Nuclear Regulatory Commission and the Department of Commerce administer in the nuclear field. Further, the Department of Energy's administration of these controls provides too many opportunities for arbitrary executive branch decisions and no routine opportunities for public or congressional scrutiny. (See p. 76.)

The Secretary of Energy should take the lead in coordinating a comprehensive interagency reassessment of the controls over foreign nuclear activities of U.S. firms and individuals and how they are administered. (See p. 87.)

AGENCY COMMENTS

The Department of Energy believes that construction of the first increment of new enrichment capacity (25 percent of the authorized capacity) should proceed as planned based on considerations of both demand and cost savings. GAO is not convinced by DOE's justification and believes more information is needed before the Congress appropriates additional funds. (See p. 44 and app. III.) Further, although DOE does not disagree with GAO's recommendation for a comprehensive interagency reassessment of controls over U.S. activities in foreign nuclear programs, it does not acknowledge that there is cause for concern. GAO believes the problems it discovered are of serious concern. (See p. 68 and app. III.)

The Departments of State and Commerce, the Arms Control and Disarmament Agency, and the Nuclear Regulatory Commission also commented on this report. Their comments were mostly of a technical nature. Where appropriate the report was revised to note their position on certain matters. (See apps. IV to VII.)

Contents

ABBREVIATIONS

ACDA	Arms Control and Disarmament Agency
AIS	advanced isotope separation
DOD	Department of Defense
DOE	Department of Energy
EURATOM	European Atomic Energy Community
GWe	gigawatts of electricity
IAEA	International Atomic Energy Agency
INFCE	International Nuclear Fuel Cycle Evaluation
LWR	light water reactor
MWe	megawatts of electricity
NEA	Nuclear Energy Agency
NNPA	Nuclear Non-Proliferation Act of 1978
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NRC	Nuclear Regulatory Commission
U308	refined uranium ore
UF6	uranium hexafluoride
SWU	separative work unit

CHAPTER 1

INTRODUCTION

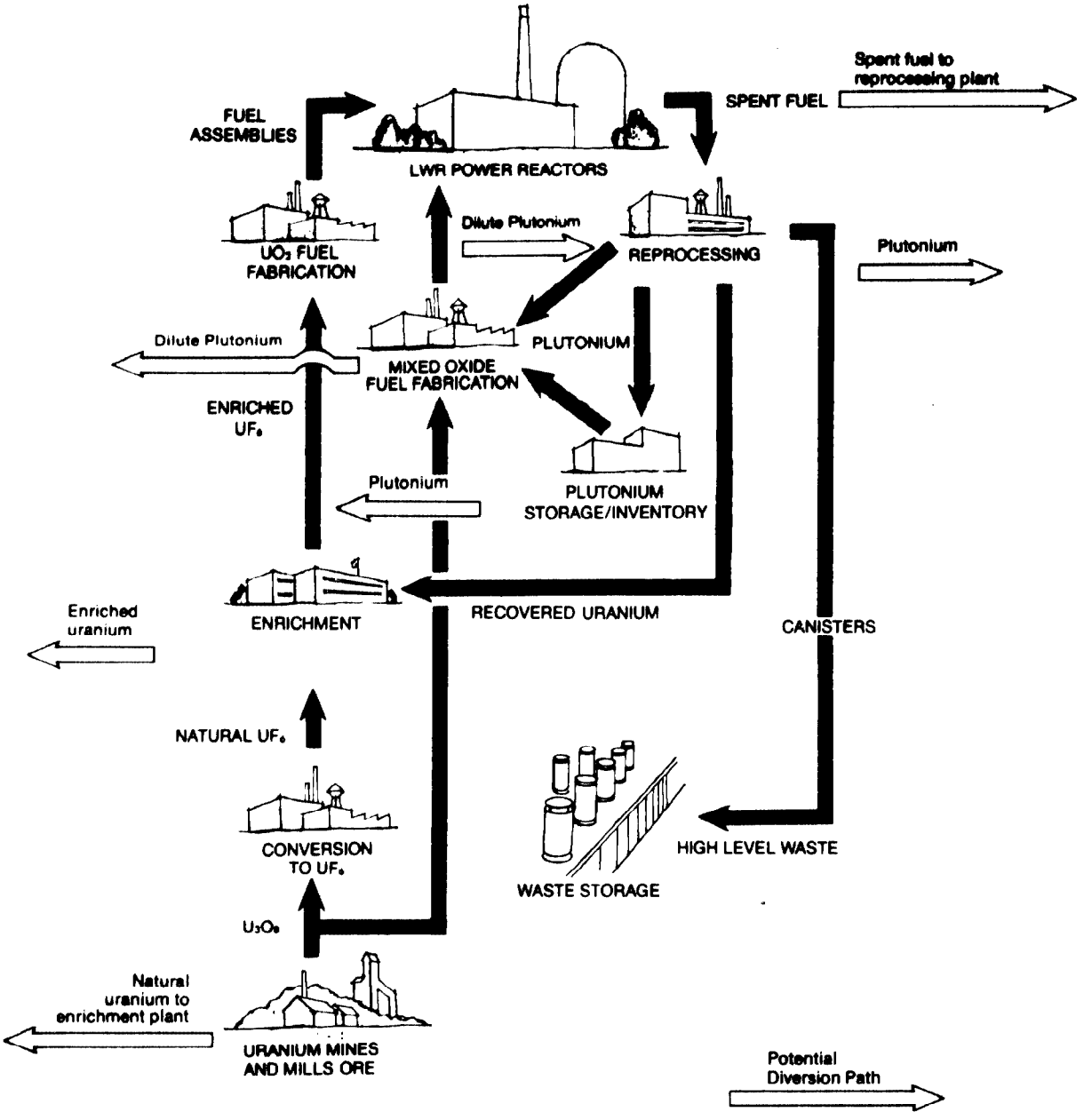
Much of the controversy over nuclear power, particularly in the international arena, centers around the possibility that the peaceful uses of nuclear energy could contribute to the proliferation of nuclear weapons. Thus far, six nations have acknowledged exploding nuclear devices--the United States, the United Kingdom, France, the Soviet Union, the People's Republic of China, and India. This report addresses selected features of U.S. initiatives aimed at preventing the spread of nuclear explosives to nations that previously did not have them.

LINKS BETWEEN NUCLEAR POWER AND NUCLEAR WEAPONS

Certain processes, materials, and technologies provide potential links between nuclear power and nuclear weapons. The linkage is strongest at those points in the nuclear fuel cycle where weapons-usable materials--highly enriched uranium or plutonium--are easily accessible. At the "front end" of the fuel cycle, diversion of highly enriched uranium from enrichment plants is of particular concern. At the "back end," diversion of plutonium from reprocessing plants is of particular concern. The diagram on page 2 shows possible diversion paths in the fuel cycle for the most common nuclear powerplant, the light water reactor (LWR).

Neither highly enriched uranium nor separated plutonium is commonly used commercially as fuel in the current generation of nuclear power reactors. As a rule, commercial power reactors use natural or slightly enriched uranium. Natural uranium ore contains less than 1 percent of the fissionable isotope U-235 and is used as nuclear fuel in the Canadian-type heavy water reactors. To be used as a nuclear fuel in the American-type light water reactors, which are predominant in the world today, the concentration of U-235 needs to be increased or enriched to 3 or 4 percent. In contrast, uranium for nuclear weapons needs to be much more highly enriched. About 15 kilograms of highly enriched uranium are needed for a nuclear bomb according to an April 1977 White House fact sheet. The United States continues to export large quantities of highly enriched uranium for use in the world's nuclear research reactors, and despite U.S. efforts to restrain the spread of enrichment technology, the capability of nations to enrich uranium is expanding.

LIGHT-WATER REACTOR FUEL CYCLE



SOURCE: OFFICE OF TECHNOLOGY ASSESSMENT

Plutonium is a manmade element produced as a byproduct of uranium-fueled reactors. If separated from the spent fuel by chemical reprocessing, it can be refabricated for use as a fuel for either the current or next generation of nuclear power reactors. According to the Arms Control and Disarmament Agency (ACDA), only about 10 kilograms of this same plutonium are needed to make a nuclear weapon. Among its peaceful uses, plutonium is valued greatest as fuel in breeder reactors which are currently under development. Breeder reactors are particularly attractive to countries which have nuclear energy programs but lack indigenous uranium resources, such as the Federal Republic of Germany, Japan, and the United Kingdom. These countries, along with Belgium, France, and the Soviet Union, have a high interest in commercialization of plutonium-fueled breeder reactors.

Uncertainties regarding the availability of natural uranium, uranium enrichment services, plus the risks of foreign government intervention in nuclear trade drive some nations to seek energy security by developing independent capabilities to produce separated plutonium and enriched uranium. Congressional and executive branch policy initiatives combined attempt to provide a delicate balance of denials, controls, and incentives directed toward discouraging other nations from premature development of these fuel-cycle capabilities.

EVOLUTION OF U.S. NON-PROLIFERATION STRATEGY

Whether a nation turns to nuclear weapons development depends upon two broad considerations: (1) its political self-interest or motivation to do so and (2) its capability for producing such weapons. Recent congressional and executive branch initiatives focus heavily on curbing the capability of nations to produce nuclear weapons. It is important, however, not to lose sight of the political instruments to reduce the motivation of nations to build nuclear weapons--chiefly military security and the quest for political prestige--that have evolved over time. Accordingly, the following sections put present U.S. nonproliferation strategy into chronological perspective.

Reliance on political instruments

The "Atoms for Peace" program, proposed by President Eisenhower in 1953 and then authorized by the Congress with the passage of the Atomic Energy Act of 1954 (42 U.S.C 2011), provides the foundation for some of the most important political instruments that the United States relies upon to deter

nations from developing nuclear weapons. After nuclear explosions by the Soviet Union and the United Kingdom, the United States shifted from a strict policy of secrecy and denial of nuclear science to a policy of sharing the benefits of the peaceful uses of nuclear energy under a system of political commitments, providing safeguards against nuclear weapons proliferation.

Agreements for cooperation

"Agreements for Cooperation Concerning the Civil Uses of Atomic Energy" were the first political instruments to evolve from the "Atoms for Peace" program. These intergovernmental agreements negotiated between the United States and other countries or groups of countries provide the basic framework for U.S. nuclear exports and specify the safeguards and controls to be applied. By the end of 1955, 22 such agreements had been negotiated. At one time agreements were in effect with more than 40 individual countries. As of January 1980 the United States had in effect 23 agreements with individual countries or groups of countries.

Agreements for cooperation are not exactly alike, due to provisions tailored to the needs of recipients, changes in U.S. statutory and regulatory requirements, new international treaties, technological developments, and an evolving U.S. non-proliferation policy. They also differ according to the scope of nuclear cooperation involved. Most agreements cover both research and power applications of nuclear energy; a few cover only research or only power. The duration of the agreements also vary. Early agreements for research applications ran for 5 to 10 years, while agreements for power applications ran up to 40 years. Newer agreements covering both research and power applications generally run for 30 years.

Agreements for cooperation are a precondition for export of nuclear reactors and most special nuclear material 1/ to other nations. They generally do not legally commit the United States to make such exports, however. Legal commitments exist only with the conclusion of specific supply contracts and the issuance of specific export licenses. Certain controls in the agreements are designed to assure both the United States and the recipient nation or group of nations

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1/Special nuclear material is defined under the Atomic Energy Act as plutonium, uranium enriched in the isotope U-235, or uranium containing the isotope U-233.

that materials and equipment transferred between the parties will be used for authorized purposes only and will be properly safeguarded. Prior to the Nuclear Non-Proliferation Act of 1978 (NNPA), 1/ major control provisions common to most U.S. civil agreements included the following.

--Cooperating nations guarantee that (1) material provided under the agreement will not be used for atomic weapons, for research and/or development of atomic weapons, or for any nuclear explosive device, (2) material made available and, in most cases, material produced from supplied material will not be transferred to unauthorized persons or beyond the jurisdiction of the cooperating party except as authorized by the Department of Energy (DOE), and (3) safeguards will be maintained on such material.

--Enriched uranium may not be supplied in excess of a ceiling specified in the agreement. 2/ A specific technical or economic justification may be required for supplying uranium that is enriched to more than 20 percent because of the suitability of highly enriched uranium for weapons development as well as for use in reactors.

--The reprocessing of any special nuclear material may be performed in facilities acceptable to both parties upon a joint determination that the safeguards provisions of the agreement may be effectively applied, or with the prior approval of the United States.

--Only unclassified data is supplied; materials, equipment, and services cannot be supplied if they would result in restricted data being communicated.

--The United States has the right to (1) require the recipient to maintain materials accountability

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1/Public Law 95-242, 92 Stat. 120 (1978), to be codified at 22 U.S.C. 3201 et. seq. and 42 U.S.C. 2011 et. seq.

2/On June 18, 1980, a congressional joint resolution lifted the ceilings for low enriched uranium (less than 20 percent) to nations that are party to the Treaty on the Non-Proliferation of Nuclear Weapons. (Public Law 96-280).

records and submit reports, (2) make onsite inspections, and (3) suspend or terminate the agreement and require the return of any material and equipment after a reasonable time in the event of noncompliance.

The content of the agreements have undergone considerable change. Initially the agreements contained provisions for U.S. bilateral inspections and verification to ensure compliance with the safeguard provisions. In 1963 the executive branch began to transfer the safeguards responsibility to the International Atomic Energy Agency (IAEA). Accordingly, provisions were incorporated into the agreements to permit trilateral safeguards agreements among the IAEA, the United States, and the third party to the agreement for cooperation. When the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) came into force in March 1970, provisions were added to all agreements to recognize this channel for exercise of IAEA safeguards as an alternative to trilateral arrangements. The NNPA requires that new agreements for cooperation contain certain provisions, and directs the executive branch to upgrade provisions in older agreements through renegotiations to reflect the requirements for new agreements. Although several agreements have been renegotiated, major U.S. trading partners have been reluctant to renegotiate their existing agreements.

International safeguards

The origins of international safeguards trace back to President Eisenhower's Atoms for Peace address before the United Nations in 1953, when he proposed the establishment of an international atomic energy agency. The IAEA subsequently came into existence in 1957 as an autonomous organization of the United Nations. Over 100 nations are now members. In general, its overall mission is to promote the peaceful uses of nuclear energy without contributing to the military uses of nuclear energy. In conjunction with this mission, it has assumed responsibility for administering a system of international safeguards with the objective of timely detection and hence deterrence of illicit diversion of nuclear materials from peaceful nuclear activities.

A nation submitting its peaceful nuclear activities to IAEA safeguards is providing a major political and legal commitment not to divert materials from such activities to nuclear explosive purposes. The Agency conducts, among other things, onsite inspections of nuclear activities to verify compliance with the commitment to peaceful uses of

nuclear energy. The continued viability and effectiveness of the IAEA safeguards system have been a major foreign policy objective of the United States since its creation.

The Treaty on the Non-Proliferation of Nuclear Weapons

International safeguards are essentially part of a bargain in which countries are assisted in meeting their peaceful nuclear energy needs in return for accepting the intrusion of safeguards into their sovereignty.

The Non-Proliferation Treaty reinforced this bargain and initiated a new era of IAEA safeguards responsibilities under which:

--All parties (currently 114 countries) agree to facilitate cooperation in the peaceful uses of nuclear energy and to require IAEA safeguards on exports of all nuclear material or equipment to a non-nuclear-weapons state.

--Non-nuclear-weapons countries pledge not to manufacture or acquire nuclear explosive devices and agree to international verification of their obligation through the application of IAEA safeguards on all peaceful nuclear activities.

--Nuclear-weapons countries party to the treaty (currently the United Kingdom, Soviet Union, and the United States) pledge (1) not to transfer nuclear explosive devices to any recipient or assist any non-nuclear-weapons state in the manufacture or acquisition of nuclear explosive devices and (2) to pursue negotiations on disarmament.

The Non-Proliferation Treaty is an unprecedented concept in international relations in that it requires a general commitment from non-nuclear-weapons countries to international inspection of all their peaceful nuclear activities. In non-NPT countries, IAEA applies safeguards only to specific facilities and/or specified nuclear material within the country.

Increased emphasis on capabilities

The international political instruments described above are not intended to prevent the accumulation of weapons-usable materials, or the facilities for their production, by non-nuclear weapons states. By the 1970s, concern was being expressed in the United States that international safeguards

and non-proliferation commitments were not enough. India's use in 1974 of plutonium produced in a research reactor and separated in a reprocessing plant--neither facility safeguarded by the IAEA--to conduct a "peaceful nuclear explosion" strengthened this view. India's explosion underscored the proliferation danger of peaceful nuclear activities which produce weapons-usable material and occur outside of the purview of existing international political instruments. Since then, the United States has increasingly tried to keep the peaceful nuclear programs of non-weapons states from moving in directions which would provide them direct access to weapons-usable materials without effective controls.

India's nuclear explosion marks a shift in emphasis for U.S. non-proliferation strategy. Before the explosion the United States relied primarily on international political instruments as the means for restraining nuclear proliferation; after the explosion a series of congressional and executive branch initiatives were implemented which focus heavily on the capability of nations to produce nuclear weapons. 1/

Foreign aid sanctions

A major congressional initiative to focus on the technical capability of nations to produce nuclear weapons was the foreign aid sanctions provided for in the 1975 and 1976 amendments to the Foreign Assistance Act of 1961 (22 U.S.C. 2429). Unless the President takes special action, these amendments require the cut off of certain funds to foreign-aid recipients that deliver or receive reprocessing or unsafeguarded nuclear enrichment materials, equipment, or technology. Under this law the executive branch announced its intention to phase out military and economic aid to Pakistan in April 1979. The executive branch was concerned that parts of Pakistan's nuclear program involving construction of an unsafeguarded enrichment

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1/In commenting on our report, ACDA noted that the increased emphasis on "capabilities" also stemmed from the increase in the price of oil and the growing interest in nuclear power by many countries, along with the substantial commitments to the use of plutonium in commercial applications advanced nuclear states were about to make. According to ACDA, the United States continued to place major emphasis on political instruments, but also had to address the serious issues raised by the possible widespread use of weapons-usable material in peaceful nuclear applications.

plant were not peaceful, but related to the development of a nuclear explosive capability.

Supplier's guidelines

In 1974 the executive branch began an effort to establish common non-proliferation guidelines for nuclear exports among major nuclear supplier nations. In February 1978 the guidelines were published. The guidelines establish minimum common ground rules for the supply and use of certain nuclear material and equipment. Although the guidelines do not go as far as present U.S. nuclear export controls, they represent a good foundation upon which the United States can urge further improvements.

Domestic nuclear power and export control policies

In April 1977, the executive branch further shifted its non-proliferation strategy to focus more squarely on the accessibility of weapons-usable material (plutonium and highly enriched uranium) from nuclear power programs. President Carter announced a series of policies which specifically linked the direction of the U.S. nuclear program with its non-proliferation efforts. 1/ Domestically, specific policies were adopted which deferred U.S. commitments to commercial use of plutonium. Commercial reprocessing and the recycling of plutonium was deferred "indefinitely," and the U.S. breeder reactor program was reoriented from its emphasis on early commercial deployment of the liquid metal fast breeder reactor to more research and development and a broadly based assessment of

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1/Although President Ford in October 1976 had linked commercial reprocessing in the United States to non-proliferation issues, until these series of policies the United States, like other countries, had been working toward early commercialization of plutonium-fueled breeder reactors. The administrator of the former Energy Research and Development Administration had set 1986 as a milestone for determining whether the United States should deploy commercially the breeder reactor as the next generation of nuclear power. In addition, the Nuclear Regulatory Commission was working toward a decision on whether commercial reprocessing and plutonium recycling should be permitted in the United States from a health and safety standpoint. Both of these decisionmaking processes have since been postponed indefinitely.

technologies and fuel cycles which do not involve direct access to weapons-usable materials.

In addition, specific policies were adopted by the executive branch which strengthened U.S. nuclear export controls. An embargo was imposed on significant exports of separated plutonium, and prior policy to embargo the export of enrichment and reprocessing plants or other sensitive nuclear technology was reaffirmed. Policy with regard to supplying highly enriched uranium was redirected toward (1) reducing the amount of such material exported from the United States, (2) minimizing inventories of it abroad, and (3) encouraging the conversion of research reactors to lower enriched fuels.

Internationally, the executive branch urged other nations to adopt similar domestic nuclear power policies and export controls. Initial international reaction was mostly negative. Some industrial nations with major commitments to plutonium usage as a route to reduced dependence on imported energy supplies perceived the shift in U.S. strategy as a threat to their energy security and, in some cases, to the health of their export-oriented nuclear industries. Some lesser developed nations saw the shift as a threat to their development of nuclear power as an energy source.

The Nuclear Non-Proliferation Act of 1978

In March 1978, the culmination of over 3 years of intense congressional scrutiny of the risks of nuclear proliferation resulted in the passage of the NNPA. It provides a stringent, but flexible legislative framework for U.S. nuclear cooperation with other nations in the peaceful uses of nuclear energy that attempts to influence both the motivation and capability of nations for producing nuclear weapons. Its enactment was quite controversial abroad. Some interests urged greater use of U.S. influence, or leverage, derived primarily from U.S.-supplied enriched uranium to pressure other countries into committing themselves to stronger non-proliferation measures. Other interests warned that radical unilateral action would place the United States at a competitive disadvantage in the world nuclear market and thereby reduce U.S. ability to influence foreign nuclear power decisions. In addition, the NNPA itself is complex. It substantially revised the terms and conditions for U.S. nuclear cooperation with other nations. It also commits the United States to a

broad range of unilateral and international initiatives for curbing the proliferation risks of nuclear power.

The international nuclear fuel-cycle evaluation

One additional initiative needs to be recognized. As a step toward achieving an international consensus on ways to minimize the risks associated with the growing number of nations with direct access to separated plutonium and highly enriched uranium, the President in April 1977, proposed an international nuclear fuel-cycle evaluation (INFCE). This unprecedented international study was officially launched in October 1977 by the President at a conference attended by representatives of 40 countries and 4 international organizations. During the following 2 years intensive joint studies were conducted regarding key areas of the commercial nuclear fuel cycle relevant to balancing nuclear power needs with the proliferation risks. An additional 26 nations subsequently joined the evaluation.

The study was completed at the end of February 1980. Because it was initially agreed that INFCE was to be a technical and analytical study, and a forum for exchanging views but not a negotiation, no government is bound to its findings and recommendations. Nevertheless, the INFCE studies do provide a basis for the world's governments to make more informed decisions regarding their national nuclear power programs.

Other U.S. efforts

In commenting on our report, ACDA noted other executive branch efforts or beliefs dealing with the motivations of nations to acquire nuclear weapons which are components of U.S. non-proliferation strategy. Specifically, ACDA noted:

--Fresh impetus given to the Treaty of Tlatelolco over the past 3 years. Under this Treaty, 22 Latin American countries have agreed not to manufacture or acquire nuclear weapons and not to permit such weapons to be stored or deployed on their territories.

--Intensified executive branch support for the IAEA in recognition of its central role in multilateral nuclear cooperation.

--A possible Comprehensive Test Ban treaty, which would prohibit all nuclear weapons explosive testing.

--The belief by the executive branch that the SALT (Strategic Arms Limitation Talks) process is important to preventing horizontal proliferation by demonstrating nuclear-weapons state's compliance with the disarmament provision of the NPT and as an admission that nuclear arms races are counterproductive to national security objectives.

--Continued strong alliance and security relationships with other countries.

--An expanded executive branch policy of not using nuclear weapons against certain states.

OBJECTIVES, SCOPE, AND METHODOLOGY

This report arises out of work we are conducting to respond to a statutory requirement to study and report to the Congress after March 10, 1981, on the NNPA's implementation and impact on U.S. non-proliferation policies, purposes, and objectives. It was not, however, prepared to fulfill that requirement, but rather was prepared to bring to the attention of the Congress issues which should be of interest regarding the difficult task of carrying out both the law and related executive branch non-proliferation policies.

Our primary source of information was from records and interviews with officials at the Nuclear Regulatory Commission, the Arms Control and Disarmament Agency, and the Departments of Energy, State, and Commerce. Secondary sources of information were from the U.S. nuclear industry, European and Japanese government and industrial officials, and INFCE working group reports.

In Europe we discussed with either government, industrial, or U.S. embassy officials in Austria, Belgium, France, Great Britain, the Netherlands and West Germany, their concerns about the implementation and impact of U.S. non-proliferation law and policies. We held similar discussions with representatives of the following international organizations: the European Atomic Energy Supply Agency, the International Atomic Energy Agency, and the Nuclear Energy Agency of the Organization for Economic Cooperation and Development. Our industrial contacts included representatives from utilities, nuclear research centers, fuel fabricators, reprocessors, and nuclear trade associations.

In analyzing the adequacy of uranium supplies to meet future demand, we reviewed the latest international studies of uranium supply and demand and interviewed DOE participants in such studies. Our objective was to determine the implication of uranium supply and demand on national commitments to nuclear fuel reprocessing and breeder reactors.

We reviewed the concept of relying on U.S. enrichment capability as leverage to influence other nations to accept or adopt more stringent non-proliferation measures because it is a fundamental concept to the NNPA and past U.S. nuclear policies. We compared DOE projections of worldwide demand for enrichment services to current and anticipated DOE and foreign enrichment capacities to determine the efficacy of U.S. enrichment leverage. We also obtained the views of foreign enrichment officials and of foreign customers for U.S. enrichment services--past, current, and potential--on the concept of U.S. leverage.

A major thrust of the NNPA was to improve the timeliness and predictability of U.S. controls over exports of nuclear materials and equipment. We tracked various categories of nuclear export license applications through the five cognizant executive branch agencies and NRC to evaluate the timeliness of the process, identify reasons for delays, and make appropriate recommendations. In performing this work, we interviewed responsible officials representing the Federal agencies involved, U.S. exporting firms, and foreign customers. We are in the process of evaluating the qualitative aspects of the Federal reviews and the results will be reported in our overall report on the NNPA's implementation and impact.

We also reviewed how well U.S. controls are working over exports of nuclear technology and other assistance provided by U.S. firms and individuals to foreign nuclear programs. We examined DOE records of executive branch decisions in this area and interviewed the Federal officials responsible for administering the controls.

In the past few years we have issued a number of reports dealing with the links between nuclear power and nuclear weapons, and related domestic issues. (See app. I.) Although we relied partially on this past work, this report is based primarily on new work and a fresh look at the issues.

The Departments of Energy, State, Commerce, the Arms Control and Disarmament Agency, and the Nuclear Regulatory Commission commented on a draft of this report. Their comments are included as appendixes.

CHAPTER 2

ARE URANIUM SUPPLIES ADEQUATE TO DEFER DEVELOPING REPROCESSING TECHNOLOGIES AND BREEDER REACTORS?

Whether enough uranium will be available to meet future nuclear power needs is central to national decisions on the need for developing reprocessing and breeder reactors, and on the urgency attached to such developmental programs. However, there is no generally accepted answer to this question because of the enormous uncertainties affecting both demand projections and resource estimates. The issue is further clouded by external political considerations. For example, the United States used the potential depletion of uranium resources to justify treating development of breeder reactors as the Nation's highest priority energy research and development project throughout the Nixon Administration. In April 1977 President Carter announced a nuclear policy based on deferring reprocessing of spent fuel and delaying breeder reactor development. While this policy was taken to reduce the risks of proliferation, it also takes into consideration that the estimated uranium resource base has been revised upward. Other industrialized nations have continued with breeder reactor development programs to reduce their dependence on imported energy sources.

While the primary ingredient in estimating demand for uranium is the projected growth of nuclear power, it is influenced by hard-to-quantify variables such as effect of environmental opposition, advances in the efficiency of reactor and enrichment processes, recycling spent reactor fuel, and development of alternative energy sources. Predicting uranium supply is also difficult because only a few countries prospect for it and then only in limited regions. However, as the price of uranium ore increases, exploration activities also increase and more areas favorable for mining uranium are identified.

A related but separate issue involves the fear of consuming nations that supply interruptions will result from intervention by the governments of some supplier nations. Only a few countries have sizable known reserves. Gaining reliable access to uranium has become a paramount concern to countries with large nuclear programs and no or little indigenous resources.

WORLD URANIUM DEMAND

The primary determinant for future uranium demand is the number of nuclear reactors expected to be in operation. INFCE reported 1/ the following boundary cases for nuclear growth in non-communist countries (expressed in net GWe 2/):

	1985	1990	1995	2000	2010	2025
Low	245	373	550	850	1300	1800
High	274	462	770	1200	2150	3900

Many of the nations participating in the INFCE study have made highly publicized national commitments calling for increased reliance on nuclear power and, accordingly, influenced the adoption of what some nations consider optimistic nuclear growth scenarios. A senior State Department official acknowledged that the INFCE projections seem excessively optimistic but that U.S. arguments to revise them downward were unsuccessful. The following table shows that DOE's most recent projections are even lower (expressed in GWe): 3/

	1985	1990	1995	2000
Low	203	286	365	450
High	237	339	440	600

To test the reasonableness of the INFCE and DOE projections, we compared them to the capacity of nuclear reactors currently operating, under construction, and planned. Approximately 120 GWe of nuclear capacity currently exists worldwide and another 170 GWe is under construction. Currently 91 reactors are planned and we assumed they will have a capacity of 91 GWe. The resulting total is 381 GWe worldwide. The continuing debate over the future of nuclear power

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1/International Atomic Energy Agency, "International Nuclear Fuel Cycle Evaluation," Summary Volume (Vienna, Austria: 1980).

2/One gigawatt (GWe) equals 1 million kilowatts. A common large power reactor might have an electrical generating output of 0.6 to 1.0 gigawatts.

3/U.S. Department of Energy, Energy Information Administration, "Annual Report to Congress, 1979, Volume Three: Projections," July 1980.

may result in termination of some planned reactors. Additional reactors that have not even reached the planning stage may be constructed and operating in the 1990 to 2000 time frame. Considering the above, the most recent DOE projections appear to be more reasonable than INFCE's.

According to DOE projections, the uranium required to meet lifetime requirements for reactors operating in the year 2000 (450 to 600 GWe) range from 2.7 million tons to 3.6 million tons for 30 years operation. 1/ World resources could meet this demand and more, as discussed in a following section.

Factors which could further reduce demand

While declining reactor projections mitigate concerns for the eventual exhaustion of uranium resources, advances in reactor technology could also reduce demand and delay uranium depletion. Since minimal uranium consumption has not been a goal in designing light water reactors, several technical modifications in fuel management and reactor design presently being considered could improve fuel utilization by increasing the energy obtained from uranium. DOE estimates that such advances could lead to uranium savings of 10 to 15 percent by 1990 and an additional 10 to 15 percent by 2000. However, we reported 2/ that uranium efficiency improvements will not be available until the middle to late 1990s, and these could be applicable to all light water reactors. The additional 10- to 15-percent improvement, however, would be applicable only to new and a small number of existing reactors and thus, probably would have a smaller impact on uranium demand.

Uranium needs will also depend on how enrichment plants operate. The plants can be operated in a mode that requires more or less uranium feed. In October 1978 DOE announced plans to operate the enrichment plants in the 1980s in a mode that decreases the demand for uranium feed about 10 percent. If more efficient enrichment techniques such as

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1/To convert anticipated reactor capacity to demand for uranium ore, we assumed 6,000 tons per 1,000 MWe reactor, no recycle, 0.20 percent tails assay, a 65-percent capacity factor, and that all reactors are of the light water design.

2/"Comments on the Administration's White Paper, 'The Clinch River Breeder Reactor Project--An End to the Impasse,'" EMD-79-89, July 10, 1979.

laser isotope separation are developed, the uranium demand could be decreased by 30 percent. (See ch. 4.)

Further reductions in uranium demand could also result from new types of reactors, such as the breeder. Breeder reactors produce more usable fuel than they consume and potentially can use 60 percent or more of the energy content of uranium. Changes in reactors, however, are not expected to appreciably affect demand until after 2000.

Another factor influencing the adequacy of uranium resources is the fuel burnup of reactors. Utilities usually order fuel assuming a 75- to 80-percent capacity factor, while in practice reactors have been operating at lower average capacity factors. A lowering of plant output extends the life of the fuel in the reactor. At the lower percentage of full power, fuel could be left in the reactor several months longer. However, utilities continue to refuel at yearly intervals because it is economical to refuel in conjunction with annual maintenance. This leaves a substantial amount of unburned uranium in the spent fuel which could be sent to a chemical reprocessing plant where uranium and plutonium would be separated from waste products. The recovered uranium could be reenriched for reactor fuel and the extracted plutonium could fuel breeders. Recycling uranium and plutonium could reduce requirements for mined uranium by approximately 35 percent. However, recycling spent reactor fuel has the potential danger of being diverted for use as weapons-type material. This issue is fully discussed in our March 1980 report entitled "Nuclear Fuel Reprocessing and the Problems of Safeguarding Against the Spread of Nuclear Weapons," EMD-80-38, March 18, 1980.

WORLD URANIUM SUPPLY

Geologically, uranium is abundant in the earth's crust. While resources occur in many kinds of deposits, only a limited number of countries have actively explored and exploited it, and the exploration has been limited to ore formations already being mined. For example, uranium resources in the United States, Gabon, and Niger are found in sandstone formations; the large deposits in Canada and Australia are found in non-sandstone formations. It is difficult to estimate how much uranium is available worldwide because the method used to develop the statistics varies and quite frequently is not substantiated by a systematic assessment of the ore.

International estimates

Since 1965 the Nuclear Energy Agency (NEA) in cooperation with the International Atomic Energy Agency (IAEA) has prepared estimates on world uranium resources, except for the People's Republic of China, the U.S.S.R. and Eastern European countries. The NEA/IAEA data are based on voluntary submissions from each country. Each country classifies its own resources using NEA/IAEA guidelines in two categories--reasonably assured resources and estimated additional resources. The assessment methods vary among the more than 50 countries with exploration programs, and their reliability has not been measured. Further, the precision of the assessments is limited because they are confined to known uranium districts. Although these estimates represent an incomplete appraisal of what could ultimately be discovered in the world, this is the most referenced international data and is generally considered the most credible. The following table shows the most current NEA/IAEA estimates used in the INFCE study.

	Up to $30/pound U308 (million tons)	Up to $50/pound U308 (million tons) (note a)
Reasonably assured resources	2.4	3.4
Estimated additional resources	1.9	3.2
Total	4.3	6.6

a/$50 cost category includes all resources in lesser cost categories.

The DOE estimates correspond very closely with the NEA/IAEA estimates. For example, DOE estimates compared to reasonably assured resources are 2.4 and 3.3 million tons at the equivalent of $30 and $50 per pound U308, respectively.

Until recently, the NEA/IAEA did not consider the potential for new discoveries beyond these categories. However, in 1977 it began evaluating more speculative resources worldwide. This program is a three-phase effort. The first phase, which was completed in 1978, estimated the uranium poten-

tial of 185 countries based on the geological strata of the country compared to known uranium areas and past and present exploration efforts. The results classified as speculative resources are shown in the following table.

Continent	Range of speculative resources (million tons U308)		
Africa	1.7	-	5.2
North America	2.7	-	4.7
South and Central America	.9	-	2.5
Asia and Far East (note a)	.3	-	1.3
Australia and Oceania	2.6	-	3.9
Western Europe	.4	-	1.7
Total	8.6	-	19.3

a/Excludes the People's Republic of China and the eastern part of the U.S.S.R.

Adding the speculative resources to the previous NEA/IAEA estimates at $50/pound U308 indicates that world uranium resources could range from 15.2 million to 25.9 million tons. Subsequent phases of the study are designed to substantiate that the uranium potential actually exists and could be exploited. The study emphasized that a major part of the speculative resources may not be discovered and brought into production until after the first quarter of the twenty-first century. It is not known when these subsequent phases will be completed.

The INFCE uranium availability analysis compared the NEA/IAEA estimates to various demand scenarios and concluded that the uranium industry would be able to achieve annual supply levels required up to 2025 for its low growth projections but that production limitations would prevent the industry from satisfying past 2000 requirements for its high growth projection. This analysis assumes that the necessary exploration and investment can be made and includes production from the speculative resource category. INFCE also pointed out that political, commercial, and technical factors foster concern over supply assurances and that certain consuming nations will maintain policy options (e.g. reproces-

sing, breeder reactors, diversity of supply) to protect against the possibility of future uranium unavailability.

Another assessment of the factors affecting uranium supply and demand worldwide was conducted between April 1978 and February 1979 by the Uranium Institute--an international forum of uranium producers and consumers headquartered in London. 1/ Demand calculations were based on installed nuclear capacity and forecasts of enrichment capacity. Although uranium consumption is ultimately determined by actual use in reactors, commitments to supply uranium under existing enrichment contracts may produce some short-term aberations in uranium demand. Supply expectations were based on the industry's production capabilities rather than uranium ore estimates. Institute members provided most of the information reported.

This study only considered the period up to 1990. It estimated that installed nuclear capacity in 1990 would range between 410 GWe and 530 GWe and concluded that a uranium supply-demand balance can be established until then. However, if installed capacity were less than 450 GWe, which appears more likely in view of the DOE estimates of 286 GWe to 339 GWe in 1990, an uranium oversupply condition could develop.

The NEA/IAEA and Uranium Institute estimates of uranium resources do not account for political uncertainties that could affect its availability. Only a few countries have significant known uranium deposits. In 1978 about 75 percent of the non-communist world's uranium production came from Australia, Canada, South Africa, and the United States. According to INFCE projections based on a mine-by-mine analysis, these four countries alone could account for up to 73 percent of the non-communist world's production capability in the year 2000.

Canada banned exports to Japan and Europe pending finalization of safeguards negotiations and implemented a policy to have ore reserves sufficient for its domestic program. Strong political opposition delayed developing Australia's uranium industry. The NNPA and executive branch policies

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1/Uranium Institute, Supply and Demand Committee. The Balance of Supply and Demand 1978-1990. (Kent, England: 1979).

have heightened foreign concern about U.S. intervention in nuclear trade. (See ch. 5) South Africa's political situation and the possibility of the United States increasing its uranium imports in the late 1980s exacerbate concerns about fuel assurance and emphasize the vulnerability of countries dependent on imports.

CONCLUSIONS AND OBSERVATIONS

No one knows how much uranium is or will be available or how much will be needed to meet future energy needs. Although the trend is for uranium supply estimates to increase while projections of future reactor growth decline, the supply and demand uncertainties make it difficult to determine how long uranium supply will be adequate to meet demand.

Comparing projected reactor growth to uranium resource estimates does provide a degree of insight into the adequacy of uranium supply. We compared the NEA/IAEA estimates, which appear to be the most authoritative and frequently referenced source on international uranium resources to the INFCE and DOE demand projections.

Current estimated world resources--classified as reasonably assured--at $30/pound would support about 400 reactors assuming each reactor has a generating capacity of 1,000 MWe and a lifetime need of 6,000 tons of U_3O_8. World resources--classified as estimated additional--would support an additional 310 reactors. While these resources would not be adequate to meet the reactors projected by INFCE through the year 2000 (850 to 1200), it exceeds DOE's worldwide projected 2000 generating capacity (450-600). Should uranium resources at $50/pound be mined, about 567 reactors could be supported with reasonably assured resources and about 533 more from estimated additional resources. This total of 1,100 reactors is within the range of INFCE projections for the year 2000.

However, differing national perceptions of the uncertainties in uranium supply and demand projections, coupled with political uncertainties that could affect its availability, appear sufficient to justify diametrically opposed national nuclear strategies for deferring or committing to early commercialization of reprocessing and/or breeder reactors. Certain highly industrialized nations like Belgium, France, the United Kingdom, and Japan have already made large investments in reprocessing and breeder reactors and are unlikely to follow the United States because of the uncertainties. It, therefore,

appears to come down to a "where you sit depends on where you stand" issue with national perceptions of uranium ore availability derived after previously announced national nuclear strategies are taken into consideration.

CHAPTER 3

CAN THE UNITED STATES USE ITS ENRICHMENT CAPABILITY TO PROMOTE NON-PROLIFERATION?

As an incentive intended to make U.S. nonproliferation controls more acceptable, the NNPA and other U.S. policies commit the United States to being a reliable supplier of enrichment services to nations adhering to effective non-proliferation policies. Because circumstances have changed since the United States held a near monopoly of the free world's commercial enrichment services, we believe U.S. reliance on its enrichment capability as a non-proliferation tool has become an outdated and unrealistic idea.

U.S. RELIANCE ON ENRICHMENT LEVERAGE

U.S. enrichment capability consists of three DOE-owned facilities located at Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio. These enrichment facilities were built in the 1940s and 1950s to satisfy military requirements for highly enriched uranium and are now used primarily to provide enrichment services to domestic and foreign electric utilities. From the time commercial nuclear powerplants started operating in the late 1950s through the mid-1970s, U.S. enrichment facilities were the predominant source of enriched uranium for commercial nuclear reactors in the free world. During this period, the "Atoms for Peace" doctrine permeated U.S. nuclear policies. This doctrine encouraged assistance to other nation's civilian nuclear programs under the controls of agreements for cooperation.

With ratification of the Non-Proliferation Treaty in 1970, the United States reaffirmed its commitment to assist the development of nuclear energy in those non-weapon countries renouncing an interest in acquiring nuclear weapons and willing to accept international safeguards over their nuclear activities. The NNPA is the most recent major expression of the U.S. continuing policy of assisting the worldwide development of peaceful nuclear activities and, at the same time, ensuring that such activities do not contribute to nuclear weapons proliferation.

A key ingredient of U.S. nuclear policy since the beginning of the Atoms for Peace program has been the provision of nuclear fuel on a long-term basis to countries willing to enter into agreements for cooperation with the United States. As a non-proliferation tool, U.S. nuclear

fuel supplies reduced the incentive for other countries to develop their own enrichment facilities, and at the same time, gave the United States leverage to influence the nuclear policies and programs of other nations since the use of the fuel was governed by U.S. controls contained in agreements for cooperation.

LOSS OF ENRICHMENT LEVERAGE

When the United States held a near monopoly on commercial enrichment services, U.S. reliance on its enrichment leverage as a non-proliferation tool made sense. However, this is no longer the situation.

During the early 1970s many countries became concerned about relying on a single source for their enrichment requirements. France, Germany, Sweden, and the United Kingdom entered into supply contracts with the Soviet Union which remain in effect today. During this same time frame, the United Kingdom, the Netherlands, and Germany entered into discussions which led to the formation of the URENCO consortium, and France announced a decision to construct a commercial enrichment facility with multinational ownership. Concern over relying on a single source for energy supplies was reinforced by the Arab oil embargo in 1973. In addition, as countries began ventures to diversify sources of enrichment services, the United States took a number of actions which brought U.S. reliability as a supplier of enrichment services into question.

Less attractive contractual features offered by the United States

In 1973 the United States announced a major change in the terms of future U.S. enrichment contracts which made the contracts significantly less attractive to foreign customers.

The original long-term enrichment contract offered by the United States was known as a requirements contract. Under this contract the United States agreed to supply all of the enrichment services required to fuel a specific nuclear reactor for up to 30 years. The customer had to provide the United States with a yearly estimate of its enrichment requirements for the next 5-year period. The estimate was non-binding, and the customers could demand delivery of additional enriched uranium upon giving only a 180-day notice to the United States. The requirements contract favored the customer by offering very flexible terms which permitted a customer to effectively match fuel needs with contractual enrichment requirements.

The contract introduced in 1973 is known as the long-term, fixed-commitment contract and it differed from the requirements contract in that it required (1) the customer to contract for fixed quantities of enrichment services on a take or pay basis for an initial 10-year period, (2) the customer to enter into the contract 8 years before the first delivery was called for, and (3) the customer to make an advance payment. The rationale for switching to the new contract was to firm up the future demand for U.S. enrichment services and also to establish a contract containing the type of terms that would be practical for creation of a private enrichment industry in the United States.

While the new contract terms were applied uniformly to both domestic and foreign customers, the switch to less attractive conditions from a foreign customer's viewpoint demonstrated that the United States could unilaterally change the terms and conditions governing many countries' primary source of future enrichment services.

Suspension of long-term contracting by the United States

The United States stopped offering long-term contracts for enrichment services for 9 months beginning in late 1972, while the terms and conditions of the long-term, fixed-commitment contract were being developed and presented to customers. While this may have been only a minor inconvenience, for foreign customers, it was a harbinger of things to come.

The United States announced the adoption of long-term, fixed-commitment contracts in September 1973 which coincided with the Arab oil embargo. As a result, domestic and foreign orders for nuclear powerplants and the associated enrichment services soared. By July 1974 the contractual commitments reached production capacity, and a month later the United States closed the order books and announced that no new applications for enrichment services would be accepted until additional enrichment capacity could be obtained. The suspension lasted almost 4 years 1/, during which time foreign enrichment suppliers emerged on the market and began establishing a solid position among non-U.S. customers.

1/In July 1978 the U.S. reentered the enrichment market and replaced the long-term, fixed-commitment contract with the adjustable, fixed-commitment contract which provides the customer with greater scheduling flexibility.

Licenses for exporting enriched uranium delayed

In 1975 the Atomic Energy Commission was split into the Energy Research and Development Administration and the Nuclear Regulatory Commission (NRC). NRC became responsible for licensing exports of nuclear material and equipment including enriched uranium. Generally, NRC took much longer than its predecessor agency to process nuclear export license requests; partly because it had to work out licensing procedures with other Federal agencies and partly because congressional and public concern over nuclear proliferation issues was heightened by India's 1974 peaceful nuclear explosion.

The resulting slowdown in granting uranium fuel export licenses contributed to the further erosion of U.S. reliability in many foreign customer's viewpoint.

U.S. Non-Proliferation policies

To a large extent, U.S. enrichment leverage was already diminished by the time the United States revised certain nuclear programs and policies in the interest of advancing non-proliferation goals. Nevertheless, the executive branch's efforts to urge other nations to defer major commitments to early plutonium usage and supplier states to tighten export controls, along with passage of the NNPA have been cited by some foreign customers as factors influencing decisions to seek enrichment services elsewhere. In addition, some saw passage of the NNPA as a reversal of the President's assurances, given at the opening of the INFCE study in 1977, promising no unilateral action by the United States to intervene in nuclear trade.

The need to renegotiate existing agreements of cooperation and the more stringent export license conditions established by the NNPA also foster the uncertainty foreign customers have toward the United States. Foreign officials note that they have no assurance that the next administration or the Congress will not again unilaterally revise the conditions governing U.S. exports. An indication of this sentiment is the clause recently inserted in U.S. enrichment contracts, at the foreign customers' requests, that the customer has the right to terminate the contract at no charge in the event the United States adds any new statutory export conditions.

EMERGENCE OF NON-U.S. SUPPLIERS

The cumulative impact of the foregoing U.S. actions, coupled with the nationalistic desires of other countries to be independent of the United States or any other sole supplier for its nuclear needs, has dramatically changed the composition of the international enrichment market.

Although the United States is still the major supplier of uranium enrichment services in the free world, and although it provides enrichment services at a very competitive price, foreign enrichers have obtained, and by all indications will continue to obtain, an increasing portion of the enrichment market once dominated by the United States. DOE records show that as recently as 1979 the United States had contracts to supply about 71 percent of non-U.S. enriched uranium needs. DOE expects that the United States' share will decrease to 43 percent by 1990.

By the mid-1980s foreign enrichment capacity could, if current plans materialize, satisfy all foreign enrichment services needs currently under contract to DOE. Although it is unlikely that DOE will lose all its foreign contracts, the availability of alternative sources represents the beginning of a new era in which the enrichment leverage the United States once had is quickly diminishing.

A brief summary of the enrichment programs and plans of other nations or groups of nations follow.

Soviet Union

The Soviet Union has supplied enrichment services to European utilities since the early 1970s. Public sources identify at least one Soviet enrichment facility, a plant in Siberia. Although the Soviet Union has not publicly disclosed any capacity or expansion plans, reports indicate that it is willing to supply the free world with 3 to 4 million separative work units (SWUs) 1/ per year.

1/The production capacity of enrichment plants is defined in terms of SWUs. It is a measure of the amount of effort expended to separate a given amount of natural uranium into two components--one having a higher concentration and one having a lower concentration of uranium-235.

EURODIF

EURODIF, incorporated in 1973, is a private consortium consisting of the French, Spanish, Belgian, Italian, and Iranian 1/ governments or utilities. Its gaseous diffusion plant, located in France, has an annual capacity of 2.2 million SWU, and plans exist for it to have a maximum of 10.8 million by 1982. Each member agreed to purchase a certain amount of EURODIF's total production. EURODIF is aggressively seeking to sell its remaining production to non-member countries. Public sources have indicated that some members' enrichment needs are smaller than their agreed purchase obligations, causing them to either stockpile or to try to sell their excess enriched uranium on the open market.

COREDIF

COREDIF is a consortium within a consortium with EURODIF being its major shareholder. Other members are the French and Iranian governments. A COREDIF publication indicates that enrichment by the diffusion method will become available in 1986, and through successive increments its capacity will eventually expand to 10 million SWU per year. More recent reports indicate that COREDIF may not be starting until 1990 at the earliest, and in view of the worldwide overcapacity, it might even be cancelled.

URENCO

URENCO, a consortium formed in 1971, is the only other foreign enricher now offering services for commercial reactors. Its members are the United Kingdom, West Germany, and the Netherlands. Although URENCO expects to operate its gas centrifuge facilities to satisfy contract commitments of 500,000 SWU in 1980, if needed to satisfy demand, it could expand its facilities to an annual capacity of 10 million SWU by 1990; a twenty-fold increase. Part of this expansion involves the construction of a centrifuge plant, planned for the beginning of 1980, in the Federal Republic of Germany. 2/ URENCO currently has centrifuge plants operating in the United Kingdom and the Netherlands.

1/At the time of our review Iran was reportedly still a member of EURODIF.

2/Commenting on our draft report, the Department of State noted that this plant will probably not be started in 1980.

Japan

By 1995 Japan plans to become partly self-sufficient by producing 5.5 million SWU per year by the centrifuge method. This will satisfy about half of its forecasted new demand. Japan is now operating a 50,000 SWU per year pilot plant according to ACDA, and is planning to have a 500,000 SWU demonstration plant in operation by about 1984. This capacity would be doubled by 1988. In addition to planning this independent effort, it has been reported that Japan has been involved in discussions with URENCO and Australia concerning a multinational enrichment arrangement involving technology sharing, natural uranium guarantees, and Japanese capital.

Australia

Australia has long expressed a desire to enrich its own natural uranium prior to exporting it to increase its economic value. A recent Australian/Japanese report indicates a 1 million SWU per year centrifuge plant could be operational in Australia by the mid-1990s. Australia is also discussing joint enrichment possibilities with France, URENCO, and on a preliminary basis, the U.S.

South Africa

Since 1974 South Africa has been constructing a 6,000 SWU prototype enrichment facility based on an indigenously developed technology. Beginning in 1985, it expects to produce 200,000 to 300,000 SWU annually to meet its domestic needs.

Brazil

In 1975, Brazil and the Federal Republic of Germany contracted for Germany to assist Brazil in constructing six to eight nuclear reactors, an enrichment facility, and a reprocessing facility. Plans call for the enrichment facility, a 220,000 SWU demonstration plant, to begin operation in 1985.

CONCLUSIONS AND OBSERVATIONS

U.S. nuclear cooperation policies from the mid-1950s through the passage of the NNPA in 1978 have been predicated on the belief that the United States can use its dominant position in the international enrichment market as leverage to influence other nations to accept or adopt more stringent non-proliferation measures. With the emergence of foreign

enrichment capacity, the U.S. share of the market is diminishing. Moreover, by the mid-1980s foreign enrichment capacity alone could, if current plans materialize, satisfy all foreign enrichment service needs currently under contract to DOE. Accordingly, we believe that U.S. reliance on its enrichment leverage as a non-proliferation tool has become an outdated and unrealistic idea.

To some extent, foreign enrichment efforts have benefited from U.S. policies and past actions. In particular, the switch to a less attractive enrichment contract, the 4-year closing of the order books, and the delays in granting export licenses contributed to an erosion of foreign confidence in the United States as a reliable supplier. More recently, the executive branch's efforts to urge other nations to defer major commitments to early plutonium usage and to tighten export controls along with the passage of the NNPA have been cited by some foreign customers as factors influencing their decisions to seek enrichment services elsewhere.

From a non-proliferation perspective, however, the emergence of a multinational enrichment capacity in Europe should not be viewed as completely undesirable. Although the United States has less direct control, the opportunities for diversification of supply offer far more assurance of supply to customer countries than did the earlier U.S. controlled market. Multinational enrichment facilities in politically stable countries also offer advantages in promoting interdependence among nations, in limiting the number of sensitive nuclear facilities built, and at the same time, in offering greater assurances that the facilities will not be used for unauthorized purposes. Further, the opportunities to diversify sources of supply make it harder for countries to justify to the world community development of indigenous enrichment capabilities.

Future U.S. non-proliferation policies should continue to link the supply of enrichment services to the non-proliferation behavior of the recipients, but also recognize that the emergence of foreign uranium enrichment facilities means that no individual nation, including the United States, is in a position to use its uranium enrichment capability to dictate the actions of others.

CHAPTER 4

IS MORE U.S. ENRICHMENT CAPACITY NEEDED TO MEET FOREIGN DEMAND?

Although the emergence of a foreign enrichment capability should not be viewed as completely undesirable from a non-proliferation perspective, the NNPA, as a matter of policy, commits the United States to having available the enrichment capacity necessary to meet foreign demand on a long-term basis. In this connection, the NNPA states that:

--The United States shall ensure that it will have available on a long-term basis the capacity to enter into new fuel supply commitments consistent with its non-proliferation policies and domestic energy needs. (sec. 101)

--The Secretary of Energy is directed to initiate construction planning and design, construction, and operation activities for expansion of uranium enrichment capacity, as elsewhere provided by law. (sec. 102)

--The President shall promptly undertake a study to determine the need for additional U.S. enrichment capacity to meet domestic and foreign needs and to promote U.S. non-proliferation objectives abroad. (sec. 103)

To determine whether U.S. enrichment capacity is adequate to meet foreign demand, we reviewed DOE's plans for increasing U.S. enrichment capacity and operating its enrichment complex in the 1980s, DOE's demand projections for U.S. enrichment services, the development status of advanced enrichment technologies, and the prospects of DOE gaining new foreign enrichment customers in the 1980s. We concluded that from the standpoint of ensuring the availability of U.S. enrichment services to meet foreign demand, it is not apparent that construction of additional enrichment capacity first authorized by the Congress in December 1975 (P. L. 94-187) is justified at this time. Whether the plant's construction now is economically justified on the basis of preserving the centrifuge option or allowing for the phaseout of the less energy efficient gaseous diffusion capacity are issues which deserve further intense scrutiny by the Secretary of Energy and the Congress.

U.S. ENRICHMENT CAPACITY

DOE has major construction projects underway to increase U.S. enrichment capacity by about 72 percent, or to a maximum of 29.5 million SWU per year by 1989. It has the authority to increase the capacity to 36.1 million SWU per year, but has no construction projects yet underway for the last 6.6 million SWU per year capacity. The increase in capacity is based on construction projects to expand DOE's three existing gaseous diffusion plants and the construction of a fourth plant using gas centrifuge technology.

Gaseous diffusion plants

The first U.S. enrichment plant began operating in 1945 at Oak Ridge, Tennessee, as part of the World War II effort to develop and make nuclear weapons. The former Atomic Energy Commission later built the Paducah, Tennessee, and Portsmouth, Ohio, plants, which began full production in 1954 and 1956, respectively. The three plants now operate as an integrated complex with the Paducah plant providing the other two plants with slightly enriched uranium for further enrichment to the level required for most power reactor fuels.

A more than $1.5 billion program to expand the capacity of the existing plants was initiated in 1971 and is now scheduled for completion in 1983. It consists of two subprograms: the Cascade Improvement Program and the Cascade Uprating Program.

The Cascade Improvement Program will increase the efficiency of plant operations by incorporating the latest advances in gaseous diffusion technology. The Cascade Uprating Program will increase the plant's capacity by modifying its equipment to allow more effective use of electric power. Because of their magnitude, these programs are being accomplished in phases.

By the end of fiscal year 1980, DOE expects to obtain 9.2 million additional SWU per year from completed phases of these programs, giving the three diffusion plants a capacity of about 26.4 million SWU per year. Upon the completion of these programs, DOE expects the plants to have a maximum capacity of 27.3 million SWU annually.

Actual capacity, however, could be less depending on the cost and availability of electric power supplies. The diffusion plants use tremendous amounts of electric power. In the past, DOE has had difficulty obtaining enough

electrical power to operate the plants at their maximum capacity. Additionally, a decision has been made not to purchase certain power considered to be uneconomical. In anticipation of future difficulties, a Presidential report 1/ to the Congress states that the diffusion plants will only produce 25.6 million SWU per year.

Centrifuge plant

In December 1975 the Congress authorized DOE to construct a new enrichment plant at the Portsmouth complex to provide an additional capacity of 8.8 million SWU per year. At that time DOE planned to construct a plant that would use the gaseous diffusion technology. In April 1977, however, the President announced that the new plant would use the gas centrifuge technology instead of gaseous diffusion. DOE estimates that construction of the full authorized capacity will cost $5.7 billion (fiscal year 1981 dollars).

The gas centrifuge process offers economic and flexibility advantages over the diffusion process, in that it

--consumes about 5 percent of the amount of electric power required by the diffusion process and

--can be built in modular units quicker than the construction of nuclear powerplants, thus allowing capacity to be more closely matched with demand.

In May 1978 DOE rescheduled construction of the gas centrifuge plant because of reduced demand for U.S. enrichment services. Instead of completing the entire plant in 1988, DOE decided to defer construction of 75 percent of the authorized capacity and construct only the first 2.2 million SWU increment. Because of budget cuts, the completion date for this first increment has slipped to 1989. DOE plans call for additional 1.1 million SWU increments to be added as demand materializes, and for long range planning purposes, completion of the entire 8.8 million SWU plant in 1994.

1/"Need For Additional U.S. Uranium Enrichment Capacity and Desirability of and Options For Foreign Participation in New U.S. Uranium Enrichment Facilities," a Report by the President, October 1979.

NEED FOR ADDITIONAL U.S. ENRICHMENT CAPACITY

The NNPA required the President to study and report on the need for additional U.S. enrichment capacity. The President reported in October 1979 1/ to the Congress that additional capacity beyond the currently authorized 36.1 million SWU per year would not be needed until the mid-to-late 1990s, and that additional centrifuge capacity can be provided in about 6 years after the start of construction. Based on this, construction of additional capacity would not need to start until about 1988 at the earliest. Given that centrifuge capacity can be added in less time than it takes to build a light water reactor, the President's report concluded that there is adequate time to monitor the growth of nuclear power and still assure that additional U.S. enrichment capacity is brought on-line in a manner consistent with demand.

We concur with the report's conclusion that a decision regarding construction of additional enrichment capacity will not be needed until the 1990s at the earliest. Moreover, further declines in demand for U.S. enrichment services, DOE's operating plans for reduced enrichment production in the 1980s, and the prospects of more efficient enrichment technologies becoming available in the early 1990s, raise questions over the need for and the economics of the Portsmouth centrifuge plant's scheduled construction. DOE believes the first centrifuge increment is needed when scheduled to meet demand. Our basis for questioning this is explained in the remainder of this chapter. Appendix III details DOE's position and contains our further comments.

Declines in demand for U.S. enrichment services

DOE demand projections for U.S. enrichment services have decreased dramatically as the following table shows.

1/"Need For Additional U.S. Uranium Enrichment Capacity and Desirability of and Options For Foreign Participation in New U.S. Uranium Enrichment Facilities," a Report by the President, October 1979.

DOE Projections of Demand
For U.S. Enrichment Services (note a)

Fiscal year	Projection when Portsmouth add-on plant authorized (Dec. 1975)	Projection when decision made to defer 75 percent of authorized capacity (April 1978)	Projection in effect during fiscal year 1981 authorization hearings (March 1980)	Most recent projection (June 1980)
	(in millions of SWUs)			
1980	26.0	18.3	11.2	11.2
1982	40.6	28.5	16.8	16.6
1985	37.2	38.5	24.0	22.0
1988	35.1	38.8	27.2	23.6
1990	unavailable	39.6	30.3	26.8
1995	unavailable	unavailable	38.8	36.6

a/Based on 0.20 percent operating tails assay.

Cumulatively, DOE's demand projections for the period 1980 through 1988 have declined by

--43.3 percent, or an average of 14.8 million SWU a year since being forecasted in December 1975, when Congress authorized the construction of the Portsmouth add-on plant and

--41.3 percent, or an average of 13.7 million SWU a year since being forecasted in 1978, when DOE decided to defer construction of 75 percent of the Portsmouth plant's authorized capacity and construct only the first 2.2 million annual SWU increment.

Operating plans

DOE plans on operating the three diffusion plants in the 1980s in a manner that would produce much less enriched uranium than they are capable of producing. For example:

--In October 1978 DOE reduced the operating tails assay 1/ of the enrichment plants from 0.25 to 0.20 percent U-235. 2/ This increases the amount of capacity needed to produce a given amount of enriched uranium by about 13 percent. Stated another way, the number of nuclear reactors the plants could support is about 13 percent lower. DOE expects to maintain the 0.20 percent tails assay until the early 1990s.

--In fiscal year 1981 DOE plans to operate the enrichment plants at minimum production level and use only 9.5 million SWU or 36 percent of anticipated capacity. DOE faces $43 million in penalty charges for electric power contracted for but not taken as a result of this action.

--DOE has deferred the purchase of 320 megawatts of electric power not yet under contract. This means that instead of the diffusion plants having a maximum capacity of 27.3 million SWUs per year upon completion of the improvement and uprating programs in 1983, the maximum capacity will be 26.3 million SWU per year; a loss of 1 million SWU per year.

--To meet projected demand in the 1980s, DOE plans to gradually draw down its current stockpile of low enriched uranium containing about 30 million SWUs to an eventual 14 million SWUs, a level DOE considers necessary to maintain a working inventory and for possible U.S. participation in an international fuel guarantee program under consideration.

1/Tails assay is a term referring to the amount of U-235 that remains in the uranium depleted (tails) by the enrichment process. The uranium fed into the plants contains about 0.71 percent U-235.

2/Reducing the tails assay also reduces the amount of natural uranium required to produce a given amount of enriched uranium. Therefore, it has been argued that a lower tails assay is beneficial from a non-proliferation standpoint because it stretches out uranium reserves and thus, from the U.S. perspective, delays the need for commercial reprocessing and breeder reactors.

DOE's operating plan for its enrichment plants is based on acquiring the annual 2.2 million SWU capacity from the new Portsmouth centrifuge plant in 1989. It should be recognized, however, that this operating plant is quite flexible, and changes in the plan could postpone the time when a new plant would be needed. For example, an option available to DOE would be to preproduce SWU during the 1980s when DOE forecasts indicate demand will be less than capacity and then draw down the resulting stockpile to meet demand in the 1990 to 1995 time frame. How much time could be gained and the pros and cons of making such changes are issues which involve complicated tradeoff analyses.

Advanced isotope separation technologies

Decisions on the timing of construction of additional U.S. enrichment capacity, including the Portsmouth centrifuge plant, take on increased significance when considering DOE's objectives for the advanced isotope separation (AIS) technologies under development and expected to become available in the 1990s. A major objective of the AIS program is to reduce the cost of primary enrichment to less than one-half of the current production process. 1/ In addition, the technologies are being developed to economically produce enriched uranium for reactor fuel from the depleted uranium tails left over from existing and planned enrichment plants.

According to DOE, through fiscal year 1980 it has funded at a cost of about $240 million research on three distinct advanced enrichment processes:

--Los Alamos Scientific Laboratory is researching a process to enrich uranium by using lasers to separate uranium isotopes from uranium hexafluoride.

--Lawrence Livermore Laboratory is also doing research on a laser enrichment process; however, it uses uranium metal vapor as its process material instead of uranium hexafluoride.

--TRW, Inc. is researching a non-laser enrichment process based on the resonant addition of energy to uranium plasma.

1/U.S. Department of Energy, "Fission Energy Program of the U.S. Department of Energy," FY 1981, March 1980.

Another laser enrichment process was being developed privately by Exxon Nuclear Company, Inc. and AVCO Everett Research Lab, Inc., through a jointly-owned subsidiary, Jersey Nuclear-Avco Isotopes, Inc. In December 1979 it submitted a proposal to DOE for Federal funding of a $165 million program, including $60 million for the construction of a pilot plant to begin construction in early 1981, with initial operation in 1983. A trade report states that the firm has already spent about $65 million on the technology, and if the proposal is not accepted soon, the firm will withdraw it and abandon the project. At the time of our review DOE had not announced what action it would take on the proposal.

Although the commercial production potential of the advanced technologies will not be confirmed until operating experience is gained, the three program managers of the Government-funded technologies were confident that, given the resources and commitment, a production plant could be on line by 1990 using one of the technologies. 1/ DOE's current plans call for a commercial demonstration plant to begin operation at the end of fiscal year 1990 and the first production plant to begin operation at the end of fiscal year 1993. 2/

From the standpoint of attracting new or maintaining current foreign enrichment customers, the advanced enrichment technologies offer the possible advantage of much lower costs for enrichment services. DOE itself has set an objective of having the technology capable of cutting enrichment costs in half. 3/ If this objective is achieved, the United States would have a tremendous cost advantage over foreign competition in the 1990s.

1/In commenting on a draft of this report, ACDA noted "Any consideration of proceeding with commercial application of advanced isotopic separation technologies must also take into account global non-proliferation considerations." ACDA further noted that performance improvements in centrifuge technology are feasible.

2/U.S. Department of Energy, "Fission Energy Program of the U.S. Department of Energy," FY 1981, March 1980.

3/Ibid.

ENSURING THE AVAILABILITY OF U.S. ENRICHMENT CAPACITY TO MEET FOREIGN DEMAND

As discussed in chapter 3, the United States in the past took a number of actions which raised doubts over U.S. reliability as a supplier of enrichment services. By committing the United States to a policy of having available the enrichment capacity to meet foreign demand on a long-term basis, the NNPA seeks to assure foreign customers that the United States will not turn them away in the future, as it did in 1974 when DOE suspended long-term contracting for almost 4 years.

When the initial 8.8 million SWU per year Portsmouth add-on plant was authorized in December 1975, U.S. enrichment production capacity was fully contracted for, and the subsequent decision to use the less energy intensive centrifuge technology seemed appropriate. In May 1978 DOE decided to construct only the first 2.2 million SWU increment because of reduced demand for U.S. enrichment services. Since then there have been further significant declines in demand; however, DOE justifies following through with construction of the first increment on the basis that:

--The first increment is needed to meet even declining demand.

--A delay or cancellation will further erode confidence in the United States as a reliable supplier.

--Keeping the centrifuge program on schedule will allow certain gaseous diffusion capacity to be phased out after 1995, thus reducing power costs and making available electric power for other uses.

--The Government has been developing an industrial infrastructure to support the gaseous centrifuge program as evidenced by the selection of three private companies to supply the machines. This commercial structure, therefore, is critical to the centrifuge. If DOE were to stop centrifuge development now and, for example, wait until the commercial potential of the advanced processes is confirmed, this industrial base and the centrifuge option may be lost.

Before a decision can be made to postpone or terminate construction of the centrifuge plant, a thorough evaluation

of DOE's justification is needed along with a thorough and objective analysis of the costs and benefits of delaying construction of the initial 2.2 million SWU increment until more is known about the AIS enrichment technologies. DOE has not conducted such an analysis because it believes its plans to complete this initial increment are justified.

DOE's justification that cancellation would damage U.S. credibility as a reliable supplier conflicts with information foreign customers provided us indicating that the adequacy of U.S. enrichment capacity was not a major concern. Their concerns over U.S. reliability center around current U.S. non-proliferation policies, and delays and uncertainties in the U.S. nuclear export control system. In addition, some believe the prospects of the United States gaining many new foreign customers in the 1980s is generally bleak because of the emergence of a foreign enrichment capacity and the strong desire of many nations to diversify sources of supply in order not to be too dependent on any one nation.

We reviewed the support for the enrichment demand projections DOE provided the Congress in its March 1980 authorization hearings. In a draft of this report provided to DOE for comment, we questioned a number of the assumptions DOE made when projecting future foreign demand for U.S. enrichment services. In commenting on the draft report, DOE officials characterized our information in this area as outdated. A review of DOE's current forecast, (prepared only 3 months after the now outdated forecast was presented to the Congress), indicates that similar concerns still exist over DOE's forecast assumptions and raises the additional question of how much reliance should be placed on DOE demand forecasts which apparently can become outdated so quickly.

Due to time limitations we did not perform a detailed review of DOE's forecast methodology. However, DOE's demand forecast presented to the Congress in March 1980 needs to be tempered by the following considerations.

--Since DOE reopened its order book in 1978 and began offering a more desirable contract, the only foreign contracts it has obtained have been either those transferred from one customer to another or those replacing or adjusting contracts once held by DOE customers. DOE has not independently obtained any brand new foreign contracts during this period.

--Those countries currently obtaining enrichment services solely from the United States may decide it best not to put all of its eggs in one basket, and therefore, take the opportunity to diversify by contracting with one or more non-U.S. enrichers.

Because of the high cost of constructing enrichment plants, a balance must be struck between having available too much enrichment capacity and not enough to satisfy foreign demand. Determining the appropriate balance is further complicated by the argument that a degree of over-capacity may be a desirable means for the United States to underscore its commitment to be a reliable supplier of enrichment services and to discourage other nations from building their own uranium enrichment capability.

In a November 1977 report to the Congress 1/, we recommended that, to facilitate planning for future enrichment plants, DOE establish specific goals for the percentage of the foreign market it expected to serve. In addition, we stated that unless "reliable supplier" is better defined in terms of the percentage of the foreign market the United States may want or is able to obtain, it would be difficult to determine whether U.S. non-proliferation objectives are being met. At that time, DOE disagreed with our recommendation, and accordingly, its only goal is to capture as much of the market as possible. DOE still has not established specific goals for the percentage of the foreign market to be served by U.S. enrichment services.

From the standpoint of making sound financial decisions and ensuring the availability of U.S. enrichment services to satisfy demand as the NNPA mandates, we believe it more important now that specific short-term and long-range goals be established for the percentage of the foreign enrichment market the United States may want or can realistically expect to obtain. This is particularly important given the expected increase in availability of enriched uranium from foreign enrichers and surplus foreign stockpiles. Without setting specific goals, it will be difficult, if not impossible, to determine the proper balance between constructing too much or too little enrichment capacity to satisfy foreign demand.

1/"Uranium Enrichment Policies and Operations: Status and Future Needs," EMD-77-64, Nov. 18, 1977.

CONCLUSIONS

It is not apparent that construction of the first increment of the Portsmouth centrifuge plant (2.2 million SWU per year) is needed at this time to meet future foreign demand because:

- --There has been a dramatic decrease in domestic and foreign demand for U.S. enrichment services since December 1975, when additional capacity was first authorized for construction, leaving the United States with excess capacity from its existing facilities.

- --The Department of Energy plans on operating its gaseous diffusion plants in the 1980s in a manner that would produce much less enriched uranium than they are capable of producing.

- --The prospects of the United States gaining many new foreign enrichment customers in the 1980s is generally bleak.

- --Foreign concerns over contracting with the United States for enrichment services center around current U.S. non-proliferation policies and export controls, and therefore will not be alleviated by construction of the Portsmouth add-on plant.

- --Advanced enrichment technologies under development could make centrifuge technology obsolete in the 1990s.

DOE believes that completing construction of the first 2.2 million SWU increment of centrifuge capacity in 1989 is justified to meet projected increases in demand and to achieve cost savings by replacing certain existing high-cost, energy-intensive gaseous diffusion capacity with centrifuge capacity. We do not believe that DOE has fully and objectively considered available options that would both allow demand to be met and the current construction program to be delayed until more is known about the AIS technologies under development. DOE's records show that a production plant using AIS technologies, which offer the potential of even greater cost savings than the centrifuge technology, could be in operation by the end of fiscal year 1993. Thus, the AIS technologies appear to be viable candidates for the next increment of enrichment capacity.

RECOMMENDATION TO THE SECRETARY OF ENERGY

The Congress, as part of its authorization and appropriation process, should have access to up-to-date and accurate information on the need for additional U.S. enrichment capacity. Therefore, we recommend that the Secretary of Energy in future budget requests for construction of uncommitted increments of enrichment capacity at Portsmouth or elsewhere specifically demonstrate

- --that the need for new capacity is based on realistic demand forecasts that cannot be met by the Department's recently upgraded existing facilities, or

- --that the new capacity will further U.S. non-proliferation objectives by enhancing U.S. reliability as a nuclear supplier and/or by providing a disincentive for other nations to acquire enrichment technologies, or

- --that the new capacity is economically justified and the economic justification fully and objectively considers options involving the use of AIS technologies for the new capacity.

MATTERS FOR CONSIDERATION BY THE CONGRESS

In view of the changed circumstances since the Congress initially authorized construction of additional enrichment capacity and in view of the $5.7 billion estimated cost of constructing the entire Portsmouth plant, we believe the Congress should look very closely at DOE requests for construction funding. In particular, we believe the Department of Energy needs to develop and present sufficient documentation demonstrating that the additional capacity is needed to meet demand, to further U.S. non-proliferation objectives, or is justified on an economic basis. If convincing documentation is not presented, the Congress should consider not appropriating additional funds for construction of uncommitted increments of centrifuge capacity.

AGENCY COMMENTS AND
OUR EVALUATION 1/

DOE believes that the first 2.2 million SWU centrifuge facility should be constructed as planned because it is needed to satisfy projected enrichment demand and because it would result in a substantial cost savings over the diffusion process. We disagree because we found that DOE's projected demand has historically proven to be overstated, and because DOE's cost savings analysis wrongly assumes that all the increments of the centrifuge facility will definitely be built rather than only those increments needed to match demand. Because of these concerns, and because DOE itself has indicated that advanced isotope separation technology could be available for production by the end of fiscal year 1993, we believe DOE needs to fully and objectively examine the benefits and costs of delaying construction of the first increment of new centrifuge technology until the AIS enrichment technologies are further developed. Our review revealed that there is enough flexibility, and therefore options, in the way in which DOE can operate its existing enrichment facility to permit delaying the first centrifuge increment if a thorough examination by DOE and the Congress shows this to be the most desirable course of action.

Also in support of centrifuge construction, DOE basically stated that centrifuge construction will further U.S. nonproliferation objectives by improving the U.S. image as a reliable supplier and by enabling the United States to offer enrichment services on the international market, thereby providing a disincentive for other countries to acquire enrichment technology. We note that foreign concerns over U.S. reliability are generally produced by delays and uncertainties in the export licensing and subsequent arrangement process, and that this is a problem that will not be solved by building additional capacity. Also, the current abundance of U.S. enrichment capacity has apparently not been successful in discouraging certain countries from developing indigenous enrichment capabilities. While we recognize that a legitimate argument could be made in favor of building additional capacity or even an overcapacity to promote U.S. non-proliferation policies, we do not believe DOE has done a convincing job of developing and supporting this position.

1/DOE's detailed comments and our response are included as appendix III.

CHAPTER 5

HOW WELL ARE U.S. CONTROLS OVER EXPORTS OF NUCLEAR MATERIAL AND EQUIPMENT WORKING TO REMOVE DOUBTS ABOUT U.S. RELIABILITY?

Five executive branch agencies (the Departments of State, Energy, Commerce, Defense, and the ACDA), plus the independent NRC, review the proliferation risks of U.S. nuclear exports. These reviews are conducted before the NRC grants export licenses to private parties and before DOE enters into certain cooperative arrangements with any nation or private party regarding the supply, use, or retransfer of the exports, referred to in the NNPA as "subsequent arrangements." Appendix II provides an overview of the agencies' roles and responsibilities.

The NNPA as a matter of policy commits the United States to being a reliable supplier of nuclear materials and equipment to nations which adhere to effective non-proliferation policies. To do this, the NNPA established statutory procedures and directed the executive branch and NRC to adopt regulatory procedures to facilitate the timely processing of requests for export licenses and subsequent arrangements.

The NNPA's enactment in March 1978 dramatically increased foreign concern about the risks of U.S. Government intervention in nuclear trade to further its non-proliferation objectives. As Government administrators and our trading partners have adjusted to the NNPA's specific provisions, numerous initial implementation problems were overcome. However, significant concerns over actual or perceived uncertainties and inconsistencies in the way export licenses and subsequent arrangements are administered remain. These need to be addressed by the Federal agencies responsible for implementing the law if the United States is to remove doubts about its predictability and reliability as a nuclear trading partner. In particular, concerns remain about

--export license processing time,

--U.S. controls over foreign reprocessing and plutonium use,

--U.S. controls over exports of highly enriched uranium, and

--U.S. controls over retransfers of previously exported nuclear material and equipment.

EXPORT LICENSE PROCESSING TIME

A frequent complaint made by some of our nuclear trading partners is the time it takes the Government to issue nuclear export licenses. In examining this complaint, we focused on four basic questions.

--How long does it take to issue export licenses?

--How effective have statutory time limits been in shortening the openended licensing process?

--What are the reasons for statutory time limits not being met?

--What is being done to expedite the licensing process?

How long does it take to issue export licenses?

NRC cannot issue an export license until it determines that all statutory requirements are met, and it receives a favorable "executive branch judgment" transmitted by the State Department. NRC and the executive branch agencies have agreed on simplified processing procedures for licensing exports depending primarily on their proliferation significance. These internal procedures in practice result in final approval authority resting at three progressively higher levels of Government, namely:

--NRC staff. Through a series of delegations of authority the Director of NRC's Office of International Programs has the authority to issue licenses for certain categories of nuclear materials and equipment including routine exports of low-enriched nuclear fuel, without referral to executive branch agencies or the NRC Commissioners.

--NRC staff after executive branch approval. Certain additional categories of nuclear materials and equipment may be licensed by the NRC staff without referral to the NRC Commissioners, but only after executive branch approval (usually at the staff level).

--NRC Commissioners. Normally, the Commissioners personally review and approve licenses for exports of nuclear reactors, plutonium, highly enriched uranium, certain initial exports to countries under the NNPA, and any export raising major policy or legal issues.

Those cases handled by the NRC staff have generally been completed in a timely manner. Those requiring the executive branch and/or the NRC Commissioners review have not.

We analyzed the processing time of all issued export licenses considered by NRC as major cases 1/ during the Government's first and second years under the NNPA. During the first year (Mar. 10, 1978 to Mar. 9, 1979), NRC issued or amended 512 licenses. Of these, 88 exports were considered major cases and were issued in the following time frames (NRC and executive branch review times combined).

	Final approval authority		
Time frames	NRC Commissioners	NRC staff after executive branch approval	Total licenses issued
Less than 120 days	1	2	3
120 to 240 days	11	28	39
240 to 365 days	24	4	28
1 to 2 years	13	1	14
Over 2 years	4	-	4
Totals	53	35	88

During a period corresponding to the second year (March 10, 1979 to February 29, 1980), NRC issued or amended 698 licenses. Of these 86 exports were considered major cases and were issued in the following time frames (NRC and executive branch review times combined).

1/NRC defines major cases as (1) all nuclear reactor exports, (2) one effective kilogram or more of special nuclear material, (3) 10,000 kilograms or more of source material, (4) 1,000 kilograms or more of heavy water or nuclear grade graphite, and (5) any other export determined by NRC to warrant special consideration or the review of NRC Commissioners. The processing time of the major cases we analyzed included all proposed exports requiring the approval of the NRC Commissioners, but none requiring the approval of just the NRC staff.

Time frames	Final approval authority: NRC Commissioners	Final approval authority: NRC staff after executive branch approval	Total licenses issued
Less than 120 days	7	21	28
120 to 240 days	18	13	31
240 to 365 days	8	3	11
1 to 2 years	14	-	14
Over 2 years	2	-	2
Totals	49	37	86

In addition, our analysis disclosed the following time frames for 194 export license applications pending Government approval as of February 29, 1980, close to the end of the NNPA's second year.

Time frames	Under executive branch review or in the process of being forwarded to NRC	Under NRC review or in the process of being issued (note a)	Total licenses pending
Less than 120 days	51	7	58
120 to 240 days	47	5	52
240 to 366 days	16	5	21
1 to 2 years	25	8	33
Over 2 years	25	5	30
Totals	164	30	194

a/This column also accounts for executive branch review time; thus, it should not be interpreted to mean that NRC alone has had these license applications under review for the noted time frames.

A comparison of the first and second year data reveals a general reduction in the time it takes the Government to issue export licenses. For example, during the first year only 3 or 3.4 percent of the major exports licensed were approved in less than 120 days, but during the second year the corresponding statistic was 28 or 32.5 percent.

Nevertheless, as the data for export license applications pending Government approval show, many exports have been under review for a long time. For example, as of February 29, 1980, 63, or 32 percent, of the export license applications pending Government approval were under review for a year or more.

How effective have statutory time limits been in shortening the open-endness of the licensing process?

To enhance U.S. reliability and predictability as a nuclear supplier, the NNPA establishes specific time limits for Government reviews of license applications. The clear aim was to place some reasonable pressure on the agencies to complete their reviews in a timely manner in order to minimize adverse impacts of licensing delays and uncertainties. We found, however, that agency implementation of the time limits and the procedures to be followed when the time limits are exceeded have done little to shorten the openendness of the licensing process.

The NNPA seeks to further U.S. non-proliferation objectives by denying nuclear exports to nations not adhering to U.S. controls and by seeking to assure such exports to nations that do. Although the NNPA time limits do not force the agencies to deny or approve an export within a certain time period, except for rare circumstances, the Congress expected that the agencies would make a decision within 120 days, as follows.

--The State Department would provide NRC an executive branch decision within 60 days. If this time limit is not met, the State Department is authorized to take additional time, upon finding that it would be in the "national interest" to do so. However, when such authorizations are granted, two congressional committees must be notified.

--The NRC would then decide whether to issue an export license within 60 days (120 days total for Government review). If this time limit is not met, NRC must

"inform the applicant in writing of the reason for delay and provide follow-up reports as appropriate."

The NNPA also gives the President discretion to supersede NRC. If the NRC has not decided on a pending application within 120 days from receipt of executive branch approval, the President may withdraw the application from NRC and authorize the export by executive order. In such a situation, the President is not required to authorize the export, but may do so upon a finding that "further delay would be excessive." There are several constraints to Presidential use of this discretionary authority, however. If NRC begins procedures for public participation or has outstanding requests for additional information from the executive branch, the President cannot supersede NRC for at least 60 days after completion of public proceedings or until the executive branch has responded fully to NRC. Further, a Presidential authorization is subject to congressional review and possible disapproval. 1/

As previously noted, the vast majority of major nuclear exports are not decided within the NNPA 120-day limit, although the Government's second year under the NNPA produced a significant improvement over the first. The improvement can be attributed largely to the agencies overcoming initial implementation problems, and greater experience working with the law and implementing regulations as time passes. In addition, many exports have long been under review, particularly in the executive branch. According to State Department officials, the executive branch prefers to let export

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1/The President may also override a negative NRC decision. The NRC may find that the proposed export fails to meet statutory licensing conditions. In this situation, NRC is required to refer the license application to the President. In April 1978, the President authorized a nuclear fuel export to India after referral by NRC because it reached an impasse on the license. At that time the Commission had four members and only two voted in favor of the export. In May 1980 NRC referred to the President seven export applications. They involved sending nuclear fuel and reactor replacement parts to India, and the Commission found that the proposed exports failed to meet statutory licensing conditions. The President authorized these exports by executive order on June 19, 1980.

applications "sit" until it can approve the application or until the applicant withdraws the application rather than having it formally denied or returning it without action. While the Government has only formally denied one nuclear export license application, for 26.2 kilograms of highly enriched uranium to Iran, 23 were withdrawn during the NNPA's first year--some because it became clear that the Government would not act in time to meet the applicant's needs. Further, NRC has only twice referred proposed exports to the President for decision, and the President has never used his discretionary authority to withdraw an export application from NRC.

What are the reasons for statutory time limits not being met?

Most of the reasons that the statutory time limits are not being met relate to the failure to comply with U.S. export conditions. Many of these conditions were in effect prior to the NNPA. Since NNPA passage, the most frequent delays have occurred for the following reasons.

--Lack of appropriate nuclear cooperation agreements. This accounts for executive branch delays in cases where no bilateral agreement for cooperation between the United States and the recipient government was in force, or in cases where the applicable agreement for cooperation needed to be supplemented with additional understandings. These governmental nuclear cooperation agreements are a statutory condition for exports of nuclear reactors and special nuclear material.

--Lack of recipient government assurances. This accounts for delays in cases where the executive branch was waiting for a letter from the recipient government stating that the proposed export will be subject to the terms and conditions of the agreement for cooperation with the United States and that the proposed recipient is authorized to receive the proposed export. This "authorized persons letter" is a longstanding U.S. export requirement.

--Difficulties in implementing administration policy for U.S. supply of highly enriched uranium. In April 1977 the President established more restrictive conditions for U.S. exports of highly enriched uranium. Executive branch difficulties in implementing

these policy conditions account for most of these licensing delays. This issue is discussed further in a following section.

--Need for additional information. This accounts for delays in cases where an executive agency or NRC had questions about (1) the stated end use of the proposed export, (2) the terms and conditions of its supply, (3) the non-proliferation intentions of certain countries, and (4) whether statutory or administration export conditions were met.

Further delays in many exports have also resulted from "unique" situations caused by NNPA implementation or other events.

--Exports to the nine-member countries of the European Atomic Energy Community (EURATOM) 1/ were prohibited between April 9, 1978 and July 20, 1978. This temporary embargo resulted because EURATOM did not agree to renegotiate the provisions of its agreement for cooperation with the United States within the time limit set by the NNPA--April 10, 1978. Subsequently, EURATOM agreed to "discussions" on the issue and the export ban was lifted on July 20, 1978. This situation is discussed further in a following section.

--Exports to several countries were delayed pending receipt of written assurances from recipient governments that, in accordance with the NNPA, (1) adequate physical security would be provided and (2) nuclear reactor components and special reactor materials would not be retransferred to another nation without U.S. approval.

--Exports to Pakistan, Iran, and South Africa were delayed because the executive branch had decided to defer continuing any form of nuclear cooperation with them in light of recent events in those countries.

--Exports to Taiwan were delayed pending legislation defining a new U.S. relationship with the country and resolution of questions regarding arrangements related to the U.S./Taiwan Agreement for Cooperation.

1/Belgium, Denmark, France, Ireland, Italy, Luxembourg, the Netherlands, the United Kingdom, and West Germany.

--Exports to the Philippines were delayed because of environmental, health, and safety concerns; and how the President's recent executive order on foreign environmental impacts of U.S. exports would be implemented.

--Exports of enriched uranium fuel to Spain have been delayed pending conclusion of an agreement between Spain and the IAEA to bring all Spanish nuclear facilities under safeguards.

--Exports to Argentina and Brazil have been delayed as the countries move toward, according to ACDA, compliance with the full-scope safeguards condition in the NNPA.

--Exports to India have been delayed because of questions about the applicability of the full-scope safeguards condition in the NNPA, the Indian Government's attitude toward non-proliferation issues, and more recently, the refusal of India to accept the condition.

What is being done to expedite the licensing process?

NRC and the executive branch agencies have adopted streamlined review and approval procedures to expedite the licensing process. Initial NNPA implementation problems hampered the agencies in adopting streamlined procedures. Because many of the problems have now been overcome (e.g., the EURATOM embargo, obtaining agreement by recipient countries for certain NNPA export conditions), greater use of streamlined procedures is now being made.

Significant actions taken by the agencies to expedite the export licensing process since NNPA passage have been:

--Granting the NRC staff generic authority to license certain exports without commissioner review or referral to the executive branch agencies. Initially, this generic authority applied to exports of only small quantities of nuclear material, and equipment to certain destinations, but it now includes exports of single reloads of nuclear fuel for power reactors in countries considered to have good non-proliferation credentials.

--Using more precedents. Instead of preparing detailed analyses of how proposed exports meet statutory conditions, both NRC and the executive branch agencies are

now approving, in accordance with the NNPA, most routine exports upon a finding of "no material change in circumstances" from previously approved exports to the same country, thus, eliminating preparation and review of time-consuming repetitive analyses.

--Increasing and expanding general license authority. Exports under a general license may be carried out without any Government case-by-case review or approval. NRC's general licensing provisions have recently been expanded and now include small quantities of special nuclear material. NRC also has under consideration a proposal approved by the executive branch in March 1980 to export nuclear reactor components to designated nuclear facilities in certain countries. In addition, several other proposals to further increase or expand existing general licenses and establish new general licenses are under review.

--Allowing licensing of multiple nuclear fuel reloads for power reactors to countries with good non-proliferation credentials. The executive branch established a policy whereby countries considered to have "good non-proliferation credentials" may be granted nuclear fuel export licenses for the initial reactor core plus three reloads or five reloads. According to DOE, this policy effectively results in a guaranteed fuel supply for five years after export license issuance. Presently, Japan, South Korea, Switzerland, Mexico, Sweden, Yugoslavia, and the nine-member nations of EURATOM qualify for this multi-year license approval. 1/

U.S. CONTROLS OVER FOREIGN REPROCESSING AND PLUTONIUM USE

Most major U.S. nuclear trading partners view reprocessing as the best or only option available to manage or use spent nuclear fuel. Several have contractual commitments with the only two countries offering reprocessing services for the international market--the United Kingdom and France. As a result there is substantial opposition to (1) the requirements

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1/Commenting on our report, ACDA noted that since EURATOM does not at present meet all NNPA licensing criteria, its multiple reload licenses are conditioned on either future compliance or a continuation of a Presidential waiver.

of the NNPA which would extend U.S. rights to approve foreign reprocessing of nuclear fuel and (2) how the United States exercises its reprocessing approval rights.

Extension of U.S. approval rights over foreign reprocessing

Except for EURATOM, IAEA, and Canada, the United States has historically had approval rights over the foreign reprocessing of U.S.-supplied nuclear fuel in its agreements for cooperation. Today, the exercise of these rights continues to stem primarily from these older agreements. The NNPA attempts to extend U.S.-approval rights by (1) conditioning the licensing of nuclear fuel exports on a U.S.-approval right over the reprocessing of such exports or material produced through its use and (2) requiring that in new agreements for cooperation the United States obtain approval rights over the reprocessing of non-U.S.-supplied fuel used in U.S.-supplied reactors.

Exports to the nine-member countries of EURATOM were disrupted shortly after enactment of the NNPA. The NNPA exempted EURATOM and the IAEA (i.e., groups of nations) from U.S. reprocessing approval requirements for a period of two years and gave the President discretionary authority to grant further yearly exemptions provided they agree to renegotiate their agreements within 30 days of NNPA enactment. 1/ Several member countries viewed the renegotiation requirement as a unilateral attempt by the United States to amend a valid international agreement. EURATOM did not agree to renegotiate within the 30-day grace period provided in the law, and on April 9, 1978, NRC ceased issuing export licenses to all EURATOM countries. In a subsequent compromise, EURATOM notified the Department of State of its readiness to enter "discussions" on their agreements, and the export licensing ban was lifted on July 20, 1978. Based on DOE data, 19 EURATOM utilities planned to reprocess a total of 2,716 metric tons of spent fuel in either the United Kingdom or France as of November 1978.

The licensing ban involved shipment of 23 exports destined for the routine operation of 19 reactors in EURATOM countries. The ban did not result in the shut-down or slow-down of these reactors. However, according to many European

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1/The United States has two agreements for cooperation with EURATOM; one is scheduled to expire on Decmeber 31, 1985, the other on December 31, 1995.

nuclear fuel supply managers, it further eroded their confidence in the United States as a reliable supplier and has intensified their efforts to diversify sources of supply in order not to be "hostage" to any future U.S. Government intervention. Particularly irksome was the fact that EURATOM was contractually obligated to DOE during this time to meet commitments arising from their enrichment contracts (e.g., delivery of feed material, payment for services rendered), and in some cases were prohibited by DOE contracts from using substitute material from other sources.

Traditionally, DOE's enrichment contracts have not included any provisions relieving the customer of its contract obligations when the Government was unable to issue an export license or delayed its issuance beyond scheduled delivery dates. In essence, DOE maintained that because its contracts provided for enriching services only, its obligations were fulfilled when the enriched product was ready for shipment from its facilities. Issuance of the export license was viewed as a separate Governmental matter.

Because of the EURATOM experience, DOE has agreed to give all customers in new contracts the right to terminate the contract at their option and with no penalty if the United States adds new statutory export conditions. 1/ Although this reduces some foreign concerns, it does not relieve the customer from its contract obligations when the Government is unable to issue an export license because present statutory conditions are not met, or the export license is delayed beyond scheduled delivery dates. Thus, for example, if the President decides not to grant any further 1-year waivers to EURATOM because it had not agreed to the U.S. reprocessing licensing condition, the new contract termination clause would not apply.

In addition to the possibilities of another licensing ban, 2/ concerns have emerged about when the United States will claim reprocessing approval rights. First, to

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1/Commenting on our report, ACDA noted that while customers would not be subject to penalty payments, they would lose any prepayments upon termination.

2/If EURATOM does not agree to accept the U.S. reprocessing approval licensing condition by March 10, 1981, and the President does not grant another extension, the NNPA would require that NRC once again cease issuing export licenses to all EURATOM countries.

what extent will the Government claim approval rights when a U.S. export is "co-mingled" with the exports of another nation? This can occur, for example, when a foreign reactor is fueled by U.S. and non-U.S. supplies. Does the U.S. approval right apply solely to the U.S. fuel or all the fuel contained in the reactor?

Second, what happens when more than one nation claims approval rights on the same commodity as it moves through the fuel cycle? This "double-labeling" can occur, for example, when Canadian uranium is enriched in the United States and exported to a third country. Is the third country required to obtain approval for reprocessing from the United States, Canada, or both?

Third, what conditions will be required to obtain U.S. approval to retransfer reactor component exports? The NNPA requires that retransfers of component exports be subject to prior approval by the United States, but was silent on the conditions required to obtain U.S. approval. In at least one case, the agencies attempted to attach a "second order" approval right on a component export. They sought an effective right to approve reprocessing of fuel in the facility containing the retransferred component. The countries involved strongly resisted the attempt, and the agencies ultimately dropped this "second-order" approval condition. Will the United States again attempt to condition component exports on reprocessing approval rights?

The agencies have not publicly clarified the U.S. position on these concerns and questions. The resulting uncertainty has been cited as a factor impeding EURATOM acceptance of U.S. reprocessing approval rights and as a factor influencing several foreign decisions not to purchase U.S. supplies or services.

Exercising U.S. approval rights

How the United States will exercise its reprocessing and plutonium use approval rights in the future is very important to many of our nuclear trading partners. In some countries the continued use of nuclear power now depends, legislatively or from a public opinion standpoint, on spent fuel management arrangements that involve reprocessing. In the longer term, development of plutonium breeder reactors and plutonium recycling in light water reactors is dependent on reprocessing. In addition, reprocessing is a multi-million-dollar-a-year business for two of our major allies--France and Great Britain. One estimate places the value

of the European reprocessing contracts over the next decade, including transport charges, at almost $3 billion.

On the other hand, the proliferation implications of widespread reprocessing capabilities and plutonium use are very important concerns of the United States. In considering how the United States exercises its reprocessing and plutonium approval rights, it is necessary to distinguish between the statutory and policy conditions which must be met before DOE grants such approvals. As discussed in appendix II, the NNPA requires that foreign requests be processed as subsequent arrangements. Although the NNPA distinguishes between facilities which have and have not reprocessed power reactor fuel before its enactment on March 10, 1978, common standards clearly apply to both circumstances. Namely, the reprocessing and the use of the derived plutonium must not result in a "significant increase in the risk of proliferation." In addition, the reprocessing and plutonium use must take place under conditions that will ensure "timely warning" to the United States of any plutonium diversion by a non-nuclear-weapons state to nuclear explosive purposes.

On top of these statutory standards, the executive branch as a matter of policy has adopted additional conditions to govern approval until formulation of a new post-INFCE policy.

--Requests involving a clear showing of physical need (i.e., spent fuel congestion) will continue to be approved on a case-by-case basis if the requesting country has made appropriate efforts to expand its spent fuel storage capacity.

--Requests not meeting the physical need condition but involving reprocessing contracts predating the President's call for deferral of commercial reprocessing in April 1977 will be considered for approval on a case-by-case basis if the approval will directly further major non-proliferation objectives.

--Prior approval by the United States will continue to be required for the subsequent transfer, including return to the country which has title to the material, of any plutonium resulting from the reprocessing.

A State Department spokesman in an October 1978 congressional testimony characterized the executive branch's policy for granting reprocessing approvals as a "last resort." Storage of spent fuel, whether in the requesting country, in the United States, or in an international repository, comes first. However, the United States has not finalized arrangements for accepting foreign spent fuel for storage and there is no international repository. Consequently, foreign requests have evoked "last resort" approval many times. As of May 16, 1979, the executive branch had approved, according to DOE, a total of 15 requests from Japan, Spain, Sweden, and Switzerland to retransfer spent fuel to British and French facilities for reprocessing since it began approving such requests on the basis of physical need in late 1976. The spent fuel involved contained approximately 2,353 kilograms of plutonium and 234,018 kilograms of uranium according to DOE.

In these cases, U.S. approval was just for the retransfer of the spent fuel to Great Britain and France (weapons states) and for the reprocessing itself. Subsequent transfer of the separated plutonium to other countries including its return to Japan, Spain, Sweden, or Switzerland (non-weapons states) will require another U.S. approval. By conditioning any subsequent transfer of the separated plutonium on another U.S. approval, the executive branch effectively deferred addressing whether the statutory standard would be met for non-weapons states, and what, if any, policy conditions should be attached to plutonium use.

The policy conditions, if any, that would be attached to U.S. approval of reprocessing in national facilities are also of foreign concern, particularly in Japan. Unlike EURATOM countries, which can now reprocess U.S.-origin spent fuel within the European community without U.S. approval, Japanese reprocessing in a national facility is subject to U.S. approval. In September 1977, before NNPA passage, the United States approved the reprocessing of 99 tons of spent fuel over a two-year period in the Japanese prototype reprocessing facility at Tokai Mura. Subject to certain restrictions and understandings, the approval was extended in September 1979 for 6 months and for another year in July 1980.

The future course of U.S. nuclear cooperation with other nations, particularly in Europe and Japan, depends fundamentally on reaching a consensus on the terms and conditions under which commercial reprocessing and plutonium use can proceed. Agreement on answers to questions such as these still need to be reached:

--What should be the purpose of reprocessing?

--Who may reprocess and where?

--What processes should be used for reprocessing spent fuel?

--What international controls are to be applied to reprocessing and the derived plutonium?

--What should be the rules for plutonium use, particularly in non-weapons nations?

Now that the INFCE studies have been completed, the United States can no longer afford to avoid clarifying the terms and conditions under which it will grant approval pending development of an international consensus on the reprocessing issue. The United States should act soon as evidenced by the following INFCE finding.

> "The right of prior consent, which certain supplier countries wish to retain in respect of the retransfer to third countries and/or reprocessing of fuel supplied by them to consumer countries, may, if exercised arbitrarily, have a negative impact upon their assurance of fuel supply and a consequent adverse effect upon their nuclear programmes. Where the right of prior consent exists, the criteria for the exercise of such rights should be established, to the extent possible, before long-term contracts for fuel supply are concluded or, for short-term contracts, before fuel is committed to nuclear reactors. Also, such consent should, whenever possible, be given prior to the conclusion of commercial arrangements and not be exercised on a case-by-case basis but in a more general manner. It is generally agreed that pending development of common approaches to the exercise of the right of prior consent and as a first step towards broader international consensus, supplier countries should exercise that right in a manner that takes account of the national policies and particular circumstances of consumer countries, with the objective of avoiding, wherever possible, problems in the planning of their nuclear power programmes. Subject to relevant circumstances not having changed, the right

> of prior consent should be exercised in a manner that is predictable and that conforms to understandings that may have been reached between the parties when the right of prior consent was established."

For the United States the underlying message of this INFCE finding is a request to tell its trading partners what use they can make of U.S. nuclear fuel and equipment before they buy it. To fully adopt this INFCE approach in exercising its reprocessing and plutonium use approval rights would be a major departure from existing U.S. practices, particularly the executive branch policy of considering some foreign reprocessing requests only as a "last resort" for the disposition of spent fuel.

This "last resort" policy is widely regarded in Europe as a way in which the executive branch is attempting to impose its reprocessing views on other nations. This is contrary to statements made by the President and the Congress regarding U.S. intentions. For example, in April 1977, when the President called for the indefinite deferral of commercial reprocessing and plutonium recycling in the United States he said,

> "We are not trying to impose our will on those nations like Japan and France and Britain and Germany which already have reprocessing plants in operation. * * * But I hope that by this unilateral action we can set a standard and that those countries that don't now have reprocessing capability will not acquire that capability in the future."

In addition, in the section establishing standards for approving foreign reprocessing requests, the NNPA provides that:

> "Nothing in this section is intended to prohibit, permanently or unconditionally, the reprocessing of spent fuel owned by a foreign nation which fuel has been supplied by the United States..." (sec. 303(a))

Because of the lack of an international consensus on how commercial reprocessing and plutonium use should proceed worldwide, we believe the United States should continue its case-by-case review of subsequent arrangements involving reprocessing and plutonium use and maintain the NNPA's strict standards governing U.S. approvals. However, we believe the

executive branch could remove much of the uncertainty associated with how U.S. reprocessing approval rights are exercised by considering and acting on foreign requests without our trading partners having to demonstrate an imminent physical need (i.e., spent fuel congestion). Although this would be a major departure from present executive branch policy, it would be more consistent with the NNPA provisions requiring the "timely consideration" of such requests. 1/ Further, because this change would allow our trading partners to request U.S. approvals before they enter into fuel supply contracts, it would allow them to more predictably plan their nuclear power programs. On the other hand, it raises the possibilities of the executive branch having to deny such requests because more requests would likely be submitted and the NNPA standards have only been tested in a few cases.

U.S. CONTROLS OVER EXPORTS OF HIGHLY ENRICHED URANIUM

Since 1955 the United States has been the principal supplier of highly enriched uranium for civil uses. Such material also can be used for nuclear weapons. Over 100 research reactors located in 31 foreign countries have used U.S.-supplied highly enriched uranium. As of May 1978, the United States had transferred to foreign countries about 11,600 kilograms of U-235 in this uranium. Most of this material went to European allies and Japan according to ACDA. However, other supplier countries can produce highly enriched uranium and, in the past, have provided at least limited quantities.

1/Section 303(a) of the NNPA provides in pertinent part that:

> "The United States will give timely consideration to all requests for prior approval, when required by this Act, for the reprocessing of material proposed to be exported, previously exported and subject to the applicable agreement for cooperation, or special nuclear material produced through the use of such material or a production or utilization facility transferred pursuant to such agreement for cooperation, or to the altering of irradiated fuel elements containing such material..." (Underscoring supplied)

Since its involvement in peaceful nuclear energy cooperation with other nations, the United States has recognized the special sensitivity of highly enriched uranium. However, in the mid-1970s divergent views developed within the executive branch as to what extent this material should be exported and under what circumstances. Historically, foreign supply requests generally were treated no differently than those applied to nuclear exports of a less sensitive nature, such as low-enriched uranium to fuel power reactors.

The NNPA does not subject highly enriched uranium exports to more stringent export conditions than those required for low-enriched uranium exports. The executive branch now does, however, as a matter of administration policy. In April 1977 the President strengthened controls over highly enriched uranium exports by directing executive branch agencies to:

--Avoid new commitments to export significant quantities except when the project is of exceptional merit and the use of low-enriched fuel or some other less than weapons-usable material is clearly shown to be technically infeasible.

--Require direct Presidential approval for any supply greater than 15 kilograms (the approximate amount needed for a bomb). 1/

--Identify projects and facilities which might be converted to low-enriched uranium.

--Minimize inventories of highly enriched uranium abroad.

The heart of the administration policy is the conversion of research and test reactors to fuels substantially less than 93 percent enrichment, which the United States has traditionally supplied. The ultimate objective is to convert most reactors to less than 20 percent enriched fuel.

Research on lower enriched fuel substitutes is now underway in the United States and abroad. For fiscal years 1980

1/The current practice, according to the Department of State, is to seek Presidential approval for 15 "effective" kilograms or greater of highly enriched uranium.

and 1981, the DOE's budget requests totaled $10 million for a program to develop and demonstrate technology for reducing the enrichment levels of research and test reactor fuels. 1/ Similar research and development programs are underway in Japan, France, and Germany.

Despite such efforts, it may be some time before lower enriched fuels will be commercially available and usable on a wide-scale basis. In addition to the time needed to develop and test the fuels, other problems need to be resolved, such as foreign regulatory agencies' acceptance of the new fuel and willingness to authorize its use. According to the January 1980 findings of an INFCE study, in some countries it may take 5 years or more after the decision to convert the reactor before it is operating with lower enriched fuels.

In the meantime, the Government is faced with numerous export requests for highly enriched uranium. Since NNPA passage, the Government either had licensed or had under review as of September 30. 1979, 64 exports totaling almost 3,000 kilograms of highly enriched uranium. These exports are mostly for 93 percent enriched uranium for ultimate use in research reactors in at least 18 countries, as shown on the following page.

Under current administration policy, the President must personally approve highly enriched uranium exports of over 15 effective kilograms. As of September 30, 1979, 9 months had elapsed since the State Department had submitted such export requests to the President for approval. At this time 25 export licenses requiring Presidential approval were under review by executive branch agencies. According to a State Department official, the Department, for administrative reasons, preferred to send export requests to the President in batches, rather than individually as they occur. 2/

European and Japanese recipients we met were concerned about the potential impact on their nuclear research programs arising from persistent delays in receiving highly enriched

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1/Commenting on our report, the Department of State noted that the administration's request for this program was $2 million less than that we note. According to State the program will consequently be slowed down.

2/Commenting on our report, the Department of State indicated that in the future such requests will be forwarded to the President individually as they occur.

U.S. EXPORTS OF HIGHLY ENRICHED URANIUM (note a)

(March 10, 1978 through September 30, 1979)

	License issued	Under Government review	Total
	(in kilograms)		
Euratom (Belgium, Denmark, France, Netherlands, West Germany)	666	1,481	2,147
Canada	207	101	308
Romania	83	-	83
Sweden	60	35	95
Japan	40	140	180
South Korea	19	-	19
Greece	7	-	7
Austria	4	-	4
South Africa	-	26	26
Iran (note b)	-	26	26
Argentina	-	12	12
Various countries (note c)	-	45	45
Totals	1,086	1,866	2,952

a/Uranium enriched 20 percent or more.

b/On May 30, 1980, the Government formally denied issuance of an export license for this proposed export.

c/The purpose of this export is to test experimental 20 and 45 percent enriched uranium in research reactors located in Austria, Brazil, Denmark, the Netherlands, Sweden, Switzerland, Venezuela, and West Germany.

uranium export licenses. The delays have, indeed, been long and persistent. For example, between March 10, 1978, and September 30, 1979, the Government took an average of over 15 months to review 26 highly enriched uranium licenses for European and Japanese recipients. The review time ranged from a high of 33 months to a low of 7 months. In addition, 28 highly enriched uranium exports destined for Europe and Japan were under Government review as of September 30, 1979, for an average of almost 10 months.

In our discussions, European and Japanese recipients stressed their support of the administration policy to reduce enrichment levels. Some noted their own research efforts. They also pointed out their need for highly enriched uranium to continue existing research programs pending development and testing of new fuels and their uncertainty about whether the United States will continue supplies during the interim period. In addition, they noted that it was technically or economically infeasible to convert some existing research reactors to lower enrichment levels.

The foreign recipients also stressed the need for a constant flow of material to avoid disruption of fuel-cycle services. Most highly enriched uranium exports are in the form of a gas--uranium hexafluoride. It must first be converted into oxide or metal and then fabricated into fuel assemblies before it can be used in a reactor. It was noted that it is very difficult to maintain a constant flow of material throughout the fuel cycle when the State Department batches requests for Presidential review, and that delays in receiving export licenses caused additional fuel-cycle costs due to disruption of processing schedules.

In a draft of this report, we characterized the reason for delays in issuing highly enriched uranium export licenses to Europe and Japan as being due to Government indecision on which foreign research reactors merit continued supplies under administration policies. The Department of State and ACDA, when commenting on our report, objected to this characterization and provided the following rationale for the delays:

--The delays were caused primarily by Government review of the actual requirement for highly enriched uranium for foreign research reactors. Because applications for export licenses sometimes come in well in advance of need, they are delayed. (Department of State)

--The longest part of executive branch consideration of highly enriched uranium exports involves preparation and review of the technical and economic justification of continued supply to a particular research reactor. Inventory of unused highly enriched fuel is weighed against rate of use and amount requested. Interagency clearance of the submission memorandum to the President can be delayed if any of the cases included for review are deemed sensitive. The technical/economic analysis is carried out by DOE. (Department of State)

--Applications for highly enriched uranium are reviewed to determine the actual need for the material based upon supplied inventory data and licenses are timed so as not to allow its accumulation on site abroad. (ACDA)

--U.S. Government officials meet frequently with European and Japanese officials to plan highly enriched uranium deliveries. Submissions to the President attempt to take into account the need for a steady flow of material to the fabricators and the transportation available. It is U.S. policy to provide material on an as needed basis on the basis of inventory data, and after a technical and economic review of the possibilities of reducing the enrichment level of the fuel used. To characterize this as government "indecision" as to which reactors merit continued supplies of highly enriched uranium is not at all accurate. The executive branch fully recognizes that many reactors continue to merit supplies and cannot be converted to lower enrichments for the near term. However, it is still necessary for the executive branch to review carefully the inventory data to determine the amount needed and the time frame in which this material should be supplied. (ACDA)

Although we strongly endorse the administration's policy to reduce the enrichment levels of highly enriched uranium exports, we believe that after appropriate consultations the executive branch should decide and tell foreign governments (1) which reactors merit continued U.S. supplies, (2) the quantity needed to meet legitimate reactor needs and fuel fabrication schedules, and (3) the level of enrichment to be supplied. Continuation of the current practice of making these policy determinations for each individual supply request in the context of export license reviews can only perpetuate foreign

uncertainty about U.S. reliability pending commercial availability of more proliferation-resistant fuels.

U.S. CONTROLS OVER RETRANSFERS OF PREVIOUSLY EXPORTED NUCLEAR MATERIAL AND EQUIPMENT

An NRC export license only gives the licensee authority to ship nuclear material and equipment from the United States to its initial foreign destination. Once the export enters a foreign country, NRC's regulatory jurisdiction is terminated. At this point, DOE must approve retransfers (or nuclear material produced through the use of such material or equipment) to third countries. Any such retransfer must be within the scope of an agreement for cooperation between the United States and the country or group of countries (e.g., EURATOM) to which the material is transferred. The NNPA exempted retransfers among EURATOM countries from requiring U.S. approval.

A regulatory jurisdictional issue arises when a particular export transaction involves more than one agreement country. Many U.S. exports of enriched uranium are shipped from DOE facilities to foreign facilities for conversion into fuel pellets. They are then fabricated into fuel assemblies before use in either powerplants or research reactors. Oftentimes the fuel conversion and fabrication plants are located in different agreement countries than the powerplant or research reactor. When this occurs, the initial export falls under NRC's export licensing jurisdiction, but retransfers to any other intermediate destination as well as the final destination fall under DOE's subsequent arrangement jurisdiction.

To avoid duplication in reviewing such transactions, the executive branch in regulations implementing the NNPA established a 1-year standard to govern their approval. If the retransfer occurs within 1 year of export license issuance, then the export license serves as retransfer authority; no subsequent arrangement review and approval is required. DOE, however, publishes notice of the retransfer in the Federal Register based on the export license. If the retransfer occurs after 1 year of export license issuance, then the parties must request retransfer approval from DOE as a subsequent arrangement.

According to executive branch officials, the reason for the 1-year retransfer approval standard was that circumstances could change in a year. Therefore, from a nonproliferation control perspective, the standard provided

the United States greater leverage to react to circumstances which may be different than those existing at the time of export license issuance.

From our discussions with exporters and recipients, we found that some foreign countries are concerned that the United States might change its policies between the time the export license is issued and the retransfer takes place which might preclude or delay the retransfer. In addition, they resent the time and administrative burdens of requesting U.S. approval for a previously approved transaction.

Commenting on our report, DOE noted that on February 27, 1980, the President released a statement on the reduction of export disincentives which provides in part that "a separate retransfer authorization is no longer required in cases where the retransfer was foreseen and approved in the license issued by the Nuclear Regulatory Commission." Department of State comments, however, indicate that as of August 8, 1980, this action had not been implemented. State commented that the executive branch agencies administering nuclear export controls are "...prepared to permit retransfers without an application or formal USG approval of nuclear material and equipment if authorized in the NRC export license for periods beyond one year, provided that the retransfer occurs within the period of validity of the export license." State further commented that "...in order for this elimination of double control to take place, the Procedures Established Pursuant to the Nuclear Non-Proliferation Act of 1978, published in the Federal Register, June 9, 1978, need to be revised."

CONCLUSIONS AND OBSERVATIONS

The international nuclear market is characterized by a high degree of interdependence and competitiveness among countries. Although a few countries have the necessary resources and technical capability to sustain a complete nuclear power program on their own, most countries need others for some nuclear supplies. However, because of the number of nuclear suppliers, no country has to rely on any one country to sustain its nuclear power program.

Commercial contracts are central to international nuclear trade. Because of the long lead times for performance of many contracts, most countries view the predictable performance of these contracts as vitally important for the uninterrupted continuation of its nuclear power programs. For the United States to remove doubts about its reliability as a nuclear trading partner, the Government must conduct its non-proliferation reviews of export licenses and

subsequent arrangements in a manner which allows for the predictable performance of commercial contracts.

The primary purpose of the export license and subsequent arrangement process is to ensure that all U.S. nuclear export conditions are met at the time of export from the United States, at the time U.S. supply commitments are made, or at the time foreign use is made of the export or its by-products. The conditions are imposed by law, executive branch policies, or agency regulations. Because the NNPA was the first major revision to U.S. nuclear export control law since 1954, there was, as might be expected, a period of uncertainty as Government administrators and our nuclear trading partners made adjustments to accommodate the law.

The initial concern was heightened by the 3-month interruption in nuclear exports to several European countries. Since this situation was temporarily resolved, the NNPA has proven to be an administratively workable means of exercising U.S. non-proliferation controls over nuclear exports. The worst fears of both U.S. and foreign critics have somewhat abated as the review procedures and control mechanisms have gradually unfolded and become better understood. However, considerable anxiety and uncertainty still exists primarily due to a widely perceived unpredictability and/or opportunities for unpredictability in the way U.S. nuclear export controls are administered. For the most part, remedial actions can be taken within the constraints of the law to make Government reviews of export licenses and subsequent arrangements more predictable and timely. The actions we envision would mitigate foreign concerns about U.S. Government intervention in nuclear trade without denigrating the quality or thoroughness of U.S. non-proliferation reviews of nuclear exports.

RECOMMENDATON TO THE SECRETARY OF STATE

We recommend that the Secretary of State:

--Announce the U.S. position on when the United States will claim reprocessing approval rights. Matters that should be clarified include but are not limited to (1) what happens when U.S. exports are "co-mingled" with exports of other nations, (2) what happens when more than one nation claims approval rights on the same commodity, and (3) will the executive branch condition component exports on reprocessing approval rights.

--Improve the predictability of the export licensing process for highly enriched uranium by (1) telling foreign governments, after appropriate consultations, which reactors merit under administration policies continued U.S. supplies pending commercial availability of more proliferation-resistant fuels and (2) expediting the executive branch processing of export requests for Presidential review.

RECOMMENDATION TO THE SECRETARY OF ENERGY

To remove much of the uncertainty about how U.S. reprocessing approval rights are exercised, executive branch policy needs to be changed. Accordingly, it is necessary that top-level policy approvals be sought.

In view of this, and the Secretary of Energy's lead statutory responsibilities, we recommend that the Secretary seek, in accordance with the executive branch consultative procedures established pursuant to the NNPA, the necessary top-level policy approvals to allow the executive branch to consider and act on foreign reprocessing requests without our trading partners having to demonstrate an imminent physical need (i.e., spent fuel congestion).

AGENCY COMMENTS AND OUR EVALUATION

We were provided numerous detailed comments on this chapter by ACDA, NRC, and the Departments of Energy and State. Where appropriate, we have incorporated a number of the specific comments in the body of the chapter. This section reflects their major concerns and our response if needed.

Export license processing time

NRC commented that this section generally presents an accurate picture of the export licensing process as far as NRC is concerned.

ACDA commented that any evaluation of export licensing needs to determine whether the United States is meeting the goal of being a reliable supplier to nations "which adhere to effective non-proliferation policies." ACDA believes that one needs to distinguish between timely licensing of exports to states with good non-proliferation credentials and cases that may require more extensive review since they concern states with less than excellent credentials. In ACDA's view,

any statistics which do not, for example, distinguish between the time it takes to license to NPT parties and the time it takes to license to non-parties like South Africa are inaccurate reflections of what the NNPA intended as the goal of being a reliable supplier.

We found this comment quite puzzling. ACDA seems to suggest that it is not U.S. policy to be a reliable supplier to non-NPT nations and that the Government may have issued export licenses which are inconsistent with the NNPA. Our evaluation of export licensing processing time covered all major export licenses issued by NRC during a 2-year period following NNPA passage and all pending export cases close to the end of the second year. Neither the NNPA nor executive branch policy condition nuclear export licenses on NPT adherence, and there are no criteria of which we are aware that explicitly distinguishes countries based on their "non-proliferation credentials." According to an ACDA official, the term "good non-proliferation credentials" is a general characterization of the NNPA policy statement referring to countries "which adhere to effective non-proliferation policies." As a point of information, only 19 or 30 percent of the 63 export license applications we note on page 49 that were under Government review for a year or more were destined for non-NPT countries, as shown below.

Non-NPT country	Total licenses pending (A year or more as of February 29, 1980)
Spain	9
Argentina	2
France (note a)	2
India	2
South Africa	2
Israel	1
Pakistan	1
Total	19

a/France is a nuclear weapon state which, although not an NPT party, has stated it would in any event behave as if it were a party.

ACDA also commented that many license applications included in our statistics could have been returned to the

applicant, thereby reducing the average review time substantially. In an attempt to assist exporters according to ACDA, these applications were kept in the review process so as to move them more quickly when the necessary statutory conditions are met or required assurances such as the "authorized person letter" are received. In ACDA's view, this gives the "appearance" that the statutory time limits are not being met when in "reality" the executive branch could return the application and the "clock" would stop.

We believe the "reality" was that the statutory time limits were not met in the majority of cases we analyzed. (See pages 46 to 49.) Many could have been returned to the applicant under NRC and executive branch regulatory procedures as ACDA notes, but none were. The NNPA attaches great importance to the timely processing of requests for nuclear export licenses. Regarding executive branch processing of requests for nuclear export licenses, the NNPA specifically states that "The executive branch judgment shall be completed in not more than sixty days from receipt of the applications or request, unless the Secretary of State in his discretion specifically authorizes additional time for consideration of the application or request because it is in the national interest to allow such additional time." (Underscoring is ours.) During a 2-year period following passage of the NNPA, the Department of State has determined it to be in the national interest to allow such additional time for at least 455 license applications. In our opinion, these national interest determinations are made indiscriminately and so often that they have become virtually meaningless. Returning license applications without action in cases where basic U.S. export conditions are not met, such as the lack of agreements for cooperation or recipient government assurances, could be one way to instill meaning to these determinations when they are made.

U.S. controls over foreign reprocessing and plutonium use

A draft of this report included a proposal that the Secretary of Energy remove much of the uncertainty associated with the requirement for prior approval before U.S. origin fuel can be reprocessed by (1) clarifying the circumstances when approval is required and (2) acting on applications for reprocessing at the time such approval is requested by our trading partners. We have deleted this proposal based on ACDA, DOE, and Department of State comments. These agencies apparently misunderstood the thrust of the proposal. Accordingly, we have revised our text to make clear we believe that executive branch policy in this regard

needs to be changed, what should be changed, and that the Secretary of Energy should seek the necessary top-level policy approvals to accomplish the change. (See pp. 61 and 71.)

U.S. controls over exports of highly enriched uranium

ACDA commented that our recommendation to the Secretary of State on highly enriched uranium is one which the executive branch has under consideration. ACDA anticipates progress in improving the predictability and timeliness of the export license process for highly enriched uranium will come in the "near future."

The Department of State believes that authorizing highly enriched uranium for export pending the commercial availability of more proliferation resistant fuel is not a major problem and not nearly as important to foreigners as is the reprocessing approval issue. For countries that have existing supply contracts, the Department said that by and large the executive branch is honoring those contracts. As for new exports, the Department said the executive branch has made clear that the Government will license highly enriched uranium for reactors that are moving to low-enriched fuels.

We believe that the problems our nuclear trading partners experience in acquiring timely and predictable supplies of highly enriched uranium is not as important a concern as the reprocessing approval issue. Nevertheless, based on our discussions with European and Japanese recipients, we believe the uncertainties which have arisen because of executive branch difficulties in carrying out administration policies is a major foreign concern which needs to be addressed.

U.S. controls over retransfers of previously exported nuclear material and equipment

A draft of this report included a proposal that the Secretary of Energy provide greater assurances that the United States will allow previously approved exports to reach their final destination by allowing retransfers approved in the context of export license reviews to also serve as DOE's retransfer approval, conditioned upon there being no material change in circumstances since license issuance. ACDA, DOE, and the Department of State noted recent actions to implement this proposal. Accordingly, we revised our report to reflect these actions and deleted

the proposal from our report. Based on the agency comments and follow-up discussion with DOE officials, we believe that DOE is moving to fully implement the thrust of the proposal.

CHAPTER 6

HOW WELL ARE OTHER FORMS OF U.S. ASSISTANCE TO FOREIGN NUCLEAR PROGRAMS CONTROLLED?

In addition to controlling nuclear material and equipment exports, the Government, primarily through DOE, attempts to control virtually every nuclear fuel cycle-related activity by a U.S. citizen or firm abroad. These DOE controls contain significant loopholes and are not well coordinated with the controls NRC and the Department of Commerce administer. In addition, DOE's administration of the controls provide too many opportunities for arbitrary executive branch decisions and no opportunities for public or congressional scrutiny.

DEPARTMENT OF ENERGY CONTROLS

DOE's authority to control foreign activities of U.S. firms and individuals stems from section 57(b) of the Atomic Energy Act of 1954. Section 57(b) forbids "any person to directly or indirectly engage in the production of any special nuclear material outside the United States," except when authorized. If specific authorization is not contained in a U.S. agreement for cooperation, then only the Secretary of Energy 1/ can grant a specific authorization after finding that the proposed activity "will not be inimical to the interests of the United States."

Section 57(b) has been interpreted by DOE and its predecessor agencies to encompass virtually any activity by a U.S. citizen or firm abroad related to the nuclear fuel cycle. This broad interpretation is not just limited to the transfer of nuclear technology in the form of blueprints, instruction manuals, or other technical know-how but to any form of assistance in foreign nuclear programs, including consulting services and at times the export of commodities licensed by the Department of Commerce.

The NNPA amended section 57(b) to require that decisions on specific authorizations by the Secretary be made with the concurrence of the Department of State after consultation with ACDA, NRC, and the Departments of Commerce and Defense. In addition, the NNPA amendment transferred nuclear reactor components from DOE's export control authority to NRC.

1/Section 161(n) of the Atomic Energy Act prohibits the Secretary from delegating his responsibility for granting specific authorizations.

In practice the Secretary of Energy does not grant specific authorization for every nuclear fuel cycle-related activity. DOE's implementing regulations for section 57(b), Unclassified Activities in Foreign Atomic Energy Programs (10 C.F.R. 810), provides a general authorization for certain activities and procedures for requesting specific authorizations for other activities. According to DOE about 20 to 25 requests for specific authorizations are received each year.

DOE distinguishes between communist and "free-world" countries in applying its rules. The chart below summarizes the applicability of DOE rules to U.S. activities in foreign nuclear programs.

Type of activity	Communist countries (note a)	Free-world countries
Transferring published technical information available to the public	Generally authorized	Generally authorized
Providing assistance to "non-sensitive" foreign nuclear facilities (e.g., mining and milling of source material, conversion, power and research reactors)	Specific authorization required	Generally authorized
Providing assistance to "sensitive" foreign nuclear facilities (i.e., reprocessing, enrichment, heavy water production, plutonium fuel fabrication)	Specific authorization required	Specific authorization required

a/In this category, DOE's rules include the following 19 countries: Albania, Bulgaria, Cambodia, China (excluding Taiwan), Cuba, Czechoslovakia, East Germany, Estonia, Hungary, Laos, Latvia, Lithuania, North Korea, Outer Mongolia, Poland, Romania, Southern Rhodesia, the Soviet Union, and Vietnam. All other countries are included in the "free-world" category.

Although not reflected in DOE's rules nor prohibited by law, it has long been executive branch policy not to allow U.S. firms and individuals to provide significant assistance to foreign activities in the areas of reprocessing, uranium enrichment, and heavy water production because of their proliferation risk significance. This

policy was reaffirmed by the President on April 7, 1977, when announcing major changes in U.S. domestic nuclear energy policies and programs. Specifically, the President said that the executive branch "...will continue to embargo the export of either equipment or technology that could permit uranium enrichment and chemical reprocessing."

TECHNOLOGY EXPORT CONTROL PROBLEMS

Two loopholes exist in DOE's rules controlling the foreign nuclear activities of U.S. firms and individuals that could in the future undermine the effectiveness of U.S. efforts to control the spread of nuclear explosive capability. The first loophole allows DOE controls to be circumvented by publishing information on sensitive nuclear technology. The NNPA defines "sensitive nuclear technology" as any unclassified information which is not available to the public and which is important to the design, construction, fabrication, operation, or maintenance of enrichment, reprocessing, or heavy water production facilities. Under DOE rules such unclassified information, plus unclassified information relating to plutonium fuel fabrication facilities, requires the specific authorization of the Secretary of Energy before it can be exported to any country. However, if the information is available to the public in published form, it can be exported to any country without any Government authorization or specific conditions.

By simply publishing the information, anyone can circumvent the need for obtaining the Secretary of Energy's authorization. According to DOE officials, the commercial value of unpublished information is relied upon to discourage U.S. firms or individuals from doing this. As described below, this factor was not much of a disincentive to prevent at least one U.S. firm from exporting technology the Government did not want exported.

In November 1977 a small U.S. engineering firm requested approval from the Secretary of Energy to assist a foreign country in their fast breeder reactor spent fuel reprocessing development program. In June 1978 the Secretary, with Department of State concurrence, denied the request. The firm subsequently requested reconsideration of the decision, but the denial decision was reaffirmed in August 1978.

The firm wanted to transfer unclassified design information regarding remote maintenance and handling equipment

for a breeder reactor spent fuel reprocessing pilot plant. The Secretary denied the request because it was the unanimous view of all Federal agencies consulted that approval would be inconsistent with executive branch policy not to provide significant assistance to foreign reprocessing activities.

Despite two formal Government denials, the firm subsequently transferred the information after making it "publicly available" by sending the information to DOE for unrestricted public distribution. According to DOE officials, once the information became available to the public, DOE had no legal means to prevent its transfer because it was unclassified. 1/

This loophole could also allow potentially sensitive private research findings in laser enrichment to be transferred to foreign countries without any U.S. controls.

DOE does not now require private researchers in laser enrichment to inform the Government of its work until it reaches the stage where the researcher believes classification advice may be needed. Section 151(c) of the Atomic Energy Act of 1954 requires that any discovery useful in the production of special nuclear material, including enriched uranium, must be reported to DOE or to the Commissioner of Patents. To minimize Government interference in private research, the Atomic Energy Commission in 1967 liberalized this reporting requirement by declassifying all private research and development work on methods not involving gaseous diffusion or centrifuge until it has a "reasonable potential" of enriching practical quantities of uranium. In 1972 the Commission reviewed its declassification activities and reaffirmed its 1967 decision. In addition, the Commission issued a public notice on procedures for submission of reports on private research in "novel methods" of isotope separation which requires private researchers to notify the Commission only when, in the opinion of the researcher, the process has demonstrated, through experiments in the laboratory or through theoretical studies or calculations, that the process can separate uranium isotopes.

1/Commenting on our report, DOE said this is the only case it knows of where a company circumvented export controls through this "loophole."

Because DOE's classification policy relies partially on voluntary compliance, its effectiveness depends on DOE keeping abreast of the status of private research developments and its potential proliferation significance. It is unclear, however, actually how much unclassified private research and development is being conducted in the United States on laser enrichment methods and the status of the work.

According to DOE officials, it keeps abreast of private research and development in laser enrichment conducted in the United States by reviewing numerous requests from private researchers for classification advice and patent filings in the field. Additional monitoring is done through a variety of informal means, such as personal contacts, conferences, trade journals, and other publications. Nevertheless, in February 1980 DOE officials could not document the magnitude and current research status of the classification requests or patent filings it had reviewed. To compile such documentation, we were told that DOE would have to research about 2,000 files and it did not have the time or staff to do so.

Given the lack of this information, we were unable to independently determine the effectiveness of the classification policy in ensuring that private research in laser enrichment is being classified when it should. Coupled with our finding that DOE controls over transfers of unclassified technology can be circumvented, we are concerned that an inordinate risk of potentially sensitive private research findings in laser enrichment being widely disseminated might exist.

Inconsistent export controls

The second loophole involves the lack of covenants governing exports of nuclear reactor manufacturing expertise and technology. The NNPA, as implemented by NRC rules, conditions the export of nuclear reactors on (1) the application of IAEA safeguards, (2) peaceful use assurances, (3) adequate physical security, (4) U.S. retransfer approval rights, and (5) U.S. reprocessing approval rights, regardless of the recipient country. However, no similar conditions are required on the technology for such reactors or reactor components. For example, reactor pressure vessels exported under NRC rules must meet licensing conditions governing reactor components, but reactor pressure vessel technology exported under DOE rules is generally authorized to free world countries. Although a specific authorization is required for such technology exports to communist countries,

there is no requirement that the authorization include the covenants that apply to reactor component exports. 1/

U.S. firms have exported reactor technology without any explicit non-proliferation conditions attached to it for the last 24 years. In 1956, the former Atomic Energy Commission provided U.S. firms a general authorization to transfer such technology without specific Government approval. U.S. firms have sold or licensed their technology for designing and producing nuclear reactors or components to many foreign manufacturers. One result has been that today U.S.-type light water reactors are predominant in the world and U.S. firms face stiff competition in the foreign market.

The inconsistency between U.S. export controls over equipment and technology extends to the response in the event the export is improperly used. NRC rules governing exported equipment provide for the termination of nuclear equipment and material licenses to countries which conduct certain prohibited activities, such as detonating a nuclear explosive device. There is no requirement, however, for the withdrawal of the Secretary's general authorization for technology transfers in similar circumstances. 2/

Although DOE has considered the transfer of some reactor manufacturing technology more sensitive than the export of nuclear equipment and materials, it has not harmonized its rules with NRC's since NNPA passage. Because countries can and have unconditionally purchased reactor manufacturing technology from the United States under DOE rules, we are concerned that some countries might do this as a way of circumventing NNPA conditions or prohibitions.

IMPLEMENTATION PROBLEMS

In addition to the loopholes in DOE rules which could limit the effectiveness of NNPA non-proliferation controls, we found that DOE and the other executive agencies

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1/Commenting on our report, DOE noted that its regulations "...are broad enough to include all the 'covenants' that apply to reactor component exports, yet flexible enough to choose the appropriate 'covenant' depending on the nature of the export, its significance, the end-user, the end-use and other factors."

2/Commenting on our report, DOE noted that a revision to its regulations presently under review within the executive branch contains such a requirement.

responsible for controlling nuclear technology exports have failed to clearly define what exports are subject to Government control, what are the criteria governing approval, and what are the control jurisdictions between DOE and the Department of Commerce.

Lack of criteria

Before Government authorization can be granted, the Atomic Energy Act, as amended by the NNPA, requires that DOE find a proposed activity "not inimical to the interest of the United States." Except for exports of sensitive nuclear technology, neither the law nor DOE regulations established the criteria to be used in making this statutory finding. For activities involving exports of sensitive nuclear technology, the NNPA requires, as a minimum, that the same criteria applicable to exports of nuclear material and equipment NRC licenses be used.

Because the DOE rules are broadly written, U.S. firms and individuals make many inquiries regarding their applicability. According to DOE over 100 such inquiries are received per year. DOE officials decide whether the proposed activity is generally authorized, requires a specific authorization from the Secretary of Energy, or is even covered by DOE rules.

This decisionmaking process is important because it determines whether a proposed activity will require additional Government review. Despite its importance, however, we found that outside of the broadly worded published rules, DOE has little additional criteria or policy to guide it in making the decision. According to DOE the nature of the activity and overall U.S. non-proliferation policy provides guidance for deciding whether a proposed activity is generally authorized or will require a specific authorization. Furthermore, DOE normally makes the decision without consulting other Federal agencies.

After DOE determines that an activity requires the specific authorization by the Secretary of Energy, the Secretary by law must consult with ACDA, NRC, Commerce, and Defense, and obtain the concurrence of the State Department before granting any approvals. The executive branch, however, has no clearly defined criteria for deciding whether to approve or deny a specific authorization request.

DOE rules state that the Secretary of Energy will approve an application for a specific authorization if, after taking into account the following factors, the Secretary

determines that such activity will not be inimical to the interest of the United States:

--Whether the United States has an agreement for cooperation with the country in which the proposed activity will be conducted.

--Whether the country in which the proposed activity will be conducted is a party to the NPT and, pursuant thereto, has entered into an agreement with the IAEA for the application of safeguards to its peaceful nuclear activities.

--Whether the country in which the proposed activity will be conducted, if not a party to the NPT, will accept IAEA safeguards with respect to the project.

--The relative significance of the proposed activity and availability of comparable assistance from other sources.

--Any other fact which may bear upon the political, economic, or security interests of the United States.

These factors provide the executive branch considerable flexibility and discretion in determining how each will be weighed in producing a decision. Unlike the statutory criteria governing the licensing of nuclear exports over which NRC has authority, these factors are not determinative; that is, they do not have to be met before approval can be granted.

We would be less concerned about this issue if the public had an opportunity to review the basis of executive decisions in this area. But they do not. There is no requirement for DOE to make public the basis for its decisions. 1/

In other nuclear export control areas, the public has many more opportunities to review and question the basis of executive branch decisions. For example, under NRC rules most documents pertaining to Government decisions on nuclear material and equipment exports are available for review in the NRC

1/Members of the public may, however, seek information under the Freedom of Information Act (5 U.S.C. 552(a)).

Public Document Room, and the NRC provides the public opportunities to intervene on a license application and to comment on proposed rules. 1/

In every case we reviewed, DOE simply notified the exporter whether the Secretary was able to determine that the proposed activity would be inimical to the interest of the United States; and thus, whether the application was denied or approved.

We recognize that in certain cases it may be inappropriate for DOE to make public all information relating to Government decisions in this area because proprietary information, classified information, or sensitive foreign policy concerns may be involved. NRC has established procedures for public scrutiny of Government nuclear export decisions, and we believe, with the effort, so can DOE.

Overlapping jurisdiction between the Departments of Energy and Commerce

In some instances, the Departments of Energy and Commerce both claim jurisdiction over the export of commodities related to the production of special nuclear material. The basic reason for this overlapping jurisdiction is that DOE interprets its authority to control U.S. activities in foreign nuclear programs very broadly. As previously mentioned, DOE attempts to control not only transfers of nuclear technology but any form of U.S. assistance which may involve "the direct or indirect production of special nuclear material." As a result, the jurisdictional overlap arises in cases involving the export of nuclear-related commodities which are not licensed by NRC but by Commerce and have a nuclear fuel-cycle end use. Examples of these so-called dual-use commodities include certain types of computers, high-speed cameras, heat exchangers, neutron generators, and lasers.

Under the Export Administration Act of 1979 Commerce has export control authority over most commercially available commodities, including dual-use commodities. All items under its general jurisdiction require a license. However, many

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1/Commenting on our report, DOE noted that the public has generally been provided the opportunity to review and comment on proposed revisions to its regulations, even though the Administrative Procedure Act (5 U.S.C.552, et seq.) exempts DOE from having to do so in this area.

items are under "general license," which means that exporters may freely export the items without obtaining a specific authorization from Commerce. Other items require a "validated license" (a specific authorization) before they can be exported. Commerce's export regulations contain a Commodity Control List that indicates the items which require a validated license to certain destinations. In June 1980, Commerce added to the list the group of commodities being controlled for non-proliferation purposes. 1/

DOE tries to control the export of commodities that can be exported under general licenses from Commerce when the commodity, for example standard welding equipment, is destined for a nuclear fuel cycle end use in a communist country or for use in "sensitive" nuclear facilities in any foreign country. Specific authorization from both agencies is required when (1) the commodity is destined for a nuclear fuel cycle end use in a communist country or is for use in "sensitive" nuclear facilities in any country and (2) the commodity falls in Commerce's validated license category; for example certain lasers that are used in uranium enrichment.

DOE and Commerce officials acknowledge that this overlapping jurisdiction has resulted in unwarranted duplication of effort and confusion among exporters. In particular, the additional time and expense needed to obtain approval from two Government agencies is resented by all involved parties. Although Commerce and DOE officials recognize the problem, they have been unable to resolve it. Each agency apparently wants the other to relinquish jurisdiction when a conflict arises, but neither has been willing to do so. Each apparently believes it is constrained by its statutory authority and own regulations.

It should be recognized that commodities under a Commerce general license destined for a nuclear fuel-cycle end use cause particularly difficult control problems. Commerce rules provide for the revocation or invalidation of general licenses when the exporter "knows or has reason to know" that its exports will be used for nuclear weapons purposes or for a "sensitive" nuclear facility. In such circumstances, the exporter is required to obtain a validated license and the

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1/Commenting on our report, Commerce said that this action is an important step in the implementation of the NNPA, which in section 309(c) directs the institution of controls by Commerce over items which, if used for purposes other than those intended, could be of significance for nuclear explosive purposes.

Secretary of Energy would have to grant a specific authorization before the commodity could be exported. For these rules to be effective, exporters must be aware that their exports are destined for a sensitive nuclear end use. They do not always know the end use, however. For example, in 1978 it was revealed that Pakistan had purchased some items which could be exported under a Department of Commerce general license for use in an unsafeguarded enrichment facility but which were claimed to be for a non-nuclear end use. Subseqently, the Department revised its Commodity Control List to require validated licenses for such items. According to the Department this action was possible because the commodities could be fairly narrowly defined. The Department notes, however, that if similar circumstances were to arise in the future when the commodities are of a very general purpose, off-the-shelf nature this control measure may not always be feasible or desirable.

In commenting on our report, the Department of Commerce said that ways are being sought to tell U.S. exporters which countries or foreign entities engage in one or more of the "sensitive" activities, but notes there are security and diplomatic problems in so doing that have not been resolved. Meanwhile, the Department believes existing controls represent the current best way to ensure review of sensitive exports and provides a basis for punitive action when a willful violation occurs. Nevertheless, both the Department and DOE acknowledged that existing controls have their limitations in preventing an export when the exporter does not know the true intended end use or engages in deception about the end use.

CONCLUSIONS AND OBSERVATIONS

How should the Government control foreign nuclear activities of U.S. firms and individuals? For over a quarter century DOE and its predecessor agencies had essentially unlimited and unchecked authority for establishing and implementing specific controls. When it was given this authority there was not a commercial nuclear industry, and U.S. nuclear technology was still classified. Today, the commercial nuclear industry is international and most civilian nuclear technology is unclassified.

In 1956, the former Atomic Energy Commission granted U.S. firms and individuals a general authorization to export unclassified nuclear technology to foreign recipients without any non-proliferation conditions attached to the export. Over the years an increasing amount of attention has been paid to the proliferation significance of U.S. exports.

This concern culminated in the NNPA which provided for tightened statutory controls over exports of sensitive nuclear technology, material, and equipment. Previous manifestation of heightened U.S. concern over proliferation of sensitive exports occurred in 1972 with the withdrawal of the general export authorization for technologies related to reprocessing, enrichment, and heavy water production, and in 1977 when plutonium fuel fabrication technology was added to this list. Nevertheless, loopholes in the DOE technology control procedures present opportunities to circumvent DOE's controls and/or allow the manufacturing expertise directly relevant to reprocessing, enrichment, heavy water, and plutonium fuel fabrication facilities to be exported without the non-proliferation covenants that are attached to the export of material and equipment used in such facilities. In addition, other nuclear technology useful to manufacturing nuclear reactor equipment can still be exported under standing general authorizations.

Further, the Government's implementation and administration of nuclear technology export controls have caused confusion and uncertainty, which we believe can be reduced or eliminated by DOE and the other responsible executive branch agencies adopting and promulgating definitive procedures and criteria governing their reviews and jurisdictions. In view of the significance of the shortcomings we have found, and in recognition of how absolutely essential technology controls are to restraining proliferation, we conclude that a comprehensive reassessment is needed of the controls DOE administers over nuclear technology exports and all other unclassified foreign nuclear activities of U.S. firms and individuals.

RECOMMENDATION TO THE SECRETARY OF ENERGY

Accordingly, we recommend that the Secretary of Energy take the lead in coordinating a comprehensive interagency reassessment of the controls over unclassified nuclear activities of U.S. firms and individuals and how they are administered. This reassessment should focus on ways to

--reduce opportunities for controls to be circumvented,

--better harmonize controls the Department of Energy administers with the controls the Department of Commerce and the NRC administer in the nuclear field, and

--reduce confusion over Government decisions by establishing (1) more specific review and approval criteria and (2) administrative procedures which permit greater public accountability.

The Secretary of Energy should provide for full NRC participation in the reassessment.

AGENCY COMMENTS

Commerce believes that a comprehensive interagency reassessment of the controls DOE administers over various forms of U.S. assistance to foreign nuclear programs would be useful. However, the Department of Commerce defers to the Secretary of Energy on the subject of DOE's own technology controls.

ACDA shares our concern over the lack of specific criteria for the export of reactor technology. ACDA believes that dealing with this issue would be complicated by existing commercial licensing arrangements which U.S. light water reactor manufacturers have abroad.

DOE provided several detailed comments on this chapter which, along with our detailed evaluation, are included in appendix III.

In general, DOE does not acknowledge that any of the problems we found are of any serious concern. DOE believes that any reassessment of the controls over foreign activities of U.S. firms and individuals should give considerable weight to the desirability of further changes in our export control regime only 3 years after the NNPA's major revisions of the Atomic Energy Act.

We believe the problems we found are of serious concern and are troubled by DOE's apparent unwillingness to acknowledge that there is even a cause for concern. We recognize that the problems, particularly the loopholes in DOE's rules, will be difficult to resolve without some changes in our export control regime. Further, we believe that any changes should further the overall goals of the NNPA, particularly section 3(d) which established as a goal "...effective controls by the United States over its exports of nuclear materials and equipment and of technology." In our opinion, the effectiveness of such controls are now limited by the problems we found.

APPENDIX I

SELECTED GAO REPORTS ON THE LINKS BETWEEN NUCLEAR POWER AND NUCLEAR WEAPONS, AND RELATED DOMESTIC ISSUES

Title	Date Issued
U.S. Nuclear Non-Proliferation Policy: Impact on Exports and Nuclear Industry Could Not Be Determined (ID-80-42)	September 23, 1980
U.S. Fast Breeder Reactor Program Needs Direction (EMD-80-81)	September 22, 1980
Evaluation of U.S. Efforts to Promote the Nuclear Non-Proliferation Treaty (ID-80-41)	July 31, 1980
U.S. Energy Assistance to Developing Countries: Clarification and Co-ordination Needed (ID-80-7)	March 28, 1980
Nuclear Fuel Reprocessing and the Problems of Safeguarding Against the Spread of Nuclear Weapons (EMD-80-38)	March 18, 1980
Comments on the Administration's White Paper: "The Clinch River Breeder Reactor Project--An End to the Impasse" (EMD-79-89)	July 10, 1979
Federal Facilities for Storing Spent Nuclear Fuel--Are They Needed? (EMD-79-82)	June 27, 1979
Nuclear Reactor Options to Reduce the Risk of Proliferation and to Succeed Current Light Water Reactor Technology (EMD-79-15)	May 23, 1979
Questions on the Future of Nuclear Power: Implications and Trade-Offs (EMD-79-56)	May 21, 1979

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Title	Date Issued
The Clinch River Breeder Reactor --Should the Congress Continue to Fund It? (EMD-79-62)	May 7, 1979
Difficulties in Determining if Nuclear Training of Foreigners Contributes to Weapons Proliferation (ID-79-2)	April 23, 1979
The United States and International Energy Issues (EMD-78-105)	December 18, 1978
Quick and Secret Construction of Plutonium Reprocessing Plants: A Way to Nuclear Weapons Proliferation? (EMD-78-104)	October 6, 1978
An Evaluation of Federal Support of the Barnwell Reprocessing Plant and the Department of Energy's Spent Fuel Storage Policy (EMD-78-97)	July 20, 1978
Fair Value Enrichment Pricing: Is It Fair? (EMD-78-66)	April 19, 1978
An Evaluation of the Administration's Proposed Nuclear Non-Proliferation Strategy (ID-77-53)	October 4, 1977
Assessment of U.S. and International Controls Over the Peaceful Uses of Nuclear Energy (ID-76-60)	September 14, 1976

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OVERVIEW OF THE EXPORT LICENSE AND SUBSEQUENT ARRANGEMENT APPROVAL PROCESS

This appendix provides an overview of the unilateral non-proliferation controls the U.S. Government exercises over exports of nuclear materials and equipment. It describes the statutory export conditions and the procedures applicable for approval of export licenses and subsequent arrangements by the five executive branch agencies involved in routine nuclear export decisions (the Departments of Energy, Commerce, State, Defense and the Arms Control and Disarmament Agency) and the independent Nuclear Regulatory Commission (NRC), the President, and the Congress. It is important to note, however, that the Government also relies on bilateral or multilateral assurances contained in "Agreements for Cooperation Concerning the Civil Uses of Atomic Energy" with individual nations or groups of nations 1/ and the safeguard system of the International Atomic Energy Agency (IAEA) as part of its control system over individual exports.

Export licenses

Under the Atomic Energy Act of 1954, as amended by the Nuclear Non-Proliferation Act of 1978 (NNPA), NRC licenses five categories of nuclear exports: (1) power and research reactors, (2) special nuclear material (enriched uranium, uranium-233, or plutonium), (3) source material (natural uranium or thorium), (4) radioactive byproduct material (e.g., tritium or cesium), (5) reactor components, and moderator materials (nuclear grade graphite and heavy water).

The NNPA carefully defined the roles of the independent NRC and the executive branch in the nuclear export licensing process. NRC cannot issue an export license until it has been notified by the Department of State that the executive branch believes the proposed export will not be "inimical to the common defense and security" of the United States. This

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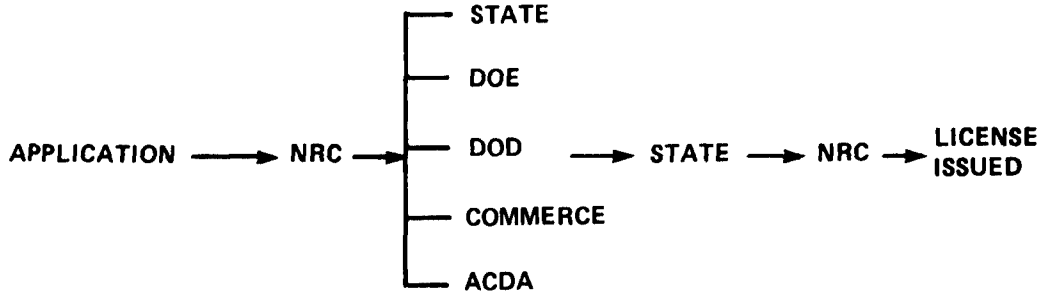
1/These agreements provide the basic framework for U.S. nuclear exports and specify the safeguards and controls the recipient nations or groups of nations will exercise over the exports. As of January 1980, the United States had 23 such agreements in force.

national security finding essentially involves a judgment that the proposed export will be used for its intended peaceful use and will not be diverted to unauthorized uses. An executive branch analysis is assembled and forwarded to NRC by the Department of State only after consulting with the Departments of Energy, Defense, Commerce, and the Arms Control and Disarmament Agency (ACDA). 1/ The flow chart below summarizes the process.

EXPORT-LICENSING PROCESS



In addition to the national security finding, the executive branch agencies must address and NRC must find that other statutory conditions are met before issuing the export license depending on the type of export. Briefly, these conditions require that the export, and in some cases, special nuclear material used in or produced through the use of such export, be subject to

--the terms and conditions of the U.S. agreement for cooperation with the receiving nation or group of nations,

--IAEA safeguards,

--no nuclear explosive use assurance,

--adequate physical security measures,

--prior U.S. approval for any export retransfers to the jurisdiction of any other country or group of countries than was initially authorized, and

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1/Commenting on our report, ACDA said that the NNPA provides for an executive branch judgment which would require a consensus of the concerned agencies rather than requiring only consultations.

--prior U.S. approval for any reprocessing or other physical alteration of the export.

As a further condition, the NNPA prohibits exports of nuclear reactors, special nuclear material, and source material for nuclear end uses to those non-nuclear weapons states where IAEA safeguards are not maintained on all its peaceful nuclear activities at the time of export from the United States. 1/ Unlike the other statutory export criteria which were effective upon enactment of the NNPA, this "full-scope safeguards" condition only applies to export license applications received by NRC after September 10, 1979, or to export license applications where the first export would occur after March 10, 1980. The NNPA gave the President explicit authority to waive this condition on a case-by-case basis if he notifies the NRC that failure to approve a proposed export because this condition is not met would be "seriously prejudicial to the achievement of U.S. non-proliferation objectives" or otherwise "jeopardize the common defense and security" of the United States.

The table on the next page summarizes the applicability of the statutory conditions discussed above to the five basic categories of nuclear exports NRC licenses.

SUBSEQUENT ARRANGEMENTS

"Subsequent arrangements" is a new statutory term in the NNPA. The term is used to define contracts, authorizations, approvals, and other arrangements that concern U.S. nuclear exports or the export-related non-proliferation conditions required by the NNPA. Although the term was apparently conceived to apply to Government activities that are subsidiary to U.S. agreements for cooperation, the statutory definition includes activities not covered by such agreements.

Under this authority the Government has reviewed and approved arrangements involving retransfers of U.S. nuclear exports, contracts for the sale of enriched material, DOE authorizations of nuclear material exports, application of IAEA safeguards, and arrangements involving the return to

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1/Principally India, Israel, South Africa, and Spain. Commenting on our report, the Department of State noted that this condition also has applicability for exports to Pakistan and possibly Brazil and Argentina.

APPLICABILITY OF STATUTORY CONDITIONS TO NUCLEAR EXPORTS FOR PEACEFUL USES

Condition	Nuclear reactors	Special nuclear material	Source material	Nuclear reactor components and special reactor materials	Byproduct material
National security	X	X	X	X	X
Agreement for cooperation	X	X	(note a)		
IAEA safeguards	X	X	X	X	
No explosive use	X	X	X	X	
Physical security	X	X	X		
Retransfer	X	X	X	X	
Reprocessing	X	X	X		
Full-scope safeguards	X	X	X		

a/In the case of agreements for cooperation entered into by the United States after passage of the NNPA, the export of source material for reactor fueling or for enrichment must be pursuant to such agreement.

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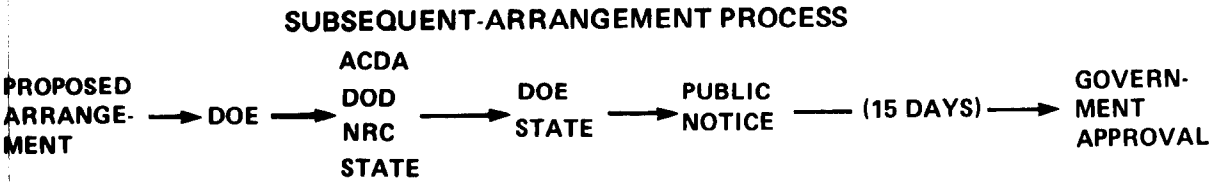
the United States of foreign research reactor fuel for reprocessing. Although no cases have yet been presented, the Government must also review any arrangements involving the storage or other disposition of foreign spent nuclear fuel from power reactors in the United States. In addition, any other form of U.S. nuclear cooperation with other countries which the President finds to be important from the standpoint of preventing proliferation may be declared a "subsequent arrangement," thus requiring prior Government review and approval.

Before the Government can approve any proposed subsequent arrangement, the NNPA requires that DOE make the same national security determination required in granting export licenses; that is, the arrangement must not be "inimical to the common defense and security" of the United States. In making this determination, DOE must obtain the concurrence of the Department of State and consult with ACDA, DOD, and NRC. Government approval of the arrangement does not take effect until 15 days after DOE publishes its findings in the Federal Register. The flow chart below summarizes the process.



This finding and public notice are the only common statutory conditions governing approval of all types of subsequent arrangements. However, the NNPA places additional conditions on subsequent arrangements involving foreign reprocessing and U.S. storage of foreign spent fuel, which also includes provisions for congressional review.

Before approving foreign reprocessing requests, DOE must determine that the reprocessing, and the plutonium derived from such reprocessing, will not result in a "significant increase in the risk of proliferation." In reaching this decision, DOE must consider whether the reprocessing will take place under conditions that will ensure "timely warning" to the United States of any plutonium diversion to nuclear explosive purposes. In addition, DOE must provide two congressional committees a report stating its reasons for approval. After submission of the report, DOE must wait for 15 days of continuous congressional session before approval can take effect. The Congress has no veto right, however.

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In contrast, the NNPA provides the Congress an opportunity to veto proposed subsequent arrangements involving a commitment to store or otherwise dispose of foreign spent nuclear fuel in the United States. Before completing such an arrangement, DOE must provide the Congress 60 days of continuous session to review it. During this period the Congress can veto the arrangement by adopting a concurrent resolution opposing the U.S. commitment. This condition only applies to spent fuel discharged from foreign power reactors. Fuel discharged from foreign research reactors was excluded from this condition.

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THE DEPARTMENT OF ENERGY'S COMMENTS ON

A DRAFT OF THIS REPORT AND GAO'S EVALUATION OF THE COMMENTS

Department of Energy
Washington, D.C. 20585

AUG 13 1980

Mr. J. Dexter Peach
Energy and Minerals Division
US General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

We appreciate the opportunity to review the GAO draft report entitled "An Evaluation of Selected Features of US Nonproliferation Law and Policy."

DOE COMMENTS ON THE NEED TO CONSTRUCT ADDITIONAL ENRICHMENT CAPACITY

The major conclusion of the report is embodied in the following language appearing on page xii of the Digest:

> "...GAO believes that Congress should consider not appropriating additional funds for construction of uncommitted increments of centrifuge capacity until the Department of Energy presents sufficient documentation demonstrating that the additional capacity is needed to meet demand, to enhance U.S. reliability as a nuclear supplier, or is justified on an economic basis."

We agree that appropriations for a project must be justified to Congress' satisfaction. This process has occured for the first increment of the addition of gas centrifuge enrichment capacity at the Department of Energy's (DOE) Portsmouth, Ohio, plant. The presentations to Congress were based on studies which show the capacity is needed to meet projected demand. Evidence derived from these studies led DOE to recommend, and Congress to sanction, a change in the construction schedule authorized by Congress in 1976. The GAO draft report appears to confirm the conclusions of DOE and the Congress that the originally authorized schedule is no longer warranted and must be stretched out. We are concerned, however, that the wording of GAO's report might be construed as suggesting that past Congressional actions were taken without Congressional review of the need for plant increments. In assessing the need for new enrichment capacity, we have to bear in mind the fact that

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DOE currently has contracts which will support 304 gigawatts of electric power, a level which those contracts project to be reached in the 1990s. On the basis of their projected operation, the existing expanded gaseous diffusion plants (GDP) could satisfy, depending on tails assay, only about 185 to 210 gigawatts on a sustaining basis. The initial 2.2 million separative work units per year increment of the Portsmouth Gas Centrifuge Enrichment Plant (GCEP) would permit the US to serve a total of about 200 to 230 gigawatts electric depending on tails assays and other considerations.

DOE periodically analyzes likely future demand for enrichment services. Current DOE plans are based on a reactor-by-reactor analysis which recognizes the possibility that approximately 50 gigawatts of nuclear power now under contract could be terminated or not renewed. In this respect, we disagree with the statement in the GAO's draft report that DOE assumed that no foreign contracts will be cancelled, since DOE's forecast of nuclear power demand did assume that 15 GWe of existing foreign contracts would be cancelled and excluded an additional 8 GWe of foreign contracts which have already been terminated. At the same time, however, these analyses indicate that a number of new contracts amounting to about 15 gigawatts will be obtained during the next 5 to 8 years.

DOE studies further indicate a probable substantial economic advantage if high-cost, power-intensive gaseous diffusion capacity can be replaced with gas centrifuge capacity. Our analysis indicates, and our competitors confirm, that DOE is and will remain a less expensive source of enrichment services than other enrichers. The degree to which DOE's cost advantage can be improved by GCEP should mitigate the desire of our customers to diversify supply. Furthermore, DOE has conducted extensive economic evaluations to determine the most cost-effective means of balancing production through 1995 with the projected decrease in demand. These studies demonstrate the economic desirability of operating the GDPs at reduced levels and proceeding with GCEP capacity.

Therefore, based on considerations of both demand and cost savings, we believe that the first increment of the GCEP is fully justified. We agree, however, that the installation of follow-on increments of capacity should be scheduled to meet market demand and should be fully justified at the time the commitment is sought.

GAO EVALUATION

The point of contention between us and DOE arises from our conclusion that the need for the initial 2.2 million SWU increment is not apparent and that it should be fully justified before the Congress appropriates additional funds. When the Congress authorized construction of 8.8 million SWU of additional enrichment capacity in December 1975, U.S. enrichment capacity was fully contracted for. However, the slowdown in the growth of nuclear power and the emergence of foreign enrichment capabilities has resulted in DOE operating its existing enrichment complex at about 40 percent of full capacity. DOE projects a substantial increase in future demand for enrichment services and believes that the 2.2 million SWU increment is justified on the basis of both demand and cost savings.

Before we address the two components of DOE's justification, we want to emphasize that the primary reason we are questioning the wisdom of continuing with the scheduled first increment of centrifuge capacity is because Advanced Isotope Separation (AIS) enrichment technologies are on the horizon. The energy savings associated with AIS technologies are anticipated to be comparable to the centrifuge technology; however, AIS technologies offer the additional potential of (1) lowering the costs for enriching uranium and (2) being able to stretch out uranium resources by producing more enriched uranium from a given amount of feed. Although AIS technologies are still under development, DOE's current plans call for a first production plant to begin operation by the end of fiscal year 1993.

While 1993 represents a slight slippage in the 1989 date that the centrifuge addition is scheduled to begin operation, DOE has several options it can take to maximize production from its existing facilities and thereby minimize any adverse impact of the delay. Once again, our disagreement with DOE is not over the ultimate need for additional U.S. enrichment capacity but over the option of delaying the centrifuge construction program until more is known about the feasibility of using AIS technologies to produce enriched uranium.

With regard to DOE's argument that the first increment of centrifuge enrichment capacity is fully needed to meet demand, we offer the following observations.

--DOE states that current enrichment contracts support 304 gigawatts of electric power which substantially exceeds the production of its gaseous diffusion plants. However, DOE assumes that approximately 50 of the 304 GWe will be canceled including 15 GWe of foreign contracts. While the remaining contract demand still would exceed DOE's capacity, contract demand has historically exceeded capacity as demonstrated by the fact that DOE operates its enrichment plants at a level designed to meet forecast demand, not contract demand. 1/ DOE's forecast demand for 1990 is 197 GWe which can easily be satisfied by its existing gaseous diffusion capacity of 210 GWe.

1/Contract demand represents the enrichment services DOE has contracted to supply. In 1978 DOE started operating its facility to meet forecast demand. DOE's forecast demand is based on a realistic assessment of its customers fuel needs, computed on a reactor-by-reactor analysis.

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--DOE's current forecast for 1995 calls for 260 GWe, which exceeds its capacity. However, DOE's forecasts have tended to be overly optimistic in the past, necessitating substantial downward revisions as the forecast date neared. For example, when the Congress authorized the construction of additional enrichment capacity in December 1975, DOE's projected 1980 demand for enrichment services was 26 million SWU--this contrasts with actual 1980 demand of about 11.2 million SWU. DOE's 1990 demand projections have already decreased from 39.2 million SWU forecasted in April 1978 to 26.8 million SWU forecasted in June 1980.

--If DOE's 1995 forecast demand should materialize, DOE has alternative options it could take to meet such demand without constructing additional capacity. One option available to DOE is to pre-produce SWU during the 1980s when DOE's forecasts indicate demand will be less than capacity and then draw down the resulting stockpile to meet demand in the 1990 to 1995 time frame. For example, DOE currently has the capacity to produce over 25 million SWU annually and only plans to produce 9.5 and 9.3 million SWU annually in 1980 and 1981, respectively.

DOE does not think that pre-producing SWU would be a cost-effective option. DOE states that it conducted extensive economic evaluations to determine the most cost-effective means of balancing production with the projected decrease in demand through 1995 and concluded that it is economically desirable to operate the diffusion plants at reduced levels and construct additional centrifuge capacity. However, DOE's economic evaluations appear to be seriously flawed because they are based on the reduced cost per SWU expected from the completed 8.8 million SWU centrifuge facility, not the cost of SWU produced by the initial 2.2 million SWU increment. The difference in cost per SWU is significant--approximately $75 from the 8.8 million SWU facility as contrasted with approximately $119 from the 2.2 million SWU increment. The cost per SWU from the existing diffusion plants is approximately $100.

DOE states that installation of additional increments beyond the initial 2.2 million SWU will only be constructed to meet demand indicating that, at this point in time, such construction is uncertain. Yet its economic evaluation supporting the construction of the initial 2.2 million SWU increment is based on construction of the entire 8.8 million SWU centrifuge enrichment plant. It therefore appears that DOE is making an inconsistent and improper evaluation by using the economic advantages of the 8.8 million SWU centrifuge plant to justify the initial 2.2 million SWU increment of centrifuge capacity.

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In summary, we believe DOE needs to fully and objectively examine and present to the Congress the benefits and costs of delaying construction of the first increment of new centrifuge capacity until the AIS enrichment technologies are further developed.

DOE'S COMMENTS ON CONSTRUCTING THE CENTRIFUGE ADD-ON TO FURTHER U.S. NONPROLIFERATION OBJECTIVES

We do not agree with the conclusion of GAO that the construction of the centrifuge add-on is unlikely to further US nonproliferation objectives. Although there has been a downturn in the projected demand for enrichment services by other countries and an increase in planned foreign enrichment capacity, the US cannot improve its image as a reliable supplier or compete for new enrichment contracts in the international markets unless it is in a position to sell new enrichment services and is at least maintaining, if not improving, its ability to supply such services. Because of the technical and price advantages of US technology and the steps taken to improve the export licensing process, we will be able to compete effectively in the international market. Finally, it should be recognized that if the US failed to build new enrichment capacity and offer enrichment services on the international market, still other countries would have an increased incentive to acquire this sensitive technology themselves.

GAO EVALUATION

DOE's statement that additional enrichment capacity will improve the United States' image as a reliable supplier fails to recognize that foreign concerns over U.S. reliability are generally produced by delays and uncertainties in the export licensing and subsequent arrangement approval processes and do not involve enrichment capacity. Adequacy of U.S. enrichment capacity was a paramount foreign concern through the mid-1970s; however, the sluggish growth in nuclear power and the emergence of foreign enrichment facilities have created a "buyers market" for enrichment services and is expected to produce a worldwide glut in enrichment capacity in the mid-1980s. These factors along with the opportunity of foreign customers to diversify their sources of enrichment services have appeared to reduce concerns over the adequacy of U.S. enrichment capacity to an alltime low.

DOE's contention that additional U.S. capacity will diminish the incentive of other nations to acquire enrichment technology is difficult to refute or support. However, it is worth noting that certain nations, for example, Pakistan who is reportedly developing a clandestine centrifuge enrichment capability, are unlikely to be deterred by the construction of additional U.S. enrichment capacity. Further, it is questionable whether additional U.S. enrichment capacity could dissuade developed nations, Japan may be an example, from any immediate plans to build an enrichment facility.

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We, therefore, do not believe that DOE has done a convincing job of developing and supporting the position that additional U.S. enrichment capacity will deter the further spread of enrichment technology, but we recognize that a legitimate argument could be made that additional capacity, or even over-capacity, could be economically justified to promote U.S. non-proliferation policy. Accordingly, we have recommended that DOE address this issue in its justification for future budget requests for additional enrichment capacity.

DOE'S COMMENTS ON THE NEED FOR REDUCING THE UNCERTAINTY IN HOW U.S. REPROCESSING APPROVAL RIGHTS ARE EXERCISED

The GAO report discusses the need for reducing the uncertainty associated with the exercise of US consent rights on the reprocessing of US-supplied fuel. We agree that there is room for improvement here but we do not understand the GAO recommendation that DOE or the Executive Branch "should act on applications for reprocessing at the time such approval is requested by our trading partners." Under our present procedures, we act on applications on a case-by-case basis in accordance with Presidentially approved criteria. If the GAO believes that these criteria should be changed, it should specify in what way and provide its reasons for such changes.

GAO EVALUATION

A draft of this report included a proposal that the Secretary of Energy remove much of the uncertainty associated with the requirement for prior approval before U.S.-origin fuel can be reprocessed by (1) clarifying the circumstances when approval is required and (2) acting on applications for reprocessing at the time such approval is requested by our trading partners. We have deleted this proposal based on ACDA, DOE, and Department of State comments. These agencies apparently misunderstood the thrust of the proposal. Accordingly, we have revised our text to make clear that we believe executive branch policy in this regard needs to be changed, what should be changed, and that the Secretary of Energy should seek the necessary top-level policy approvals to accomplish the change. (See pages 61, 62, and 71.)

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DOE'S COMMENTS ON U.S. POLICY FOR APPROVING RETRANSFERS OF PREVIOUSLY EXPORTED NUCLEAR MATERIAL AND EQUIPMENT

The GAO discusses the issue of whether retransfer approval should be required in cases where the retransfer was foreseen in the original licenses (pp 89 and 90). This discussion should be revised to reflect the President's statement of February 27, 1980, on the reduction of export disincentives. That statement provides in part that "a separate retransfer authorization is no longer required in cases where the retransfer was foreseen and approved in the license issued by the Nuclear Regulatory Commission."

GAO EVALUATION

We have revised our report to reflect the President's statement that a separate retransfer authorization by DOE is no longer required when the retransfer was foreseen at the time NRC granted an export license. (See page 69.)

DOE COMMENTS ON "LOOPHOLES" IN ITS RULES CONTROLLING FOREIGN NUCLEAR ACTIVITIES OF U.S. FIRMS AND INDIVIDUALS

In Chapter 6 of its report, GAO concludes that "two loopholes exist in DOE's rules controlling foreign nuclear activities of US firms and individuals that could undermine the effectiveness of US efforts to control the spread of nuclear weapons." First, on page 98, the report notes that "by simply publishing the information anyone can circumvent the need for obtaining the Secretary of Energy authorization." The draft identified as a second loophole, "the lack of covenants governing the exports of nuclear manufacturing expertise and technology."

We suggest that the first "loophole" is not an inadvertent gap in a regulatory scheme, but rather a product of a carefully developed statutory framework which reflects basic values of a free society and does not attempt to cover all activities involving nuclear energy. Attempts to control publicly available information are not likely to be practical without fundamental changes in the open society established by the US Constitution. Any person, including a non-US person, has ready access to private, unclassified publications in our country. The NNPA's exclusion of publicly available information from the ambit of "Sensitive Nuclear Technology" recognizes this fact. DOE's regulations also provide a general authorization for activities which are "limited to the furnishing of information which is available to the public in published form." (10 CFR 810.7(b)(4)). We believe DOE regulations appropriately reflect the balance which Congress has struck between subjecting certain types of nuclear activities to controls and allowing publication and free exchange of certain types of scientific information.

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In almost all cases (the draft report notes only one exception and DOE knows of no other) the commercial interests of companies possessing valuable information will assure that export controls are not circumvented through this "loophole." Since companies attempt to maximize the value of their information, and since the commercial value is reduced, if not destroyed if the information is made available to the public, companies do not publicize their information simply to circumvent export controls.

In regard to the second "loophole," on pages 101-102 the draft report specifies the statutory conditions which are applicable to the export of reactors and notes that "no similar conditions are required on the technology for such reactors or reactor components." As GAO recognized in its report, civilian light water reactor technology has been widely disseminated for many years by the US and other countries through various commerical arrangements and international agreements. In recognition of this fact, the Congress did not establish statutory conditions (as it did for certain reactor components) for the transfer of such widely available technology. In contrast to its treatment of reactor technology, Congress established strict statutory conditions for the transfer of "Sensitive Nuclear Technology," a category of technology defined by the NNPA. As is recognized in the legislative history of the NNPA, reactor technology was not deemed sufficiently sensitive to be included within the category of Sensitive Nuclear Technology.1/ Thus, Congress chose not to apply the NNPA's strict export conditions to that technology. In our view, DOE's general authorization in Part 810 for the transfer of civilian light water reactor technology to the free world is consistent with the realities of controlling a widely available commodity. In sum, we submit that the NNPA's distinctions between controls on nuclear materials, components, "Sensitive Nuclear Technology" and other nuclear technology are well founded and that an effort to create identical or nearly identical controls would be ill-advised.

GAO EVALUATION

DOE's comments regarding the first loophole seriously distorts our report. Our discussion of this loophole referred to activities of U.S. firms or individuals involving the transfer of unclassified information regarding reprocessing and enrichment, not "all activities involving nuclear energy." (See pages 78 to 80.)

1/ Senate Report No. 95-467 on S.897, p.16.

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In our view, DOE's comments on the lack of controls over publicly available information relfect the practical difficulty DOE can have in implementing the executive branch policy of not providing significant assistance to foreign reprocessing or enrichment facilities. Because this policy lacks a statutory basis, in the case we cited in chapter 5 (see page 78), DOE had no leqal means to prevent the transfer of reprocessing information the executive branch believed was inconsistent with the policy.

We do not share DOE's confidence that "...the commercial interests of companies possessing valuable information will assure that export controls are not circumvented through this 'loophole'." It didn't in the case we cited, and although we do not know of other cases, DOE's assurances don't convince us that this loophole is not a serious concern. A Washington, D.C., law firm, in advising the company involved in this case how to qualify for a general authorization under DOE's publicly available rule (i.e., send the information without any restrictions to DOE and wait a week or so), stated that, "It is our understanding that other firms have followed a similar course without difficulty."

In regard to the second loophole, DOE's comments fail to address our major concern. As noted on page 81, we are concerned that some countries might unconditionally purchase reactor manufacturing technology from the United States under DOE rules as a way of circumventing NNPA conditions or prohibitions over exports of nuclear materials and equipment. DOE's comments do nothing to alleviate our concern. We note that ACDA in commenting on our report shares our concern over the lack of specific criteria for the export of reactor technology.

Further, we do not accept as a "fact" that the 95th Congress did not establish statutory conditions for the transfer of reactor technology because such technology is so widely avaialble. In our opinion, DOE's citation to the legislative history of the NNPA does not support this view. In amending section 57b of the Atomic Energy Act, however, the 95th Congress did direct DOE "...to establish quickly any necessary standards and criteria, including the nature of any required assurances or evidentiary showings..." for any person to engage in the production of any special nuclear material outside the United States, including the transfer of reactor technology. Thus, the 95th Congress recognized that a need for more specific controls over reactor technology might be needed and gave DOE the authority to adopt such controls.

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DOE COMMENTS ON THE NEED FOR A COMPREHENSIVE REASSESSMENT OF THE CONTROLS IT EXERCISES OVER U.S. ACTIVITIES IN FOREIGN NUCLEAR PROGRAMS

GAO recommends "a comprehensive reassessment of the controls DOE administers over nuclear technology exports." We note, however, that Congress had occasion to assess these very matters during its consideration of the Nuclear Non-Proliferation Act of 1978. In particular, the two sections of the Atomic Energy Act which GAO characterizes as creating damaging loopholes were established by the NNPA (in the case of "Sensitive Nuclear Technology") or amended by that Act (section 57b of the Atomic Energy Act). Moreover, GAO'S report gives only limited attention to the fundamental question of whether a new approach to controlling nuclear technology transfer would be consistent with the overall goals of the NNPA. Any reassessment should give considerable weight to the desirability of further changes in our export control regime only 3 years after the NNPA's major revisions of the Atomic Energy Act.

GAO EVALUATION

Based on our review, we concluded that a comprehensive reassessment is needed of the controls DOE administers over nuclear technology exports and all other unclassified U.S. activities in foreign nuclear programs (see page 87). We did not call for a "new approach to controlling nuclear technology transfers." Specifically, we suggested that the Secretary of Energy take the lead in coordinating a comprehensive interagency reassessment of controls over unclassified U.S. activities in foreign nuclear programs which should focus on ways to

--reduce opportunities for controls to be circumvented.

--better harmonize the controls the Department of Energy administers with the controls the Department of Commerce and the Nuclear Regulatory Commission administer in the nuclear field, and

--reduce confusion over Government decisions by establishing (1) more specific review and approval criteria and (2) administrative procedures which permit greater public accountability.

Further, we suggested that the Secretary of Energy provide for full NRC participation in the reassessment.

We believe that any changes in our export control regime resulting from this reassessment should be consistent with the overall goals of the NNPA, particularly section 3(d) which

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establishes as a goal "...effective controls by the United States over its exports of nuclear materials and equipment and of technology." In our opinion, the effectiveness of such controls are limited by the two loopholes in DOE's rules controlling foreign nuclear activities of U.S. firms and individuals that we discuss on pages 78 to 81. Whether or not these loopholes were established by the NNPA as DOE contends (a debatable point in our view), we are troubled about DOE's apparent unwillingness to acknowledge that there is even a cause for concern.

DOE COMMENTS ON THE CONVENANTS APPLICABLE TO THE EXPORT OF REACTOR TECHNOLOGY TO COMMUNIST COUNTRIES

With regard to the export of reactor technology to communist countries, the report states that although a specific authorization is required for the export of such technology "there is no requirement that the authorization include the covenants that apply to reactor component exports." The 810 criteria are broad enough to include all the "covenants" that apply to reactor component exports, yet flexible enough to choose the appropriate "covenant" depending on the nature of the export, its significance, the end-user, the end-use and other factors.

GAO EVALUATION

We have revised our report presentation to acknowledge DOE's comment. (See p. 81.) Time did not allow us to conduct a detailed evaluation of how DOE in practice applies covenants to exports of reactor technology to communist countries.

DOE COMMENTS ON THE LACK OF CRITERIA GOVERNING SPECIFIC AUTHORIZATIONS BY THE SECRETARY OF ENERGY

The GAO report further contends that once DOE reaches a decision on the applicability of Part 810 it lacks clearly defined "criteria" to use in reaching a decision on whether or not the activity should be authorized. The report further states with regard to Part 810 criteria that "unlike the statutory criteria governing the licensing of nuclear exports over which NRC has authority, they are not determinative; that is, they do not have to be met before approval can be granted." We find a significant difference between components licensed by the NRC and the numerous and varied activities that could be associated with those components. For example, an activity that constitutes indirectly engaging in the production of special nuclear material (SNM) may be determined upon review to be of little significance from a nuclear nonproliferation standpoint, and in some cases similar assistance may be readily available from foreign sources.

APPENDIX III

It would be inappropriate and possibly even detrimental to US nuclear non-proliferation policy to require that specific criteria be met regardless of the significance of the activity. DOE, in concert with the other Executive Branch agencies, must evaluate each 10 CFR 810 request in the light of overall US non-proliferation policy. A basic policy requirement in each case is a consideration by the Secretary of DOE of the factors contained in 10 CFR Part 810.8. Key considerations are the countries involved and US policy objectives. As an ultimate consideration, DOE considers whether such activity is inimical to the interest of the United States. The Secretary's determination is concurred in by the State Department, and views of DOD, Commerce, NRC, and ACDA are obtained by the DOE. In cases where agencies disagree on the disposition of a request, the matter is referred to the National Security Council. In appropriate cases, the National Security Council refers the ultimate decision to the President.

In sum, US action on requests for authorization pursuant to Part 810 is very much a part of the "delicate balance" of incentives and controls necessary to obtain US objectives. In our view, development of rigid criteria and procedures for such exports is simply not in the interest of sound decisionmaking in the area of US foreign policy. Given the highly individual circumstances of these requests, substantive criteria going beyond the policies stated above would be undesirable. Our present procedures are in our judgment sufficient to ensure that Part 810 requests are reviewed in an orderly fashion with consideration of all relevant factors including regulatory and foreign policy considerations.

GAO EVALUATION

We believe the development of specific criteria to govern both general and specific authorizations by the Secretary of Energy is in the interest of sound decisionmaking. Otherwise, opportunities for arbitrary decisions, in our opinion, are too great. Moreover, we believe that specific criteria should be based on the significance of the activity; not regardless of its significance as DOE states.

We recognize that the significance of the activities U.S. firms and individuals DOE attempts to control under its rules vary widely. (See page 77.) Nevertheless, as noted on page 81 of our report, DOE has considered the transfer of some reactor manufacturing technology more sensitive than the export of nuclear equipment and materials, which are subject to NRC authorization. Because countries can and have unconditionally purchased reactor manufacturing technology from the United States under DOE rules, DOE's comments do little to provide assurances that countries won't purchase reactor manufacturing technology from the United States as a way of circumventing NNPA conditions over nuclear equipment or materials.

APPENDIX III

Our report clearly recognizes the factors DOE considers in determining whether an activity will be inimical to the interest of the United States and the roles of executive branch agencies in the decisionmaking process (see pages 82 and 83). The roles of the National Security Council and the President are less clear. Whereas DOE notes that in appropriate cases the President may make the "ultimate decision," DOE officials told us during our review that the ultimate decision regarding specific authorizations can only be made by the Secretary of Energy under sections 161 (n) and 57(b) of the Atomic Energy Act.

DOE COMMENTS ON PUBLIC OPPORTUNITIES TO REVIEW THE BASIS OF SECRETARY OF ENERGY DECISIONS

The GAO further states that "we would be less concerned about this issue (lack of criteria) if the public had routine opportunities to review the basis of executive decisions in this area. But they do not. There is no requirement for DOE to make public the basis for its decisions." As the GAO correctly recognizes, the Administrative Procedure Act (5 U.S.C. 552, et seq.) exempts from rulemaking and adjudicatory requirements activities relating to "military and foreign affairs function." However, DOE has generally provided the public with an opportunity to review and comment on proposed revisions to 10 CFR Part 810. With respect to Executive Branch actions on specific export applications, much of the material underlying final decisions would be unavailable to the public. Furthermore, the factors which underlie DOE's decision and that of other agencies may involve classified information or sensitive foreign policy considerations, which could not be made available for public discussion. We find it significant that in amending section 57b of the Atomic Energy Act, the Congress in 1978 established detailed procedures which do not include provisions for public participation.

GAO EVALUATION

The lack of statutory provisions in the Atomic Energy Act providing the public opporutnities to review and question the basis of executive branch decisions in this area does not preclude DOE from establishing regulatory procedures. NRC had established such regulatory procedures before the NNPA codified them.

As stated on page 84 of the report, we recognize that in certain cases it may be inappropriate for DOE to make public all information relating to Government decisions in this area because proprietory information, classified information, or sensitive foreign policy concerns may be involved. Nevertheless, NRC has established procedures for public scrutiny of Government nuclear export decisions, and we believe, with the effort, so can DOE.

APPENDIX III

DOE COMMENTS ON OVERLAPPING REGULATORY JURISDICTION

The GAO comments on "overlapping jurisdiction between the Departments of Energy and Commerce" stating that "...this overlapping jurisdiction has resulted in unwarranted duplication of effort and confusion among exporters" and "In particular, the additional time and expense to obtain approval from two Government agencies is resented by all involved parties." The GAO report fails to recognize the important fact that the Department of Energy reviews approximately 20 to 25 requests for authorization under Part 810 per year while the Department of Commerce processes over 70,000 export license applications. Therefore, while some delay may result from dual processing by these agencies, we believe the magnitude of the problem does not deserve the attention devoted to it in the GAO report. However, the Departments of Commerce and Energy have been and will continue to address the existing regulatory overlap in an attempt to establish guidelines to ensure that license processing delays are minimized while ensuring proper and thorough review of export requests which could pose a proliferation threat.

GAO EVALUATION

The attention we devote to this jurisdictional problem arises due to its complexity. Although the problem is not as significant as others we discuss, we believe the Secretary of Energy should address it in the context of the reassessment we recommend.

ADDITIONAL DOE COMMENTS

Comments of an editorial nature have been provided directly to members of your staff. We appreciate the opportunity to comment on this draft report and trust you will consider our comments in preparing the final report.

Sincerely,

P. Marshall Ryan
Acting Controller

GAO NOTE: Subcaptions provided by GAO. DOE's additional comments were incorporated in the report where appropriate and when time permitted adequate verification.

APPENDIX IV

DEPARTMENT OF STATE
Comptroller
Washington, D.C. 20520

August 8, 1980

Mr. J. Kenneth Fasick
Director
International Division
U.S. General Accounting Office
Washington, D.C.

Dear Mr. Fasick:

I am replying to your letter of July 11, 1980, which forwarded copies of the draft report: "An Evaluation of Selected Features of U.S. Non-Proliferation Law and Policy".

The enclosed comments on this report were prepared by the Assistant Secretary for the Bureau of Oceans and International Environmental and Scientific Affairs.

We appreciate having had the opportunity to comment on the draft report. If I may be of further assistance, I trust you will let me know.

Sincerely,

Roger B. Feldman

Roger B. Feldman

Enclosure:
As Stated

GAO Draft Report: "An Evaluation of Selected Features of U.S. Nuclear Non-proliferation Law and Policy"

P. IX (Digest)	First paragraph. The Government does not review the proliferation risks of most nuclear exports. We believe the following suggested language more accurately describes the review process, and could be used as a replacement for the entire first paragraph. "Concerning a proposed export of nuclear material, equipment, or technology, the Executive Branch undertakes a review to determine whether the export would be subject to the export criteria contained in the Atomic Energy Act as amended by the Nuclear Non-Proliferation Act of 1978. If the Executive Branch determines that these criteria have been satisfied and that the export is not inimical to the common defense and security of the United States, then it must be approved by the Nuclear Regulatory Commission before an export license can be issued."
P. IX (Digest)	Second paragraph. In most cases, it is not a question of export licensing delays (although this perception is widespread). The real problem which causes delays relates to "subsequent arrangements."
P. X (Digest)	First tic. Item (1). The law says that approval is necessary in all cases. Item (2). The point is not entirely clear. Does this mean "immediate approval"? Second tic. We do not believe that authorizing highly enriched uranium for export pending the commercial availability of low enriched fuel is a major problem. (See comments below for p. 95 on same subject.)
P. X (Digest)	Last paragraph, first line. Insert "technology" after "equipment".

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P. 4	Last paragraph, item (1). You might want to spell out under political self-interest or motivation the thought that whether a nation has a percieved security threat is a major consideration in a decision to turn the nuclear weapon development.
Pp. 5,6	Bottom of p. 5 and top of 6. As stated, the implication is that agreements for research and for power are separate entities. In fact, in most cases research and power are covered under the same agreement (up to 40 years). Only in a few cases are there separate research agreements.
P. 6	First full para, last line. With respect to U.S. civil agreements it is essential to give a time frame, because the content of the agreements changes greatly from one time period to another. Does this refer to agreements in the 1960's, agreements written in the 1970's, all agreements prior to the NNPA or what?
P. 6	Tic at bottom of page, item (1) should include the thought that all agreements also include provision that material cannot be used for any explosive device (to cover PNE's). Item (2). After "available" insert "and, in most cases, material produced from supplied material"... . (Note: in some of our new agreements we are inserting the phrase "material produced from material and equipment.") Item (3). Safeguards are to be maintained on what?
P. 7	Second tic. This provision applies only in certain old agreements.
P. 8	First line. The phrase "were added to agreements" should be changed to "were added to all agreements".

P. 9 — First full paragraph. The NPT does not provide for international inspection of all peaceful programs. The NPT provides this only for non-nuclear weapons states.

P. 12 — Second full sentence. Not entirely true that breeder reactor program was reoriented to a more more broadly based assessment of technologies and fuel cycles... etc. Although the policy shifted from early deployment of the breeder and NASAP was launched, the overwhelming emphasis in terms of budgetary outlays was on R&D for the LMFBR.

P. 13 — First paragraph. Enactment of NNPA was not controversial domestically. It was passed almost unanimously by both houses of Congress. It would be more accurate to say that its enactment was controversial abroad.

P. 18 — Last sentence. Don't agree with the proposition that predicting uranium supply is difficult because only a few nations prospect for it and only in a few regions. That factor should facilitate supply projections. To the extent that it is difficult to predict uranium supply, the difficulty probably arises from the fact that it is not always easy to read producers' expectations as to demand and response to market conditions and outlook.

P. 24 — It is important to include in the discussion of thermal recycle the fact that economics does not argue in favor of thermal recycle. INFCE Final Reports for WG 4 makes this point rather clearly.

P. 38 — Do the 71% and 43% figures include U.S. domestic consumption, or do they refer only to non-U.S. requirements?

P. 39 — EURODIF consortium members try to sell excess SWUs on the open market, but reports indicate that there has been little success.

P. 40	URENCO plant in FRG almost definitely will not be started in 1980; outlook is cloudy.
P. 40	Australia is also discussing, on a very preliminary basis, joint enrichment possibilities with the U.S.
P. 48	First full paragraph jumps to the conclusion too rapidly that GCEP might not even be needed. Although report states elsewhere that economics might suggest phasing out diffusion and phasing in centrifuge, that thought is missing here and should be incorporated for perspective. Also, last sentence in that paragraph should contain appropriate caveats along the lines that we don't really know for sure about the technical and commercial feasibility of new technologies, and of their timing.
P. 50	Last paragraph - suggests that there is more flexibility on timing for constructing GCEP than there actually is. If GCEP is delayed another year or so, the contractors that are now waiting in a holding pattern probably can't hold out much longer and their "readiness to build" will dissipate. The costs of starting over, something like from scratch, in the late 1980's, should be carefully calculated before the statement that there is a lot of flexibility can be justified. (n.b. p. 54 notes that GAO has not revaluated DOE's claims on need for GCEP. This should be done before GAO asserts that there is a lot of flexibility as to timing, etc.)
P. 60	First line. Should "six" be changed to "five" (State, DOE, DOD, ACDA, Commerce. The question is whether NRC should be included in this list.)
P. 60	First paragraph, line 4. Suggest you change "certain" to "other". Lines 5 and 6. Delete "regarding the supply or use of the exports".

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P. 61	The question of whether reviews by the NRC and by the rest of the Executive Branch represents "double jeopardy" (i.e. two reviews instead of one) should be added to the list at top of page. It is a matter of concern which should be addressed by agencies.
P. 63	Table at top of page. It is not clear whether the delays in the tabulation are caused by NRC alone or by the Executive Branch as a whole.
P. 64	The fact that applications for export licenses are sometimes delayed because they come in well in advance of need should be factored in. (By "in advance of need" we mean current inventory and annual useage, particularly for HEU.)
P. 68-9	Second line from bottom of p. 68, starting with "Executive Branch..." through "delays." on second line of p. 69. We suggest you delete these sentences and use the following language instead: The longest part of the Executive Branch consideration of these cases involves preparation and review of the technical and economic justification of continued supply of highly enriched uranium to a particular research reactor. Inventory of unused highly enriched fuel is weighed against rate of use and amount requested. Interagency clearance of the submission memorandum to the President can be delayed if any of the cases included for review are deemed sensitive. the technical/economic analysis carried out by DOE.
P. 70	After third tic, add a new tic -- Exports of enriched uranium fuel to Spain have been delayed pending conclusion of agreement between Spain and the IAEA to bring all Spanish nuclear facilities under Agency Safeguards.

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P. 70 — Last tic. We propose the following language:

-- Exports to India have been delayed because of questions about the applicability of the full-scope safeguards condition in the NNPA, the Indian Government attitude toward non-proliferation issues, and more recently, the refusal of India to accept the condition.

P. 71 — First tic. It is confusing to mix up Executive Branch review with NRC internal review. These are two completely separate issues or categories of review.

P. 72 — Second tic. Sentence should make clear that one-time licensing of nuclear fuel reloads refers to power reactors only (not research reactors).

P. 73 — Third paragraph, first sentence. We suggest the sentence be reworded as follows:

Exports to the nine-member countries of EURATOM were disrupted shortly after enactment of the NNPA because the US-EURATOM Agreement for Cooperation, as amended, did not provide the United States retransfer and reprocessing approval rights. 1/

P. 78 — INFCE studies are completed. Language should be updated to reflect this.

P. 80 — First paragraph, second and third sentences. We suggest these sentences read as follows:

In September 1977, before NNPA passage, the United States approved the reprocessing of 99 tons of spent fuel over a two-year period in the Japanese prototype reprocessing facility at Tokai Mura. Subject to certain restrictions and understandings, the approval has been extended for an additional year or until 1981.

Pp. 81-2	The recommendations on these two pages do not appear to be entirely consistent. On p. 81, the report appears to recommend that the U.S. tell its trading partners in advance what use they can make of U.S.-origin equipment or fuel. But on p. 82, report says U.S. should stick to case-by-case approach.
P. 83	Second full paragraph. Suggest you cite Presidential Document.
P. 83	Second tic at bottom of page. Suggest you add a footnote as follows: ** The current practice is 15 effective Kg.
P. 84	Second paragraph. The Administration's request for Reduced Enrichment for Research and Test Reactors program for FY 81 is $3 million instead of $5 million. The program will consequently be slowed down.
P. 84	Third paragraph. Cite the INFCE Study.
P. 86	First paragraph, last sentence. We suggest you change the working as follows: According to a State Department official, the Department for administrative reasons had preferred to send export requests to the President in batches, but in the future will forward such cases individually as they occur.
P. 86	Second paragraph, second sentence. We suggest you change the wording as follows: The delays, caused primarily by Government review of the actual requirement for highly enriched uranium for foreign research reactors have, indeed, been Long and persistent.
P. 87	Bottom paragraph, first sentence. We suggest you change the wording as follows:

P. 87

Although we strongly endorse the Administration's policy to reduce the enrichment levels of highly enriched uranium exports, we believe the Executive Branch should decide before export license applications are submitted which foreign research reactors merit continued supply of highly enriched uranium the quantity to meet fuel fabrication schedules and legitimate reactor needs and the level of enrichment.

The meaning of the last sentence on the page is not clear.

P. 89

Last paragraph. Delete entirely. Information is now overtaken by events. Suggest you substitute this paragraph and all of p. 90 with following paragraph:

In recognition of the above concern, DOE with the concurrence of the Departments of State, Commerce, Defense and ACDA is prepared to permit retransfers without an application or formal USG approval of nuclear material and equipment if authorized in the NRC export license for periods beyond one year, provided that the retransfer occurs within the period of validity of the export license. However, in order for this elimination of double control to take place, the Procedures Established Pursuant to the Nuclear Non-Proliferation Act of 1978, published in the Federal Register, June 9, 1978, need to be revised.

P. 93

First tic. By law (NNPA) U.S. must have reprocessing approval rights. It is in the area of how these rights are exercised that the Secretary of State has discretion.

P. 93

Second tic. We do not believe that the situation with respect to HEU exports is nearly as an important matter to foreigners as is the reprocessing approval issue and wonder whether it deserves equally "up front" treatment as a policy issue for consideration by the Secretary of State. For countries that have existing contracts for HEU by and large we are

P. 93	honoring those contracts. As for new exports, we have made it clear that we will license HEU for reactors that are moving to LEU.
P. 94	We wonder whether the policy recommendation tracks with DOE responsibilities with respect to technical and economic analyses, etc.
P. 96	First full paragraph, last sentence. Is this a Department of Commerce responsibility, rather than DOE's? Suggest you add the following footnote at end of this sentence: * Many of these components not deemed by the NRC to be directly nuclear-reactor related were transferred back to Department of Commerce licensing authority by publication of the Revised Commodity Control List on June 25, 1980.
Appendix 1, P. 4	We suggest the diagram be changed as shown on xeroxed page attached.
Appendix 1, P. 5	First full paragraph, line 2. After the phrase "source material" insert "for nuclear end use"
Appendix 1, P. 5	Footnote 1. Check list of countries, Pakistan should be added, possibly also Brazil and Argentina.
Appendix 1, P. 8	We suggest that diagram be changed as shown on attached xeroxed page.
Appendix II, P. 4	Last paragraph, second sentence. It is not possible to generalize about the export conditions in this manner. The provisions of the Agreements vary widely.
Appendix II, P. 5	First full paragraph, first sentence. After "condition" insert "of export,". After "nuclear" insert "material, equipment, or technology" and delete all of second line through "source material". Same para line 4. After "statutory" delete "conditions" and insert "export criteria". Same para,

Appendix II, p. 5 line 7. After "exports which" delete "will" and insert "were not reasonably expected to occur before March 10, 1980".

GAO NOTE: Page numbers refer to the draft report. To the extent we were able to verify the factual accuracy of technical comments, we made the suggested clarifications and revisions. We also revised our report to make clearer the Department's position on certain matters.

APPENDIX V

UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY
Washington, D.C. 20451

GENERAL COUNSEL

August 13, 1980

Mr. J. K. Fasick, Director
U.S. General Accounting Office
International Division
Washington, D.C. 20548

Dear Mr. Fasick:

By letter of July 11, 1980, you requested comments on a draft GAO report to the Congress entitled "An Evaluation of Selected Features of U.S. Nuclear Non-Proliferation Law and Policy." Our general comments are contained in this letter, and our more specific comments are attached or are indicated on the enclosed copy of the draft.

Chapter 1 -- While there has been considerable emphasis placed on the "capabilities" aspect of non-proliferation over the past several years, this has not resulted in a shifting of US policy priorities away from those "political" instruments of non-proliferation (e.g., the NPT); nor has there been any change in US recognition that non-proliferation is first and foremost a problem that challenges us to deal with the motivations that propel nations toward acquiring a nuclear explosive capability.

Chapter 3 -- While the ability of the United States to exercise leverage through the supply of enrichment services will diminish over time, we remain committed to associating our LWR fuel supply policy with acceptable standards of non-proliferation behavior.

Chapter 5 -- We have provided substantial specific comments to suggest a more balanced approach, to clarify certain points and, in particular, to note recommendations which have been implemented.

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Chapter 6 -- We share GAO concern over the lack of specific criteria for the export of reactor technology, but also recognize that dealing with this issue would be complicated by existing commercial licensing arrangements that US vendors have in the LWR area.

If we can be of any further assistance in connection with this draft report, please contact Harry Marshall of my staff (632-1866) or Dean Rust in the Non-Proliferation Bureau (632-7905).

Sincerely,

Philip G. Schrag
Acting

Attachments:

As stated.

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CHAPTER 1

(p. 4) We are unaware of any interest in a national breeder program on the part of Belgium, the Netherlands, or Italy. Neither the UK, Japan, nor the FRG has yet to decide on commercialization of the breeder.

(p. 4) We would suggest that the factors which motivate nations to develop indigenous enrichment and reprocessing are more numerous and complex than portrayed.

(p. 4) We do not believe that US non-proliferation policy focusses heavily on capabilities at the expense of dealing with motivations. The Congress and the President have emphasized that the NPT is an essential element of US non-proliferation policy and a continuing and intensive effort to encourage additional adherents has seen the Treaty grow to 114 parties. The Treaty of Tlatelolco has been given fresh impetus over the past three years, principally through US efforts. The US has intensified its support for the IAEA in recognition of its central role in multilateral nuclear cooperation. A possible CTB treaty is viewed as directly contributing to US non-proliferation efforts. The US believes the SALT process is important to preventing horizontal proliferation by demonstrating nuclear weapon state compliance with Article VI of the NPT and as an admission that nuclear arms races are counterproductive to national security objectives. The US has continued to maintain strong alliance and security relationships, which also play a strong role in non-proliferation. In 1978, the US also expanded upon its policy of not using nuclear weapons against certain states.

(pp. 5-8) The discussion on "agreements for cooperation" should recognize developments of the past several years, including:

-- There are only one or two research agreements still in existence;

-- While many of the early research reactors used HEU, this is not the case today and many of those older reactors are being converted to the use of LEU;

-- Point (1) on page 6 should be footnoted to indicate that in new agreements this guarantee explicitly precludes use in any nuclear explosive device regardless of purpose. Further, the NPT precludes such use and through recent note exchanges with non-NPT parties

APPENDIX V

the US has confirmed with cooperating nations that the formulation used in the older agreements also precluded use in any nuclear explosive device.

-- Regarding the first tick on page 7: (a) not all of the older agreements had plutonium ceilings; (b) it should be noted that most new agreements will not have ceilings and that LEU ceilings in existing agreements with NPT parties have recently been lifted pursuant to a Congressional joint resolution; and (c) HEU export policy has been modified so that the criteria established in the older agreements are no longer relevant.

In general, the description of the provisions in the second, third, and fourth ticks on page 7 disserves the reader because there is no acknowledgement that these provisions are being upgraded in the renegotiation program pursuant to the NNPA. (Two amended agreements are in force; several other new agreements have been completed; and negotiations have been conducted to upgrade others.)

(p. 9) In listing "political" instruments designed to prevent proliferation, the report should acknowledge the Treaty of Tlatelolco. This treaty was a Latin American initiative, but one which the US has always strongly supported. Indeed, the US has ratified Protocol II and has signed Protocol I to the Treaty of Tlatelolco. We have appended to these comments a fact sheet on the treaty.

(p. 10) The increased emphasis on "capabilities" also stemmed from the increase in the price of oil and the growing interest in nuclear power by many countries. In addition, the advanced nuclear states were about to make substantial commitments to the use of plutonium in commercial applications. All of these factors contributed to an intensive look by the US at how the international community could continue to derive the benefits of the peaceful atom while minimizing proliferation risks. The US continued to place major emphasis on political instruments, but also had to address the serious issues raised by the possible widespread use of weapons-usable material in peaceful nuclear applications.

(p. 11) We would prefer that the statement attributed to ACDA be reworded as follows: "According to ACDA...of affairs, but it would be useful if certain ambiguities could be clarified and further effort expended on the specific lists of material and equipment which trigger the guidelines;

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and if the members of the Suppliers Group could move toward a common export standard that would require a recipient state to have all its nuclear activities under IAEA safeguards as a condition of any new supply commitment."

(p. 11) The discussion on the bottom of the page could acknowledge the statement by President Ford in October 1976 that was noteworthy because it raised the issue of the serious proliferation concerns associated with reprocessing and recycling of plutonium and modified US domestic nuclear policy accordingly.

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Chapter 3

There should be some mention of two positive aspects in connection with contracting for US enrichment services: (1) US prices continue to be far more attractive than West European suppliers and (2) the recent US offer of the adjustable fixed commitment contract has remedied the negative features of the contractual changes adopted in 1973.

Also the conclusion that "US reliance on its enrichment leverage as a non-proliferation tool is an outdated and unrealistic idea" should be placed in perspective. We recognize that for a variety of reasons the percentage of US enriched uranium that will fuel light water power reactors not in the US will decline over time. Thus, the extent to which the US will be able to use this supply relationship to influence the nuclear policies of other countries will correspondingly be reduced. However, regardless of what percentage of the LWR fueling market the US has at any one time, it is essential that this supply arrangement be related directly to the non-proliferation behavior of the recipient. That is what the NNPA meant when it stated that the US would be a reliable supplier to nations that adhere to effective non-proliferation policies (Section 3). In this sense, the provision of enrichment services is an integral tool to US non-proliferation policies. It is not a tool to be used capriciously, since LWR fueling is critical to the energy security of recipient countries. Certain minimum standards are required, however, the most essential being the statutory criteria of the NNPA.

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Chapter 4

(p.52) We suggest the last sentence be footnoted as follows:

> "Any consideration of proceeding with commercial application of advanced isotopic separation technologies must also take into account global non-proliferation considerations."

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CHAPTER 5

(p. 60) We suggest this introductory section needs a paragraph which puts the issue into perspective. The NNPA directs the US to be a reliable supplier to states "which adhere to effective non-proliferation policies" and to provide incentives to other nations to join in such international cooperative efforts and to ratify the NPT (NNPA - Section 3). Any evaluation of export licensing needs to determine whether this goal is being met. Thus, one needs to distinguish between timely licensing of exports to states with good non-proliferation credentials and cases that may require more extensive review since they concern states with less than excellent credentials. For example, any statistics which do not distinguish between the time it takes to license to NPT parties and the time it takes to license to non-parties like South Africa are inaccurate reflections of what the Act intended as the goal of being a reliable supplier.

(p. 62) Add the following sentences to the footnote: "It should be noted that NRC's reactor component licensing represents a large portion of US nuclear commerce and steps have been taken that will make such export activity routine to states with good non-proliferation credentials."

(p. 64, para 3) At present this section is somewhat misleading. The following sentences should be added: "It should be noted that many of these license applications are awaiting the required assurance letter and thus the applications themselves are technically incomplete; and other licenses included in these statistics are for exports to states which do not meet the necessary statutory criteria. In both such situations, these applications could be returned to the applicant thereby reducing the average review time substantially. However, in an attempt to assist exporters, the NRC and the Executive Branch have agreed to retain such license applications and act upon them immediately upon receipt of the necessary assurances rather than returning the application and requiring the exporter to resubmit the application at a later date."

(p. 67, last para) Revise the first sentence to read: "The primary reasons that the statutory time limits are not met are that the application filed is not complete and cannot be acted upon until the required assurance letter or other information has been provided, or that the recipient state does not meet the statutory conditions which allow the USG to approve such exports."

(p. 68) This section is very misleading as it characterizes cases where the Executive Branch is legally unable to act as Executive Branch delays and fails to recognize that the NRC could return many of these applications directly to the applicant. Instead, these applications are kept in the process so as to move them more quickly when the necessary statutory conditions are met. The following wording would be a more accurate portrayal of the first two situations:

> "-- Lack of appropriate nuclear cooperation agreements. For exports of nuclear reactors or special nuclear material the statute requires that a governmental nuclear cooperation agreement be in force. The NRC and the Executive Branch are unable to approve such license applications in cases where there is no agreement for cooperation or in cases where the applicable agreement needs to be supplemented with additional understandings.
>
> "-- Lack of recipient government assurances. A long-standing US export requirement is the 'authorized persons letter' from the recipient government stating that the proposed export will be subject to the terms and conditions of the applicable agreement for cooperation and that the proposed recipient is authorized to receive the proposed export. If such a letter is not received within fifty-five days after receipt by the Executive Branch, the license can be returned to the NRC as incomplete. It has been Executive Branch practice not to return the application, but to continue to hold the application pending receipt of such a letter. This gives the appearance that time limits are not being met when in reality the Executive Branch could return the application and the 'clock' would stop. Keeping the application in the Executive Branch generally speeds up the licensing process once the requisite assurance has been received."

As to the third point on HEU, delays are not caused by "executive branch indecision on which foreign research reactors to continue to supply." HEU applications are reviewed to determine the actual need for the material based upon supplied inventory data and licenses are timed so as not to allow accumulation of HEU on site abroad.

(p. 70) Substitute the following for the fourth tick:

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"-- Exports to Spain, Argentina and Brazil have been delayed as these countries move towards compliance with the full-scope safeguards condition in the NNPA.

"-- Exports to India were delayed as a result of a dispute between the NRC and the Executive Branch on the applicability of certain NNPA criteria."

(p. 72, last sentence) Add the following: (Since EURATOM does not at present meet all the licensing criteria established in Section 127 of the Atomic Energy Act, its multiple reload licenses are conditioned on either a successful renegotiation which places them in compliance with this section, or a continuation of a Presidential waiver of this requirement as provided for in the NNPA.)

(p. 73) The section on reprocessing and plutonium use is quite one-sided and does not recognize the US interests at stake. Thus, the section gives the impression that the US is capricously exercising its control rights with no policy direction, whereas in reality actions in this area are driven by US concern over the proliferation implications of widespread plutonium use and reprocessing capability.

Point (1) in the first paragraph and the subsequent paragraph are grossly misleading. The US has always had reprocessing consent rights (except for EURATOM, IAEA and Canada) in its agreements for cooperation over US-supplied fuel. The NNPA extended this to cover any non-US fuel which may be irradiated in US-supplied reactors. However, in practical terms this will not result in any new US controls, at least in the near term. The opposition (as indicated in the draft report) stems primarily from the change in US policy which began to question the wisdom of commercial reprocessing and plutonium use. Since the US was perceived as being more hostile to these activities, it was feared we would exercise our reprocessing consent rights more arbitrarily.

(p. 75) It should be footnoted that in the new enrichment contracts, customers will lose prepayments if they terminate, but will not be subject to penalty payments.

(p. 76) The first and second points are not major problems in our dealings with other states and are issues which are being addressed as we negotiate agreements for cooperation. In particular, the Executive Branch outlined its views on the "co-mingling" question in hearings last fall on the first such agreement to be completed (Australia). On "double-labelling" an arrangement has been worked out with Canada that is designed to facilitate the administration of controls in such situations.

APPENDIX V

(p. 76) The third point is very unclear as it concerns the exercise of US approvals over the retransfer of components and it is not clear how this relates to the previous discussion of reprocessing. Both because of the requirements of Section 109b. and the Suppliers and Zangger Guidelines, the conditions applied to the export of a reactor component are IAEA safeguards, no explosive use and no retransfer without US consent.

(p. 77) The paragraph in the middle of the page overstates the case for reprocessing.

(p. 79) The US has extended the original Tokai-Mura agreement since the NNPA entered into force.

(p. 82, last three sentences) There seems to be a misunderstanding about current practices for approval of reprocessing. The US reviews such requests on a case-by-case basis and since the NNPA has not denied any such requests. Aside from the Tokai Mura reprocessing, there have been no requests to reprocess material outside the two NWS operating commercial facilities, Britain and France. Thus, the statement that this would be a major departure from existing US practices is totally inaccurate.

(p. 86, para 2) This paragraph badly misinterprets US policy on HEU exports. USG officials meet frequently with European and Japanese officials to plan HEU deliveries. Submissions to the President attempt to take into account the need for a steady flow of material to the fabricators and the transportion available. It is US policy to provide material on an as needed basis on the basis of inventory data, and after a technical and economic review of the possibilities of reducing the enrichment level of the fuel used. To characterize this as government "indecision" as to which reactors merit continued supplies is not at all accurate. The Executive Branch fully recognizes that many reactors continue to merit HEU supplies and cannot be converted to lower enrichments for the near term. However, it is still necessary for the US to review carefully the inventory data to determine the amount needed and the time frame in which this material should be supplied.

(pp. 89 and 90) This entire section is inaccurate. On February 27, 1980, as part of the President's study on export disincentives, it was announced that "a separate retransfer authorization is no longer required in cases where the retransfer was foreseen and approved in the licenses issued by the Nuclear Regulatory Commission."

(p. 93) Issues raised in the first recommendation are being considered in the context of negotiating agreements for cooperation.

The second recommendation on HEU is one which the Executive Branch has under consideration. We anticipate progress on this problem in the near future.

(p. 94) The first recommendation seems to have no operational significance. The first part should be clear from the NNPA and the requirements in the applicable agreement for cooperation. (Perhaps what GAO really means here is the question of under what conditions would the Executive Branch give such approval.) As to the second part, it is US practice to act on approvals for reprocessing at the time such approval is requested by our trading partners, and since the enactment of the NNPA, the US has not denied any such requests.

As previously stated, the US has already removed the requirement for a separate retransfer authorization and thus has already implemented the second recommendation, and we suggest you obtain from DOE the procedures it now follows in this respect.

Chapter 6

(p.97) A new footnote "b" should be added on the provision of sensitive nuclear technology to state that "While export of these technologies is under DOE jurisdiction, consistent with the restraint provision in the Supplier Guidelines, it is generally United States policy not to export them."

(p.102) ACDA shares GAO concern that the lack of specific criteria for the transfer of reactor technology results in a situation where a recipient nation could evade US controls, and supports the suggestion that the Executive branch should examine this question. However, it must be acknowledged that dealing with this issue would be complicated by existing commercial licensing arrangements that US vendors have in the LWR area which would raise potential problems of equity.

(p.105) The last paragraph asserts that "the Executive Branch has not clearly defined criteria for deciding whether to approve or deny a specific authorization request." For the time being, this may be true from the standpoint that Part 810 regulations have not officially been made consistent with the NNPA (although the concerned agencies have been acting as though the criteria were in effect). However, DOE will soon publish its revised Part 810 provisions which take into account the criteria of Sections 127 and 128 for exports of sensitive nuclear technology.

(pp.108-111) There are some general inaccuracies in this section but we will leave it to the Department of Energy and Commerce to correct them.

Appendix II

(p.1) The word "unilateral" should be deleted as the export criteria, generally speaking, have already been accepted by most US trading partners. Further, it's a pejorative characterization of the right of a sovereign state to establish its own nuclear export policies.

(p.4) The NNPA provides for an Executive branch judgement which would require a consensus of the concerned agencies rather requiring only consultations.

(p.5) Replace "the safeguards system of the IAEA" with "IAEA Safeguards."

(p.6) Add a "note a" to indicate that in the case of new "agreements for cooperation" the export of source material for reactor fueling or for enrichment must be pursuant to such agreement.

(p.7) The first two paragraphs should be replaced by the following"

Subsequent arrangements mean "arrangements entered into by any agency or department of the United States Government with respect to cooperation with any nation or group of nations (but not purely private or domestic arrangements) involving --

> "(A) contracts for the furnis ing of nuclear materials or equipment;
>
> "(B) approvals for the transfer, for which prior approval is required under an agreement for cooperation, by a recipient of any source or special nuclear material, production or utilization facility, or nuclear technology;
>
> "(C) authorization for the distribution of nuclear materials and equipment pursuant to this Act which is not subject to the procedures set forth in Section 111 b., section 126, or section 109 b.;
>
> "(D) arrangements for physical security;
>
> "(E) arrangements for the storage or disposition of irradiated fuel elements;

APPENDIX V

"(F) arrangements for the application of safeguards with respect to nuclear materials or equipment; or

"(G) any other arrangement which the President finds to be important from the standpoint of preventing proliferation."

GAO NOTE: Page numbers refer to the draft report. To the extent we were able to verify the factual accuracy of technical comments, we made the suggested clarifications and revisions. We also revised our report to make clearer the ACDA's position on certain matters.

APPENDIX VI

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 8, 1980

Mr. James Howard
Associate Director
U.S. General Accounting Office
Washington, D.C.

Dear Mr. Howard:

Enclosed are NRC's comments on your draft report entitled, "An Evaluation of Selected Features of U.S. Nuclear Non-Proliferation Law and Policy."

Sincerely,

for James J. Cummings, Director
Office of Inspector and Auditor

Enclosure:
NRC comments

APPENDIX VI

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 8 1980

Mr. J. Dexter Peach
Director, Energy and Minerals Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Peach:

We have reviewed the draft GAO report entitled "An Evaluation of Selected Features of U. S. Nuclear Non-Proliferation Law and Policy," and in general have no objections to its content and recommendations (no recommendations were directed to NRC). On July 25, NRC staff met with GAO staff and provided them with several technical comments and suggestions for improving the factual accuracy of the report. These comments were primarily with respect to Chapter 5 of the report, which dealt with export licensing procedures.

None of the staff's comments would entail any major restructuring or other significant change to the report, and GAO staff indicated it would not be necessary to provide them with detailed comments in writing with respect to these comments.

We note that Chapter 5 of the report was prepared after a series of meetings with NRC (primarily International Programs) staff, and that it generally presents an accurate picture of the export licensing process as far as NRC is concerned. We support fully GAO's recommendations in Chapter 5 to the Departments of State and Energy since the NRC would benefit from clarifications in the areas mentioned in performing its required consultative functions under the NNPA with the Executive Branch.

Sincerely,

for E. Devin Conell
William J. Dircks, Acting
Executive Director for Operations

APPENDIX VII

UNITED STATES DEPARTMENT OF COMMERCE
Office of Inspector General
Washington, D.C. 20230

AUG 29 1980

Mr. Henry Eschwege
Director, Community and
Economic Development Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Eschwege:

This is in reply to your letter of July 11, 1980 requesting comments on the draft report entitled "An Evaluation of Selected Features Of U.S. Nuclear Non-Proliferation Law And Policy."

We have reviewed the enclosed comments of the Under Secretary for International Trade and believe they are responsive to the matters discussed in the report.

Sincerely,

Mary P. Bass

Mary P. Bass
Inspector General

Enclosure

APPENDIX VII

UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary for International Trade
Washington, D.C. 20230

JUL 31 1980

Mr. Henry Eschwege, Director
Community and Economic Development Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Eschwege:

This is in response to your letter of July 11, 1980 to the Secretary asking for the comments of the Department of Commerce on the draft report to Congress entitled "An Evaluation of Selected Features of U.S. Nuclear Non-Proliferation Law and Policy."

Enclosed are our comments. Thank you for the opportunity to review the report.

Sincerely,

Robert E. Herzstein

Enclosure

APPENDIX VII

Department of Commerce Comments on GAO Draft Report: An Evaluation of Selected Features of U.S. Nuclear Non-Proliferation Law and Policy

The Department of Commerce (DOC) directed its attention to Chapters 5 and 6 of the report in light of its export licensing responsibilities under the Nuclear Non-Proliferation Act (NNPA) as well as the Export Administration Act of 1979.

Chapter 5 discusses the timeliness of the procedures for licensing exports under the jurisdiction of the Nuclear Regulatory Commission (NRC), a subject that is specifically treated in the NNPA. The discussion of the problems and the conclusions reached appear accurate, but we defer to the Secretary of State and the Secretary of Energy regarding the recommendations to them which appear in the chapter.

Chapter 6 discusses the Department of Energy's (DOE's) controls over various forms of U.S. assistance to foreign nuclear programs. This includes DOE's technology controls, or the lack of them, and the overlapping jurisdiction between DOE and DOC in the commodity export area. The report recommends that DOE coordinate a comprehensive interagency reassessment of the controls. We believe that such a reassessment would be useful and look forward to participating. However, we defer to the Secretary of Energy on the subject of DOE's own technology controls.

We are concerned that the report leaves the impression that DOC/DOE overlapping jurisdiction is a severe problem. We do not believe the problem to be severe. To date, there have been only a few applications where a jurisdictional overlap has occured. Annually, DOE receives only about 20 requests for rulings under its applicable regulations (10 CFR 810), and not all of these requests overlap our jurisdiction. Where duplicative jurisdiction exists, we intend to clarify the situation for exporters and, if at all possible, eliminate the duplication.

Since June 25, 1980, commodities under Commerce's jurisdiction that are specifically controlled for non-proliferation purposes have been identified as part of our Commodity Control List. We believe this is an important step in the implemention of Section 309(c) of the NNPA. Although inclusion of these items in the list has no effect on the DOE/DOC jurisdictional overlap, it provides a clearer indication of Commerce's nuclear non-proliferation controls and should eliminate some of the past confusion experienced by exporters.

The last paragraph on page 111 comments on "difficult control problems" with respect to commodities under a Commerce general license destined for a nuclear end use. When the exporter "knows or has reason to know" that an item will be used for certain very sensitive forms of nuclear activity, use of the general licence is invalidated. The control problem arises where the exporter does not know that a proposed export is intended for one of these activities or when the exporter deliberately attempts to conceal such an end use from us. As presently written, the paragraph leaves the impression that there is a flaw in the controls.

Indeed, while there may be flaws in the approach now taken, we believe that our controls represent the current best way to ensure review of sensitive nuclear export transactions. While our controls will not prevent an export where the exporter does not know the true intended end use or where the exporter is deliberating attempting to conceal the true end use from us, the controls notify industry of the U. S. Government's concern over such end uses and provide a basis for punitive action when a willful violation occurs. Moreover, they permit the review of export transactions involving commodities that cannot be placed under validated licensing because of their very broad multi-purpose nature. It is simply not feasible or desirable to review all exports to all determinations on the basis that they may be utilized for nuclear purposes. However, to improve the operation of the controls in question, Commerce is seeking ways to inform exporters of the countries or foreign entities that engage in one or more of the "sensitive" activities, There are security and diplomatic problems in so doing that have not been resolved.

We believe the report should be revised to reflect the above. Accordingly, the last two sentences of the first paragraph on page 109 should be revised to read:

> "As a result, the jurisdictional overlap arises when the form of assistance involves the export of commodities which are not licensed by NRC but by Commerce and have a nuclear end use. Examples of these so-called general purpose or dual-use commodities include certain types of computers, high speed cameras, heat exchangers, neutron generators and tunable diode lasers."

The last paragraph on page 109, the paragraph on page 110, and the first paragraph on page 111, should be revised to read:

> "Under the Export Administration Act of 1979 Commerce has export control authority over most commercially available commodities, including dual purpose commodities with nuclear end uses. All items under its jurisdiction require a license. However, many items are under "general license", which means that exporters may freely export the items without obtaining a specific authorization from Commerce. Other items require a "validated license" (a specific authorization) before they can

be exported. Validated licenses are required to implement various basic export control objectives, including the U. S. nuclear non-proliferation policy. This obligation is stated in Section 309(c) of the NNPA, which directs the institution of controls by Commerce over items which, if used for purposes other than those intended, could be of significance for nuclear explosive purposes.

"Commerce's export regulations contain a Commodity Control List that lists the items which require a validated license to certain destinations. As of June 25, 1980, the List specifically identifies the group of commodities being controlled for non-proliferation purposes. In addition, Commerce requires a validated license for exports of certain nuclear related technology to all destinations. However, technical data under its jurisidction may be exported under general license to free world countries.

"Commerce's regulations further indicate that its commodities may not be exported under a general license, regardless of the destination, when the exporter knows or has reason to know that the item is to be used for nulcear weapons or for use in "sensitive" nuclear facilities. Those "sensitive" uses include the chemical processing of special nuclear or source material, production of heavy water, separation of isotopes of source and special nuclear material (SNM), or fabrication of plutonium-bearing fuels.

"DOE has jurisdiction over the export of commodities that can be shipped under general licenses from Commerce when the commodity would directly or indirectly aid in the production of SNM in a communist country or is for use in any "sensitive" nuclear facility in any foreign country. Specific authorization from both agencies is required when (1) the commodity would directly or indirectly aid in the production of SNM in a communist country or is for use in a "sensitive" nuclear facility in any country, and (2) the commodity either falls in Commerce's validated license category or the exporter has submitted an application on the grounds he knows or has reason to know the item will be used for the "sensitive" nuclear facilities. In some instances Commerce may require a validated license for the export of certain nuclear related equipment on its Commodity Control List to all destinations, but the same equipment may be generally authorized by DOE rules for export to free world countries.

"DOE and Commerce officials acknowledge that this overlapping jurisdiction has occasionally resulted in duplication of effort and confusion among exporters. Time and expense to obtain approval from two Government agencies is counterproductive for all involved parties although the case volume is not large. Commerce and DOE officials recognize the problem and continue to work towards its resolution."

APPENDIX VII

Finally, the last paragraph on page 111 should be revised to read:

"It shold be recognized that controls over commodities which ordinarily could be exported under a general license but because they are destined for a nuclear end use require a validated license may not always prevent exports that the U. S. Government would wish to prevent. As indicated above, Commerce's rules provide for the revocation or invalidation of general licenses when the exporter knows or has reason to know that its exports will be used for nuclear weapons purposes or for the "sensitive" nuclear facilities. In such circumstances, the exporter is required to obtain a validated license and DOE, along with other agencies, would be consulted before authorization is granted. For these rules to be effective, exporters must be aware that their exports are destined for a sensitive nuclear end use. They do not always know the end use, however. For example, in 1978 it was revealed that Pakistan had purchased some items which could be exported under general license for use in an unsafeguarded enrichment facility but which were claimed to be for a non-nuclear end use. Subsequently, Commerce revised its Commodity Control List to require validated licenses for such items. This action was possible because the commodities could be fairly narrowly defined. This measure may not, however, always be feasible or desirable when the commodities are of a very general purpose, off-the-shelf nature.

"Commerce is seeking ways to inform exporters of the countries or foreign entities that engage in one or more of the "sensitive" activities, but there are security and diplomatic problems in so doing that have not been resolved. Meanwhile, existing controls offer a basis for punishment of willful violators. Moreover, Commerce and Energy believe that requiring a validated license serves a useful non-proliferation purpose by alerting exporters to governmental concern over assistance to nuclear weapons programs or the "sensitive" facilities."

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