

1981

Nuclear Power and Non-Proliferation: The View from Brazil

James P. Rowles

Follow this and additional works at: <https://scholarship.law.vanderbilt.edu/vjtl>



Part of the [Comparative and Foreign Law Commons](#), [Energy and Utilities Law Commons](#), and the [International Law Commons](#)

Recommended Citation

James P. Rowles, Nuclear Power and Non-Proliferation: The View from Brazil, 14 *Vanderbilt Law Review* 711 (2021)

Available at: <https://scholarship.law.vanderbilt.edu/vjtl/vol14/iss4/1>

This Article is brought to you for free and open access by Scholarship@Vanderbilt Law. It has been accepted for inclusion in Vanderbilt Journal of Transnational Law by an authorized editor of Scholarship@Vanderbilt Law. For more information, please contact mark.j.williams@vanderbilt.edu.

Vanderbilt Journal of Transnational Law

VOLUME 14

FALL 1981

NUMBER 4

NUCLEAR POWER AND NON-PROLIFERATION: THE VIEW FROM BRAZIL

*James P. Rowles**

This article contains a hypothetical memorandum written by a hypothetical Brazilian policymaker, together with a hypothetical draft Brazilian proposal for the establishment of an International Plutonium Storage regime. None of these materials should be interpreted as a statement of policy by any Brazilian official or by the Republic of Brazil.

TABLE OF CONTENTS

I. INTRODUCTION	712
A. <i>Responding to Non-Proliferation Pressures: Brazil's Options</i>	715
B. <i>The Present Non-Proliferation Regime</i>	716
C. <i>The Search for a New Consensus</i>	724
D. <i>The 1975 Agreement Between Brazil and the Federal Republic of Germany on Cooperation in the Peaceful Uses of Nuclear Energy</i>	726
II. THE HYPOTHETICAL MEMORANDUM	727
A. <i>Economic Development, National Security and Brazil's Future: The Framework for Decision</i>	727

* Associate Professor of Law, University of Alabama. A.B. 1967, J.D. 1972, J.S.M. 1976, Stanford University; S.J.D. Candidate, Harvard Law School (residency completed 1979).

The author would like to thank Abram Chayes for his generous assistance in the preparation of this article, and John R. Redick for his comments on an earlier draft of the same.

1.	Energy Independence: The Need for Nuclear Energy	729
2.	Technology Transfer	734
3.	Military Security	737
4.	Building a New International Order: International Relations Based on Non-Discrimination and Mutual Respect	743
5.	The Maintenance of Good Relations with Both Developing and Industrialized Nations	744
6.	Optimal Impact of Energy Choices on Brazil's Balance of Payments	747
7.	Non-Proliferation and Disarmament	748
B.	<i>Establishment of an International Depository for Separated Plutonium</i>	748
1.	National Interests: A Recapitulation	749
2.	Three Options	755
3.	Recommendation	758
4.	Hypothetical Draft Brazilian Proposal for the Establishment of an International Plutonium Depository	760
C.	<i>Full Entry into Force for Brazil of the Treaty of Tlatelolco</i>	769
1.	Benefits	771
2.	Disadvantages	776
3.	Exercising the Option	778
III.	CONCLUSION	779

I. INTRODUCTION

Despite indications that the Reagan Administration will accord a relatively low priority to the abatement of nuclear proliferation, events such as the apparent nuclear explosion in the South Atlantic on September 22, 1979,¹ Pakistan's program to develop enrichment and reprocessing facilities,² and the Israeli raid on the Iraqi reactor site³ demonstrate that the problem is not diminishing. Moreover, the inconclusive results of the International Nuclear

1. See, e.g., Betts, *A Diplomatic Bomb? South Africa's Nuclear Potential*, in NON-PROLIFERATION AND U.S. FOREIGN POLICY 283-84, 300-04 (J. Yager ed. 1980).

2. See, e.g., Betts, *India, Pakistan and Iran*, in NON-PROLIFERATION AND U.S. FOREIGN POLICY 102, 328 (J. Yager ed. 1980).

3. See N.Y. Times, June 9, 1981, at 1, col. 6.

Fuel Cycle Evaluation, presented at the Final Conference in February 1980,⁴ are likely to result in an acceleration in the development and spread of reprocessing and fast breeder reactor technologies. Sharply divergent views on proliferation issues also were revealed at the Non-Proliferation Treaty (NPT) Review Conference of 1980, which resulted in a total impasse.⁵ These differences of opinion are further complicated by the new round of vertical proliferation between the United States and the Soviet Union which seems imminent as a result of apparent breakdown in the Strategic Arms Limitations Talks (SALT).⁶ Such developments suggest that the existing non-proliferation regime may begin to unravel in the near future at an accelerating pace.

At such a juncture, it is of vital importance that we gain a fuller appreciation of the perspectives of potential nuclear powers such as Brazil. New efforts aimed at controlling nuclear proliferation must take into account the views of such nations in order to have any realistic chance of success. The principal goal of this article is to contribute to such understanding within a concrete policy context. This article consists primarily of a *hypothetical* review memorandum written for Brazilian President João Baptista Figueiredo by a *hypothetical* Brazilian policymaker offering advice on two issues of immediate concern to Brazil. The first involves proposals for the establishment, under International Atomic Energy Agency (IAEA) auspices, of an International Plutonium Storage (IPS) regime designed to prevent the stockpiling of plutonium by individual nations.⁷ The second issue involves the question of what action Brazil should take, if any, in order to strengthen the legal regime established by the Treaty for the Prohibition of Nuclear Weapons in Latin America, popularly known as the Treaty of Tlatelolco.⁸ Both issues are considered against the background of the increasing non-proliferation pressures which have been exercised against Brazil and other potential or "threshold" nuclear weapons states, and the need for Brazil to respond to such pressures in an optimal manner to secure its own

4. See notes 34-37 *infra* and accompanying text.

5. See note 113 *infra*.

6. Negotiations on theater nuclear forces in Europe likewise show little sign of progress. See generally U.S. ARMS CONTROL AND DISARMAMENT AGENCY, 1980 ANNUAL REPORT 97-114 (1981).

7. See notes 38-41 *infra* and accompanying text.

8. See note 18 *infra* and accompanying text.

national interests and foreign policy objectives.

The unorthodox format of this article has been adopted to convey the way in which nuclear power and non-proliferation issues are perceived through Brazilian eyes. This can best be achieved by placing the reader in the shoes of a hypothetical Brazilian policymaker. This approach should be highly useful, for a common shortcoming of United States officials and legislators in this area is their failure to recognize—on both cognitive and affective levels—that officials from countries such as Brazil may be proceeding both rationally and in good faith.

This Introduction discusses the background and general context within which the two issues addressed in the hypothetical Brazilian memorandum must be considered. In Part II(A),⁹ the memorandum sets forth the general perspective from which Brazilian policymakers are likely to view issues related to nuclear power and non-proliferation. This exposition should be particularly useful in view of the great reluctance to discuss issues of military security (including the potential nuclear rivalry with Argentina) that Brazilian officials have demonstrated in the past.¹⁰ In Part II(B),¹¹ the general Brazilian framework for decision is used to clarify the issues involved in the establishment of an international depositary for the storage and control of plutonium, and to analyze the desirability of such a depositary. A hypothetical draft Brazilian proposal for such a regime is presented. As an example of how Brazil and other developing countries could seek to link vertical and horizontal proliferation, the draft includes provisions aimed at reducing military stocks of plutonium held by nuclear weapons states. Part II(C)¹² examines the relevance of the Treaty of Tlatelolco to a Brazilian strategy for dealing with foreign—and perhaps even domestic—non-proliferation concerns, and highlights the strengths and weaknesses of that Treaty. Finally, the Conclusion¹³ returns to the perspective of this Introduction and attempts to objectively draw together some of the broader implications which arise from consideration of the hypo-

9. See notes 45-134 *infra* and accompanying text.

10. See generally Courtney, *Brazil and Argentina: Friendly Choices for Friendly Rivals*, in *NON-PROLIFERATION AND U.S. FOREIGN POLICY* 264, 269 (J. Yager ed. 1980) [hereinafter cited as Courtney].

11. See notes 140-91 *infra* and accompanying text.

12. See notes 192-241 *infra* and accompanying text.

13. See note 242-55 *infra* and accompanying text.

thetical Brazilian memorandum. In addition to providing insight into Brazilian views, the present article should contribute to a greater understanding of the potential defects to be avoided in designing an IPS scheme, as well as the strengths and weaknesses of the Tlatelolco regime.

A. *Responding to Non-Proliferation Pressures: Brazil's Options*

The hypothetical Brazilian review memorandum which follows is limited to a consideration of two Brazilian policy options: support for the establishment of an International Plutonium Storage regime and full ratification (*i.e.*, waiver of the unanimous ratification requirements) of the Treaty of Tlatelolco. There are, however, four other options which Brazil theoretically might consider in responding to non-proliferation concerns.

The ratification of the Non-Proliferation Treaty represents one possible option. At this juncture, however, it is extremely unlikely that Brazil would seriously consider the NPT option. Historically opposing the NPT as discriminatory in nature, Brazil could incur considerable diplomatic costs and loss of credibility if it adopted this sharp reversal of policy. Accession to the NPT would also mean foregoing the development of peaceful nuclear explosive devices (PNEs) and the acceptance of full-scope safeguards (which also may be required under the Treaty of Tlatelolco). Consequently, NPT ratification is not an attractive option for Brazil, particularly in light of the Tlatelolco option.

A second option for Brazil would be to accept full-scope safeguards over all of its nuclear activities in order to meet current or future demands of the nuclear supplier states. Full-scope safeguards, however, would probably contain a "no explosive use" requirement which would effectively prohibit the development of PNEs. If these safeguards are to be accepted, Brazil would probably prefer to act within the framework of the Treaty of Tlatelolco, in order to avoid the appearance of submitting to the unilateral non-proliferation demands made by the United States and certain other nuclear supplier states. It therefore appears unlikely that Brazil would unilaterally accept full-scope safeguards.

A third option would be to promote the establishment of an international or multinational nuclear fuel bank. Brazil would have little incentive to participate in such an arrangement, for an international fuel bank would add nothing to the assurance of fuel supply acquired under the 1975 Brazilian-German Agree-

ment. This assessment conceivably could change if the facility were established in Brazil and offered significant commercial advantages without requiring the abandonment of Brazil's independent development of enrichment and reprocessing facilities. The establishment of a regional fuel cycle or reprocessing center would be treated similarly. Although this third option cannot be entirely ruled out, the establishment of an IPS regime would have a much greater likelihood of being accepted in the short term and would be a prerequisite to the consideration of more complicated schemes.

Finally, Brazil could voluntarily forego the development of national enrichment and reprocessing. After surviving the United States onslaught on the issue of sensitive technologies, however, it is extremely difficult to imagine any circumstances under which Brazil would surrender gains already achieved and facilities whose development and construction are far advanced.

Support for an IPS regime and full ratification of the Treaty of Tlatelolco therefore represent the principal options realistically available to Brazilian decision-makers willing to strengthen the non-proliferation regime. It is for this reason that the following hypothetical Brazilian review memorandum focuses on these options. The reader should assume that the following memorandum has been written by an independent, rational Brazilian policymaker who has been asked by President João Baptista Figueiredo to review the advisability of proceeding with Brazil's nuclear program and to consider whether Brazil should contribute to non-proliferation efforts by supporting an IPS regime or fully ratifying the Treaty of Tlatelolco. The hypothetical memorandum does not purport to represent the official views of the Government of the Federative Republic of Brazil; it merely suggests the way in which a rational Brazilian policymaker might view these issues.

B. *The Present Non-Proliferation Regime*¹⁴

Three strategies have been adopted, by nuclear weapons states

14. The following statement provides a succinct overview of the nuclear fuel cycle and the possible routes to nuclear proliferation:

Nuclear power stations generate electricity from the heat produced when the nuclei of the atoms of heavy material are split. The nuclear reactions that produce the heat in this way take place in a reactor. The heat is then used in a boiler to produce steam to drive conventional turbines.

The material used as the fuel in current nuclear power stations is usu-

and nuclear supplier states in efforts to control the spread of nu-

ally uranium. However, other possible fuel cycles, for example cycles based on thorium, have been considered.

Uranium ore occurs naturally in the earth's crust and is mined by conventional mining techniques. It is then processed into a form suitable for using as fuel in a nuclear reactor. Natural uranium contains two main isotopes, U-238 and U-235. Only the nuclei of the U-235 atoms are readily fissionable, i.e. capable of being split, under most conditions, but U-235 accounts for only about 0.7% of natural uranium. Therefore, although some reactors use natural uranium as their fuel, most reactors now use slightly enriched uranium, in which the proportion of U-235 atoms has been artificially increased or "enriched" by U-235 taken from a further quantity of natural uranium. Consequently, most of the uranium that is mined is enriched after processing and before it is fabricated into fuel elements for loading into a reactor.

Inside the reactor the fuel is irradiated (i.e. nuclear fission reactions are allowed to take place). The U-235 atoms, when split, form lighter elements, known as fission products, some of which are highly radioactive. Some of the U-238 atoms are also transformed in the reactor to form heavier elements, also radioactive. The most important of these is plutonium since Pu-239, the isotope of plutonium produced in the largest quantity, is, like U-235, fissionable and therefore a potential fuel; indeed some of the plutonium so formed is then subsequently fissioned and releases energy while the fuel remains in the reactor. About one third of the energy released while the uranium fuel is being irradiated comes from the fission of plutonium.

The heat produced by the fission reactions is removed by a cooling agent that passes over the fuel and transfers the heat to the steam circuit which is linked to the turbine. In some types of reactors liquids, such as ordinary (light) water or heavy water, are used as the coolant; in others, gases such as carbon dioxide are used. The largest number of power reactors currently in operation use light water, and are generically referred to as Light Water Reactors (LWRs). There are two main types of LWRs: The Pressurized Water Reactor (PWR) and the Boiling Water Reactor (BWR). But there are also significant numbers of Heavy Water Reactors (HWRs), particularly in Canada, which has developed the CANDU HWR, and of Gas-Cooled Reactors, particularly in France and the U.K.

When the spent fuel is discharged from the reactor, it contains unconsumed uranium, fission products, plutonium and some other heavy elements. It generates heat and is radioactive and is placed in storage ponds filled with water to cool. When it has cooled sufficiently, it is possible to dissolve the spent fuel and chemically process ("reprocess") it in order to extract the unused uranium and plutonium. These materials can then be fabricated into new fuel elements and recycled to the reactor. When new fuel elements are fabricated in this way they contain a mixture of uranium and plutonium, the plutonium providing the main fissionable material in the fuel.

Three different types of fuel cycle are commonly identified depending

clear weapons. The first, a strategy of denial, seeks to deny poten-

on whether or not the spent fuel is reprocessed and, if it is, to what type of reactor the uranium and plutonium are recycled:

[1] In the once-through fuel cycle the spent fuel is not reprocessed but kept in storage ponds until it is sent for permanent disposal, for example by conditioning it and burying it underground in a deep geological repository.

[2] In thermal reactor recycle the spent fuel is reprocessed and the uranium and plutonium are separated from the fission products which are conditioned, for example by vitrification, and disposed of in a deep geological repository. Both the uranium and the plutonium can then be recycled in new fuel elements to reactors of basically the same type as that in which the plutonium is initially produced. (Alternatively, it is possible to recycle only the uranium and to store the plutonium and vice versa).

[3] In fast breeder reactor cycle the spent fuel is similarly reprocessed and the uranium and plutonium fabricated into new fuel elements. They are, however, recycled to fast breeder reactors (FBRs), in which there is a central core of uranium/plutonium fuel surrounded by a blanket of depleted uranium, i.e. uranium from which most of the U-235 atoms have been taken during the process of enrichment of other uranium. This depleted uranium therefore consists mostly of U-238 atoms, some of which are converted to plutonium during irradiation. By suitable operation, such reactors can produce slightly more plutonium than they consume (hence the name "breeder"), the precise mode of operation depending on the need for plutonium.

Both thermal and fast breeder reactor recycle necessitate facilities for the storage of separated plutonium until required for recycle and arrangements for the transport of plutonium between sites, in addition to reprocessing and fuel fabrication plants and the facilities for the storage or disposal of wastes. Transport of separated plutonium is not necessary if the reprocessing and fuel fabrication plants are located on the same site.

INTERNATIONAL NUCLEAR FUEL CYCLE EVALUATION, SUMMARY 281-82, 284 (1980) [hereinafter cited as SUMMARY].

The "front-end" of the nuclear fuel cycle includes the mining of uranium ore, which contains only about 0.2% of U_3O_8 . The ore is then processed at a mill, which produces a product known as "yellowcake" in which the concentration of U_3O_8 has been increased to between 75 and 85%. Yellowcake contains only about 0.7% of the isotope U-235, and therefore must be sent to a conversion plant which converts it to uranium hexafluoride (UF_6), which is then sent to an enrichment plant. There the concentration of U-235 is increased to approximately 3%, before being sent to a fuel fabrication facility where it is converted into uranium oxide (UO_2) and shaped into pellets which are enclosed in fuel rods. A number of fuel rods are placed together into fuel assemblies and are then ready for insertion into the reactor core. Heavy water reactors (HWRs) require no enrichment, and, therefore, fuel elements may be made directly from yellowcake; HWRs require the use of heavy water, however, and production of

tial nuclear powers access to nuclear materials, equipment, and technologies which would give them the capability of building nuclear weapons. The second, a strategy of warning, attempts to secure timely and adequate warning in the event a nation diverts nuclear materials or equipment from their intended peaceful pur-

the latter is technologically difficult. *See generally* J. YAGER, INTERNATIONAL COOPERATION IN NUCLEAR ENERGY 5-9 (1981).

The "back-end" of the fuel cycle may consist simply of storage and disposal of irradiated or spent fuel in the case of the once through cycle. The alternative is a "closed" cycle in which spent fuel is first stored at the reactor site until it cools. It is next sent to a reprocessing facility which yields plutonium, uranium, and nuclear waste products. The plutonium is then transferred to a fuel fabrication plant where it is converted into plutonium oxide (if it is not already in that form) and shaped into pellets together with uranium oxide to make mixed oxide fuel. The uranium produced by reprocessing must be enriched again, and thus reenters the "front-end" of the fuel cycle. Finally, the radioactive nuclear wastes produced by reprocessing must be stored or permanently disposed of.

Two aspects of the nuclear fuel cycle are particularly sensitive, for they may also be used to produce the component materials of a nuclear weapon. An enrichment plant may be used or copied in order to produce highly enriched uranium with a U-235 content exceeding 20% for even a crude explosive device and a content exceeding 90% for military weapons. *See* NUCLEAR FUELS POLICY WORKING GROUP, ATLANTIC COUNCIL, 1 NUCLEAR POWER AND NUCLEAR WEAPONS PROLIFERATION 38 (1978) [hereinafter cited as NUCLEAR FUELS]. The principal risks associated with enrichment—beyond those associated with the transport and use of enriched uranium—are that the enrichment plant may be modified to produce highly enriched uranium, and the technology and practical experience acquired in operating a legitimate enrichment facility might be used to build a secret enrichment plant designed to produce weapons-grade uranium.

The second aspect of the fuel cycle which presents particular proliferation risks is reprocessing and the storage of plutonium associated with the "closed" fuel cycle. Plutonium constitutes more efficient material for building nuclear weapons than highly enriched uranium, due to the fact that a much smaller quantity is required for the construction of a bomb. Three principal risks result from the introduction of a reprocessing facility. First, the facility may be diverted to use for the production of plutonium for nuclear bombs. Second, the technology and experience gained from operating a reprocessing plant could be used to build a secret facility whose purpose was to reprocess spent fuel in order to produce plutonium for nuclear weapons. The third risk is that the storage of separated plutonium or spent fuel containing plutonium would permit the stockpiling of the basic material needed to build weapons. Therefore, should the need arise, a state could seize separated plutonium stocks and proceed to build bombs or, with only a slight delay, simply proceed to reprocess accumulated stocks of spent fuel, thereby extracting the plutonium necessary for the construction of nuclear weapons. Diversion of small quantities from the processing stream, of course, is an additional risk.

poses in commercial nuclear power programs or known research facilities. The third strategy, political deterrence, aims to gain legal and political commitments from potential nuclear weapons states to forego the development or testing of any nuclear explosive device.

The current non-proliferation regime includes a number of international and national mechanisms employing these three strategies in varying combinations.¹⁵ After the first atomic bomb explosions in 1945, the United States sought to control the spread of nuclear weapons by placing all such weapons and technology under the control of an international agency in charge of the development of nuclear technology for peaceful purposes. It was intended that this agency possess a monopoly over the materials, equipment, and technology needed to produce nuclear weapons. Predictably, the Cold War prompted the Soviet Union and its allies to block the creation of such a supranational agency. The original plan to adopt a strategy of total denial consequently failed.¹⁶

Following the 1953 initiation of the United States "Atoms for Peace" program by President Eisenhower, the emphasis shifted toward a strategy of warning built upon the establishment of bilateral and international safeguards administered by the newly-formed International Atomic Energy Agency (IAEA). As the United States possessed a virtual monopoly over existing enrichment and reprocessing technologies and the supply of enriched uranium needed to supply light water reactors, this strategy promised to provide the international community with timely warning of any attempt by a country receiving nuclear equipment and technology to divert nuclear materials from peaceful use. It was believed that such warning would provide ample time to bring diplomatic and other pressures to dissuade any country from proceeding with plans to develop nuclear weapons. Absent the addition of independent national enrichment or reprocessing capabilities by other nations, the strategy of warning permitted international commerce and development in nuclear materials and equipment for peaceful purposes. Legal commitments that prevented the use of transferred nuclear technology for military

15. See, e.g., J. YAGER, *supra* note 14, at 25-39; Nye, *Maintaining a Non-Proliferation Regime*, 35 INT'L ORGANIZATION 15 (1981).

16. See, e.g., W. EPSTEIN, *THE LAST CHANCE: NUCLEAR PROLIFERATION AND ARMS CONTROL* 1-13 (1976).

purposes were coupled with the warning component of bilateral programs for peaceful nuclear cooperation. These commitments were contained both in the bilateral agreements establishing programs of cooperation in the peaceful use of nuclear energy, and in the agreements placing transferred nuclear materials and equipment under the international safeguards administered by the IAEA. These legal restraints, however, did not apply to unsafeguarded materials or equipment developed through a nation's indigenous capabilities.

In the early 1960s an effort was made to strengthen the legal and political commitments of non-nuclear weapons states to forego the development, manufacture, or testing of nuclear weapons, and to place all of their nuclear activities under full-scope safeguards. The Limited Test Ban Treaty of 1963,¹⁷ the first major strengthening of the the non-proliferation regime, banned nuclear testing in the atmosphere, in outer space, and under water. The Treaty was adopted primarily to curtail the spiralling nuclear arms race between the United States and the Soviet Union and to end the health threat represented by the radiation released in atmospheric tests; its effect was to complicate any weapons development program that might be pursued in the future by a state seeking to develop nuclear weapons. Perhaps for this reason, the Treaty was never ratified by the People's Republic of China or France.

A second major advance was achieved in 1967 when the Treaty of Tlatelolco¹⁸ was signed by the Latin American States. This Treaty established a nuclear-free zone in Latin America and banned the manufacture, testing, use, storage, or deployment of nuclear weapons by any signatory state. It also required each signatory to negotiate a safeguards agreement with the IAEA which would apply to its nuclear activities¹⁹—a requirement which presumably includes full-scope safeguards.²⁰ The major shortcoming of the Treaty was that it permitted the development and explosion of PNEs.

17. Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water, *done*, Aug. 5, 1963, 14 U.S.T. 1313, T.I.A.S. No. 5433, 480 U.N.T.S. 43 [hereinafter cited as Limited Test Ban Treaty].

18. Treaty for the Prohibition of Nuclear Weapons in Latin America, Feb. 14, 1967, 634 U.N.T.S. 281, *reprinted in* 6 INT'L LEGAL MATERIALS 521 (1967) [hereinafter cited as Treaty of Tlatelolco].

19. *Id.* art. 13.

20. See notes 204-08 & 226 *infra* and accompanying text.

The third and most significant advance in strengthening these legal and political commitments was the signing of the Non-Proliferation Treaty of 1968.²¹ The NPT represented a bargain between the nuclear weapons states and the non-nuclear weapons states, by which the latter agreed to forego the manufacture or acquisition of "nuclear weapons or other nuclear explosive devices"²² and to accept full-scope safeguards on all of their nuclear activities²³ in exchange for certain commitments by the nuclear weapons states. These commitments were to facilitate the exchange and development of nuclear materials, equipment, and technology for peaceful purposes,²⁴ and to pursue negotiations to end the nuclear arms race and achieve nuclear disarmament.²⁵ The bargain struck thus promised to end nuclear proliferation while permitting the free development of nuclear energy for peaceful purposes in a world in which nuclear arms would play a diminishing role.

Although ratified by the United Kingdom, the United States, the Soviet Union, and 111 non-nuclear weapons states,²⁶ the NPT has not proven to be a final solution to the problems of nuclear proliferation. Its most obvious shortcoming has been its failure to achieve universal adherence. A number of countries, among them many of the threshold nuclear powers, have refused to sign the Treaty due to its alleged discrimination between nuclear weapons and non-nuclear weapons states. A second defect, which became quite apparent during the 1970s, is that the spread of sensitive nuclear technologies such as enrichment and reprocessing allows even signatories to the NPT to develop a "near nuclear weapons capability." In short, NPT adherence does not effectively safeguard against the sudden acquisition of a nuclear weapons capability by a state which has withdrawn from the Treaty²⁷ or vio-

21. Treaty on the Non-Proliferation of Nuclear Weapons, *opened for signature*, July 1, 1968, 21 U.S.T. 483, T.I.A.S. No. 6839, 729 U.N.T.S. 161 [hereinafter cited as Non-Proliferation Treaty].

22. *Id.* art. 2.

23. *Id.* art. 3.

24. *Id.* art. 4.

25. *Id.* art. 6.

26. J. YAGER, *supra* note 14, at 28.

27. Non-Proliferation Treaty, *supra* note 21, art. 10(1). This article provides: Each party shall in exercising its national sovereignty have the right to withdraw from the Treaty if it decides that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme inter-

lated its provisions. The Israeli bombing of the Iraqi Osirak reactor on June 7, 1981,²⁸ demonstrates that the other countries may become extremely apprehensive over a state's development of sensitive technologies,²⁹ regardless of that state's adherence to the NPT.³⁰

The weaknesses of the NPT regime became increasingly apparent in the 1970s as a result of India's underground nuclear explosion in 1974,³¹ an aborted French agreement to provide reprocessing to Pakistan,³² and the 1975 agreement under which Germany undertook to provide Brazil with both enrichment and reprocessing facilities and technologies. A number of states came to the realization that the existing non-proliferation regime needed to be strengthened.³³

ests of its country. It shall give notice of such withdrawal to all other Parties to the Treaty and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its interests.

28. See N.Y. Times, June 9, 1981, at 1, col. 6.

29. The Osirak reactor used weapons grade uranium enriched to over 90% U-235.

30. Iraq had ratified the Non-Proliferation Treaty on March 5, 1970. See Non-Proliferation Treaty, *supra* note 21.

31. See, e.g., J. YAGER, *supra* note 14, at 131-32.

32. See Betts, *supra* note 2, at 101-02.

33. The first such efforts were undertaken in informal meetings in which the nuclear supplier countries participated. These first talks led to the 1974 adoption of the "Zangger Committee trigger list" of items whose export would trigger the safeguards provided by the Non-Proliferation Treaty. See INTERNATIONAL ATOMIC ENERGY AGENCY, I.N.F. CIRC. No. 209 (Sept. 3, 1974), reprinted in INTERNATIONAL INSTRUMENTS FOR NUCLEAR TECHNOLOGY TRANSFER 235-43 (L. Muntzing ed. 1978). These efforts were followed by secret meetings between nuclear supplier countries beginning in 1975 which sought to develop a common approach to the export of sensitive nuclear equipment and technology. In January 1978 this so-called "London Nuclear Suppliers" Group issued guidelines for sensitive nuclear exports, including an expanded trigger list of exports which would require the coverage of IAEA safeguards. Significantly, however, the United States failed to secure acceptance of the requirement of full-scope safeguards as a condition for export of items on the trigger list. See generally 2 NUCLEAR FUELS, *supra* note 14, at 63-75; J. YAGER, *supra* note 14, at 195-99. A number of nuclear supplier states, most notably Australia, Canada, and the United States, decided to go further than the recommended guidelines of the London Suppliers Group by adopting national legislation and regulations which conditioned the continued export of nuclear materials, equipment, and technology upon acceptance by the recipient state of certain non-proliferation conditions, including full-scope safeguards covering all nuclear activities. See J.

The existing non-proliferation regime is comprised of differing measures and instruments adopted at different times, in divergent circumstances, and with varying purposes. These differing regimes do not apply to all states in identical fashion. For example, the Limited Test Ban Treaty, the Treaty of Tlatelolco, and the NPT represent binding legal instruments, yet they do not bind a number of potential entrants into the nuclear weapons club. The guidelines of the London Nuclear Suppliers Group are not legally binding, and they have occasionally been stretched considerably in the service of important commercial interests. The unilateral imposition of non-proliferation conditions on all nuclear exports, as in the United States Nuclear Non-Proliferation Act of 1978, is legally binding within municipal legal systems, but may ultimately increase uncertainties regarding assurances of supply of nuclear fuel, equipment and technology, and stimulate the determination of threshold nuclear states to acquire the sensitive enrichment and reprocessing technologies needed to ensure their nuclear independence. The present regime, therefore, does not promise to prevent the spread of sensitive technologies, though it may help to slow this development. It allows a number of states to lawfully build peaceful nuclear explosive devices, which are scientifically indistinguishable from nuclear bombs. Finally, the present regime will not prevent the development of trade in nuclear materials and technology among states not subject to full-scope safeguards or controls on the export of sensitive technologies.

C. *The Search for a New Consensus*

At the initiative of the United States, the International Nuclear Fuel Cycle Evaluation (INFCE) was launched in October 1977.³⁴ INFCE was established to examine the issues related to the goals of making nuclear energy widely available to meet the world's energy requirements, on the one hand, and to minimize the risks of nuclear proliferation, on the other. Formally, INFCE was a "technical and analytical study and not a negotiation";³⁵ however, many hoped that the results would lead to the adoption of concrete measures which would slow the spread of nuclear weapons.

YAGER, *supra* note 14, at 32-33, 173-81.

34. SUMMARY, *supra* note 14, at 260.

35. *Id.*

The United States attempted to persuade INFCE participants to forego widespread reprocessing and the introduction of breeder reactors. By the time the Final Conference was held in February 1980, it was clear that the United States had failed to achieve this goal. Yet progress in sensitizing other countries to proliferation concerns was made on a number of fronts³⁶ and a valuable consensus on the technological aspects of nuclear power and non-proliferation was largely achieved. During the INFCE deliberations, various forms of "internationalization" of the nuclear fuel cycle were considered as methods of preventing sensitive materials and technology from being acquired or misused by states seeking a nuclear weapons capability. Unfortunately, most of these schemes presented problems of great legal, economic, and technological complexity, and failed to evoke a high degree of interest among the most significant supplier and threshold nuclear states. One concept which did achieve broad support, however, was the establishment of an international regime for the storage of plutonium.³⁷

Following the conclusion of INFCE in February 1980, attention shifted to the deliberations of the Expert Group on International Plutonium Storage, which had been meeting under IAEA auspices since 1978.³⁸ The Expert Group hopes to develop a consensus on an appropriate IPS regime by the end of 1982.³⁹ The potential

36. See, e.g., Ungerer, *International Nuclear Order Before and After INFCE*, 31 *AUSSENPOLITIK* 243, 253-55 (English ed. 1980). For a comprehensive summary of the INFCE deliberations, see SUMMARY, *supra* note 14, at 1-53.

37. See, e.g., SUMMARY, *supra* note 14, at 45-46, 154-55.

38. For information on the current deliberation of the Expert Group on International Plutonium Storage, see EXPERT GROUP ON INTERNATIONAL PLUTONIUM STORAGE, INTERNATIONAL ATOMIC ENERGY AGENCY, FIFTH MEETING (25-28 May 1981): REPORT OF THE RAPPORTEUR, IAEA Doc. IAEA-IPS/EG/114 (1981) [hereinafter cited as EXPERT GROUP]. For a sampling of the views of experts from different countries, see *id.* Annexes D through S (general statements by the experts from Australia, Belgium, Brazil, Canada, Finland, France, the Federal Republic of Germany, India, Italy, Japan, the Republic of Korea, Sweden, Switzerland, the United States, Yugoslavia, and the Commission of the European Communities). The Chairman of the Working Group is from Brazil. *Id.* at 1. For a summary of the work of the Expert Group on International Plutonium Storage, see James, *International Plutonium Storage*, in *INTERNATIONALIZATION TO PREVENT THE SPREAD OF NUCLEAR WEAPONS* 143 (Stockholm International Peace Research Institute ed. 1980). See also R. FOX & M. WILLRICH, *INTERNATIONAL CUSTODY OF PLUTONIUM STOCKS: A FIRST STEP TOWARD AN INTERNATIONAL REGIME FOR SENSITIVE NUCLEAR ENERGY ACTIVITIES* (1978).

39. EXPERT GROUP, *supra* note 38, at 14.

benefits of an IPS regime could be highly significant. A system removing excess stocks of separated plutonium from national control could reduce substantially the risk that such stocks would be used to build nuclear weapons on short notice. In the light of such protection, the reprocessing of fuel for thermal and breeder reactors arguably would proceed without creating any undue additional proliferation risk.⁴⁰ Such a regime might prove particularly desirable to countries whose nuclear development plans are currently hampered by national prohibitions contained in the national legislation of certain nuclear supplier states.⁴¹

D. The 1975 Agreement Between Brazil and the Federal Republic of Germany on Cooperation in the Peaceful Uses of Nuclear Energy

On June 27, 1975, Brazil and the Federal Republic of Germany signed an Agreement Concerning Cooperation in the Field of Peaceful Uses of Atomic Energy.⁴² Under the terms of this accord and various other subsidiary agreements, Brazil acquired the equipment and technology necessary for the construction of the complete nuclear fuel cycle. The Agreement and a Complementary Industrial Protocol provided for the establishment of Brazilian-German joint ventures in the following areas:

- (1) exploration and development of uranium mining in Brazil, including the production of uranium concentrates; under the terms of the agreement, once Brazil had satisfied its own requirements it could export up to 20% of proven uranium reserves or 49% of current production to its German partner;
- (2) co-development of the jet-nozzle enrichment process in Germany, and construction of a jet-nozzle enrichment facility in Brazil with a capacity of 250,000 Separative Work Units (SWU) per year;
- (3) supply of enriched uranium to Brazil until it was self-sufficient in production;

40. This would not necessarily be true, however, if an internationally protected store of plutonium were located in a country having a reprocessing facility.

41. See, e.g., the General Statement by the Expert from France in EXPERT GROUP, *supra* note 38 at Annex I, at 2.

42. Agreement Between the Federal Republic of Germany and Brazil Concerning Cooperation in the Field of Peaceful Uses of Nuclear Energy, June 27, 1975, *reprinted in* G. FAHL, *INTERNATIONALES RECHT DER RÜSTUNGS-BESCHRÄNKUNG* § 5.3.7.1 (1976) (German text and English translation) [hereinafter cited as Brazilian-German Agreement].

- (4) construction of a pilot reprocessing facility in Brazil to be followed by a commercial-scale reprocessing plant;
- (5) construction of a factory for heavy components of nuclear reactors;
- (6) building a fuel fabrication plant in Brazil;
- (7) eventual purchase by Brazil of eight 1300 KWe reactors from Kraftwerk Union (KWU) of Germany, with an initial commitment to buy two such reactors.⁴³

The Brazilian-German Nuclear Agreement alarmed many opponents of nuclear proliferation in the United States and elsewhere, but the Ford Administration limited itself to mild expressions of protest. Following the 1976 election of President Carter, United States opposition to the deal became increasingly vehement. During 1977 and 1978 the Carter Administration energetically sought to dissuade Germany from carrying through with the Agreement. The United States also engaged in futile efforts to persuade the Brazilians that there was no economic justification for acquiring highly sensitive enrichment and reprocessing technologies. By mid-1978, however, Washington had accepted the fact that it was powerless to block implementation of the Agreement.⁴⁴ Within the general context sketched above, the following hypothetical Brazilian memorandum considers the two "live" policy options available to Brazil: support of an IPS regime or full acceptance of the operative force of the Treaty of Tlatelolco.

II. THE HYPOTHETICAL MEMORANDUM

A. *Economic Development, National Security and Brazil's Future: The Framework for Decision*

An examination of the policy options open to Brazil in the field of nuclear energy requires consideration of the fundamental goals

43. The text of the Brazilian-German Agreement, *supra* note 42, and Complementary Industrial Protocol, are reproduced in 5 RESENHA DE POLITICA EXTERIOR DO BRASIL 156-58 (1975) (Portuguese text). See also W. ALVARES, INTRODUÇÃO AO DIREITO DA ENERGIA NUCLEAR 169-82 (1975); Soares, *O acordo de cooperação nuclear Brasil-Alemanha Federal*, 253 REVISTA FORENSE 202, 217-21 (1976); Wonder, NUCLEAR COMMERCE AND NUCLEAR PROLIFERATION: GERMANY AND BRAZIL, 1975, 21 ORBIS 277, 285-90 (1977).

44. See generally K. MIROW, LOUCURA NUCLEAR 42-47 (1979); R. WESSON, THE UNITED STATES AND BRAZIL: LIMITS OF INFLUENCE 79-89 (1981); Kaiser, *The Great Nuclear Debate: German-American Disagreements*, 30 FOREIGN POLICY 83, 94-100 (1978); Soares, *supra* note 43, at 225-27.

of our national existence, together with the range of national interests which will be affected by any major decisions in that area. These basic goals include the following: (1) achievement of rapid and continuous economic development; (2) the guarantee of national security; and (3) assurance that Brazil will in the future occupy an international position consonant with its size, population, and increasing national capabilities.⁴⁵

Each of these goals is intricately related to the others, for we seek not only to increase our standard of living in absolute terms over the next twenty-five years, but also to equal the economic achievements of the most developed countries within fifty to one hundred years.⁴⁶ Similarly, we must not only safeguard our national security in the short to intermediate terms, but we must also make decisions which will enable us to do so in seventy-five or one hundred years. We do not use the term "national security" in the all-inclusive sense as defined by the current "national security doctrine" of the War College;⁴⁷ we do use the term to include not only security from military attack, but also security from interruptions in strategic supplies which could threaten or cripple our industrial development and sharply curtail our influence in the world arena.⁴⁸

45. By the mid-1970s, Brazil already ranked as the fifth largest country in the world in area, the sixth largest in population (ahead of Japan), and the tenth largest in terms of total gross national product. R. SCHNEIDER, *BRASIL: FOREIGN POLICY OF A FUTURE WORLD POWER 1* (1976).

46. *See id.* at 32-33. According to a 1970 National Security Council codification of national goals, the government should ensure "the economic, social, and political viability of Brazil as a great power" by the year 2000. C. DE MEIRA MATTOS, *BRASIL: GEOPOLITICA E DESTINO* (1975), *quoted in* R. SCHNEIDER, *supra* note 45, at 53 n.1. This goal played an important part in the signing of the Brazilian-German Agreement. *See, e.g.*, Speech of Foreign Minister Jose de Azevedo da Silveira, Nov. 18, 1975, *reproduced in* 7 *RESENHA DE POLITICA EXTERIOR DO BRASIL* 96, 97 (1975).

47. *See generally* ESCOLA SUPERIOR DE GUERRA, *CICLO DE CONFERENCIAS SOBRE SEGURANCA NACIONAL* (1971); *see also* J. BITTENCOURT, *POLITICA E PODER NACIONAL* (1976); C. DE MEIRA MATTOS, *A GEOPOLITICA E AS PROJEÇÕES DO PODER DE CARLOS DE MEIRA MATTOS* (1977); C. DE MEIRA MATTOS, *GEOPOLITICA E DESTINO* (1975).

For a rather simplified exposition of the relationship between permanent national objectives, national power, and development, all within the framework of the National Security Doctrine, see I. RENAN, *ESTUDO DE PROBLEMAS BRASILEIROS: INTRODUÇÃO DOUTRINÁRIA* 39-43, 45-60, 91-97 (1977).

48. Despite disagreements over the National War College's National Security Doctrine, top Brazilian policymakers certainly share the view that "national se-

Before Brazil can participate in a new system of "horizontal interdependence" as an equal to the major powers, it must achieve strength through economic independence from any single nation. Because economic development, national security, and a long-term perspective are necessary to advance Brazil into the first rank of nations, they comprise the broad framework within which nuclear policy issues must be decided.⁴⁹ In order to properly assess our options in the field of nuclear energy and to reach an optimum solution, however, we must also balance our specific national interests and policy objectives.

1. Energy Independence: The Need for Nuclear Energy

In recent years Brazil has experienced an extraordinary rate of growth, averaging above ten percent in gross domestic product.⁵⁰ The rate of growth in the industrial sector has reached as high as fifteen percent.⁵¹ In order to sustain such growth, Brazil's energy supply must grow at a greater rate as we reach higher levels of industrialization. The decrease in industrial growth in 1976 and 1977 does not alter this assessment, for industrial recovery is under way as evidenced by growth in the industrial sector reaching 8.5 percent in 1979.⁵² Growth in electrical demand is expected to continue at a rate of twelve percent.⁵³ In addition, the nation's

curity is, in the final analysis, dependent on development." R. SCHNEIDER, *supra* note 45, at 154.

49. See R. SCHNEIDER, *supra* note 45, at 32-33; Araujo Castro, *The United Nations and the Freezing of the International Power Structure*, 26 INT'L ORGANIZATION 158, 166 (1972); note 116 *infra*.

50. This was the figure given by the Brazilian government in 1975. *Governo explica alcance do acordo nuclear*, 5 RESENHA DE POLITICA EXTERIOR DO BRASIL 7, 9 (1975) [hereinafter cited as *Governo explica*]. Annual growth in gross domestic product (GDP) averaged 7.1% nationally from 1960-1979, and 4.5% per capita during the same period. From 1968-74, real GDP grew at 11.3% per year. Real GDP slowed to a 6% growth rate in 1978, and an estimated 6.4% in 1979. INTER-AMERICAN DEVELOPMENT BANK, ECONOMIC AND SOCIAL PROGRESS IN LATIN AMERICA, 1979 REPORT 184-87 (1979). [hereinafter cited as 1979 REPORT].

51. This figure was given by the Brazilian government in 1975. *Governo explica*, *supra* note 50, at 9.

52. Growth in manufacturing output in 1979 exceeded that of the previous year by an estimated 8.5% (8-month period of comparison). 1979 REPORT, *supra* note 50, at 188.

53. See VEJA, Oct. 18, 1978, at 33. The growth in energy demand between 1974 and 1978 exceeded the estimate used to schedule the introduction of reactors. O Estado de São Paulo, Oct. 11, 1978, at 8, col. 2.

hydroelectric potential is being intensely exploited.⁵⁴ In 1975, when we signed the nuclear agreement with the Federal Republic of Germany,⁵⁵ government studies suggested that this potential would be progressively exhausted by the 1990s.⁵⁶ Even considering the criticism that these studies were based on energy costs in the late 1960s and thus seriously underrated our hydroelectric potential at current or future prices for energy, it is clear that Brazil will need additional sources of energy by the turn of the century.⁵⁷ It is estimated that our requirement for electric generating capacity will reach seventy megawatts by 1990,⁵⁸ only ten megawatts of which will be supplied by nuclear power generation.⁵⁹

The load factor for hydroelectric stations is only about fifty-five percent,⁶⁰ and total generating capacity therefore should not be confused with average available capacity. In light of the load factor, it is clear that the country must have adequate generating capacity for thermal complementation. The drought in 1978 demonstrates that we cannot allow our industrial output to become

54. See, e.g., Redick, *The Tlatelolco Regime and Non-Proliferation in Latin America*, 35 INT'L ORGANIZATION 103, 123 (1981).

55. Brazilian-German Agreement, *supra* note 42.

56. *O programa nuclear brasileiro, um dossiê histórico*, 12 RESENHA DE POLITICA EXTERIOR DO BRASIL 7, 9-10 (1977). The English translation, published separately as "The Brazilian Nuclear Program," is reproduced in HOUSE COMM. ON SCIENCE AND TECHNOLOGY, OVERSIGHT OF ENERGY DEVELOPMENT IN SOUTH AMERICA, 96th Cong., 2d Sess. 89-149 (1980) (report of Congressman John W. Wydler). A wealth of information on Brazil's energy needs and current programs is reproduced in *id.* at 10-31, 82-88.

57. See K. MIROW, *supra* note 44, at 175-77 (1979). Mirow reports that the purchase of eight reactors pursuant to the 1975 agreement with West Germany was based on projected costs of \$458/KWe (kilowatt) of nuclear generating capacity. *Id.* at 62.

Critics stress that untapped hydroelectric potential and alternative energy sources reduce or negate the country's need for nuclear power plants. See, e.g., VEJA, Oct. 25, 1978, at 137-39. Current hydroelectric plant costs are less than \$1000/KWe of generating capacity, as compared to between \$2,400 and \$3,000/KWe for nuclear generating capacity. Krugman, *The German-Brazilian Nuclear Deal*, 37 BULL. OF THE ATOM. SCIENTISTS 32, 34 (1981).

For a range of views on this issue, see SIMPOSIO NACIONAL DE ENERGIA, ENERGIA TECNOLOGIA E DESENVOLVIMENTO: ENERGIA ELÉCTRICA E NUCLEAR (1978).

58. O Estado de São Paulo, Oct. 11, 1978, at 8, col. 2.

59. *Id.*

60. See J. GOLDEMBERG, *ENERGIA NUCLEAR NO BRASIL* 57 (1978). *But see* Krugman, *supra* note 57, at 34.

dependent on the vagaries of nature.⁶¹ In recent years the ratio of hydroelectric to thermal generating capacity has reached a dangerous level of approximately ninety percent hydroelectric, ten percent thermal.⁶² This must be redressed toward a target figure of seventy percent and thirty percent, respectively.⁶³

The astronomical increase in oil prices by OPEC beginning in 1973 and 1974 mitigates against the use of petroleum to provide the thermal generating capacity needed by Brazil for several reasons. First, Brazil imports approximately eighty percent of its oil and pays more than one-third of its export earnings for this item alone.⁶⁴ Increases in the cost of foreign oil caused Brazil to spend more than four billion dollars on oil imports in 1978. This figure should reach thirteen billion dollars in 1981.⁶⁵ It would be foolish to increase our dependence on foreign oil in view of the probability of further price increases. Such action would severely inhibit our ability to purchase foreign technology for expansion of our industrial base, and would increase existing constraints on our freedom of political action vis-à-vis oil-exporting nations. Second, there is considerable doubt with regard to the long-term security of our oil supplies. Events in Iran and increasing concern over the security of shipping lanes in the South Atlantic⁶⁶ demon-

61. See the statement of Mines and Energy Minister Shigeaki Ueki, Washington Post, Dec. 4, 1978, A 16, col. 4. Ueki noted that following the oil crisis the government had let the hydro/thermal ratio slide from 70/30 to 85/15; he stated that he considered the latter to represent an absolute minimum. Otherwise, a drought could cause serious problems with the entire electrical system of the country. *Id.*

62. In 1979, 92.3% of electricity was generated by hydroelectric plants. MINISTERIO DAS MINAS E ENERGIA, GOVERNO FEDERATIVO DO BRASIL, BALANCE ENERGETICO NACIONAL 7 (1980) [hereinafter cited as BALANCE ENERGETICO].

63. See note 61 *supra*.

64. R. SCHNEIDER, *supra* note 45, at 23. In 1979, 85% of petroleum was imported at a cost estimated at \$6.5 to \$7.5 million. Redick, *supra* note 54, at 123. Moreover, Brazilian dependence on Arabian oil has significantly constrained the nation's foreign policy, as revealed by its votes in the United Nations General Assembly for the "Zionism is Racism" resolution and in favor of recognition of the Palestine Liberation Organization. See Selcher, Brazil's Multilateral Diplomacy 14-155 (1975) (unpublished State Department External Research paper).

65. 1979 REPORT, *supra* note 50, at 193; N.Y. Times, Sept. 21, 1981, at A3, col. 1.

66. See generally G. DO COUTO E SILVA, GEOPOLITICA DO BRASIL 225-27 (1967); V. NOBREGA, A ENERGIA NUCLEAR E SEUS CAVALOS DE TRÓIA 146 (1975); Betts, Courtney, Rowen, Brody & Yager, *Brazil and Argentina: Strategies for American Diplomacy*, in NON-PROLIFERATION AND U.S. FOREIGN POLICY 391-92

strate this point. Finally, with proven oil reserves of only one billion barrels (compared to sixty-one billion barrels in the United States), Brazil cannot afford to choose an option which will permanently foreclose its prospects for energy independence.

Development of alternate sources of energy is being explored and should be accorded a high priority, but neither solar energy nor biomass energy can be expected to satisfy our thermal generating needs in the next fifty years.⁶⁷ Although shale oil remains a potential source of petroleum products, its utilization involves considerable social costs while its economic viability remains uncertain.⁶⁸ Petroleum products which can be produced from shale oil will be needed in the plastics and fertilizer industries and for purposes other than mere electric power generation. Our limited supply of coal further complicates these matters.⁶⁹

Given the alternatives, nuclear energy remains the preferred means for supplying the thermal generating capacity needed to complement our hydroelectric capacity.⁷⁰ The acquisition of nuclear power generating capacity under the terms of the German Agreement offers several important advantages. In light of recent discoveries of uranium in Brazil—126,000 tons of proven reserves and 89,300 tons of probable reserves totaling 215,300 tons⁷¹—we

(J. Yager ed. 1980) [hereinafter cited as Betts, Courtney]; Courtney, *supra* note 10, at 267.

67. Brazil planned to have one-sixth of all new cars run on alcohol alone in 1978. Dickson, *Brazil's Scientists Fan Doubts Over Energy Priorities*, 275 NATURE 578 (1978). For information on the country's development of alternative energy sources, see K. MIROW, *supra* note 44, at 206-19; BALANCE ENERGETICO, *supra* note 62, at 4-10.

68. Brazil's one planned facility is tentatively scheduled to begin operation in 1985. BALANCE ENERGETICO, *supra* note 62, at 72.

69. *Governo explica*, *supra* note 50, at 9. Current reserves have been estimated at twelve billion tons. K. MIROW, *supra* note 44, at 179.

70. The development of nuclear energy is a permanent national objective of Brazil. In December 1967 President Artur da Costa e Silva approved a National Security Council recommendation that the country's permanent national objectives include "transfer of nuclear technology to our country; obtaining in the shortest possible time our independence in the production of nuclear fuels; creation of an infrastructure of support for the nuclear program; and formation and training of teams competent in the different (specialized) areas." Gall, *Atoms for Brazil, Dangers for All*, 23 FOREIGN POLICY 155, 186 (1976). See also R. DE BIASI, A ENERGIA NUCLEAR NO BRASIL 31 (1979).

71. These are as of Dec. 31, 1979 (at costs of less than \$43/lb.). BALANCE ENERGETICO, *supra* note 62, at 22. In 1978, 73,500 tons of proven reserves and 68,800 tons of probable reserves (total: 142,300 tons) were announced. VEJA,

can look forward to total self-sufficiency in fuel supplies for our nuclear power industry, at least through the end of the century. Moreover, given the intense exploration currently under way,⁷² we can expect a sharp increase in these figures, as suggested by the geometric increase in reserves since 1975.⁷³ Should breeder reactors begin operating in Brazil during the 1990s or early in the following decade, as expected,⁷⁴ we can look forward to total self-sufficiency in electric generating capacity far into the next century. Self-sufficiency in uranium fuel supplies will enable us to drastically reduce the foreign exchange expended for the importation of energy supplies. The transition to an alcohol-based transport sector, coupled with increased petroleum production, could permit us to reach self-sufficiency in oil if none of it is needlessly diverted toward the generation of electricity. Similarly, due to our acquisition of the complete nuclear cycle under the German Agreement,⁷⁵ valuable foreign exchange need not be spent on the purchase of enriched uranium or reprocessing services. Nuclear power generation, therefore, represents the only realistic option available to Brazil which will ensure its energy independence far into the twenty-first century. In a world in which energy is tantamount to wealth, given the energy requirements of a highly industrialized society,⁷⁶ Brazil can look forward to a bright future.

Nov. 8, 1978, at 130-31. Early estimates of uranium reserves were extremely low. In 1970, for example, it was estimated that Brazil had only 1,000 tons as opposed to 10,000 tons in Argentina. J. REDICK, *MILITARY POTENTIAL OF LATIN AMERICAN NUCLEAR ENERGY PROGRAMS* 13, 18 (1972). By 1976, however, some estimates reached 500,000 tons, though proven reserves amounted to only 16,500 tons. R. SCHNEIDER, *supra* note 45, at 122 n.5. In November 1978 the Brazilian Congress of Geology announced that the country now had 142,300 tons of reserves, a 1200% increase over the 1975 figure of 11,000 tons. VEJA, Nov. 8, 1978, at 130-31. These reserves were said to be sufficient to supply thirty-five reactors for thirty years each at 70% capacity. *Id.*

72. See note 71 *supra*.

73. *Id.*

74. See, e.g., K. MIROW, *supra* note 44, at 154-58.

75. See note 153 *infra*.

76. Compare the words of Paulo Nogueira Baptista, head of Nuclebrás:

Projects tied to the energy sector have priority by definition. If the problem of self-sufficiency in energy were not satisfactorily resolved, there would be no point in establishing priorities for anything else. Without energy, there is no progress, there can be no social peace, and there will not even be a formulation of a political plan adequate for the future of Brazil.

VEJA, Mar. 8, 1978, at 30 (translation from Portuguese).

A direct correlation between per capita gross national product and per capita

2. Technology Transfer

If Brazil is to achieve parity with advanced industrialized countries such as the United States in the next fifty years, it cannot remain dependent on foreign technology.⁷⁷ We must broaden and direct our own technological base toward production and exportation, rather than importation of foreign technologies. Consequently, purely economic considerations, such as the cost per kilowatt of electric generating capacity (KWe), should not by themselves determine Brazil's choices in the field of nuclear energy. The cost of a kilowatt of nuclear generating capacity has risen from 500 dollars to 1,600 dollars since the feasibility studies for the German Agreement were prepared. Thus additional hydroelectric projects are feasible. (The cost of hydroelectric capacity is currently less than 1,000 dollars per kilowatt.) Nonetheless, these considerations do not affect the desirability of proceeding with our nuclear power program,⁷⁸ for attention should be paid to the broader, long-term benefits to be derived from a given energy option.⁷⁹ In the long run, any reasonable excess over what is justifiable in terms of cost per KWe calculations will be easily recovered as a result of the increased economic bargaining power of the nation.

In light of these considerations, the agreement signed with the Federal Republic of Germany in 1975⁸⁰ constitutes an excellent

energy consumption is cited by one Brazilian authority who stresses that the absence of adequate energy would prevent the transition of Brazil to the status of a developed country. P. DÓRIA, *ENERGIA NO BRASIL E DILEMAS DO DESENVOLVIMENTO* 72-75, 155 (1976).

77. See note 49 *supra*.

78. Sharp criticisms of the nuclear program were voiced, for example, at a National Energy Symposium held in Rio de Janeiro in October 1978. One expert estimated the hydroelectric potential in the Amazon to be 70,000 megawatts electric (MWe), at prices far less expensive than those for electricity generated by nuclear power stations. See VEJA, Nov. 2, 1978, at 109. One estimate of the eventual cost per kilowatt hour of generating capacity for the German nuclear plants is as high as \$3,000. See *Atomgeschäft: Milliarden-Pleite in Brasilien?*, DER SPIEGEL, No. 38, at 124, 127 (1978). In 1978 the Brazilian government stated that the estimate for the final cost of the Angra II reactor was \$1,570 per kilowatt of installed capacity. This figure included many "first-time-only" items. O Estado de São Paulo, Oct. 11, at 8, col. 2.

79. See O Estado de São Paulo, Oct. 11, 1978, at 8, col. 2.

80. See note 153 *infra*.

For information about the trained manpower required to implement the 1975 Brazilian-German agreement, see V. TAVORA, *O ACORDO NUCLEAR BRASIL-*

bargain. It represents the purchase of a future technological capability which will eventually enable Brazil to compete with the most highly advanced nations in the field of nuclear energy. A few examples should suffice to illustrate this point.

First, by acquiring its own uranium enrichment and fuel production facilities, Brazil may one day become one of the world's major exporters of enriched uranium.⁸¹ We can expect to gain considerable influence, particularly in Latin America and other developing countries, by providing a source of uranium supplies which is not controlled by the United States or Western Europe.⁸² Moreover, should a cartel analogous to OPEC be created for the sale of uranium, we can expect to be economic beneficiaries rather than victims of such a development.

Admittedly, the jet-nozzle enrichment process we are developing with the Germans has some disadvantages: (1) it is unproven on a commercial scale, and difficult engineering problems could arise;⁸³ (2) it requires somewhat less than twice the energy needed by the gaseous diffusion process, and almost twenty times the energy required by the gas centrifuge process;⁸⁴ and (3) breakthroughs in laser-separation technology in the next decade could drastically reduce enrichment costs, thus rendering exports of

ALEMANHA E A UNIVERSIDADE 18-26 (1977).

81. Under the 1975 agreements, Brazil agreed to enter a joint venture with two German firms in order to develop the Becker aerodynamic jet-nozzle enrichment process, to be used in the construction of an enrichment plant. The plant is now scheduled to begin operations by 1984. Courtney, *supra* note 10, at 243-45. Given its own supplies of natural uranium, Brazil thus acquired the potential to export enriched uranium, once its own needs are met. See K. MIROW, *supra* note 44, at 40; Krugman, *supra* note 57, at 34.

82. See Courtney, *supra* note 10, at 258-59. A current example of willingness to pay a "premium" for nuclear supplies and services free of political restraints is the fact that the Société Européenne d'Usine de Diffusion Gazeuse (EURODIF) Tricastin Enrichment Facility in France is currently charging \$140-\$150 per separative work unit (SWU), as opposed to \$100-\$110 currently charged by the United States Department of Energy. Japanese and European customers are apparently willing to pay this higher price in exchange for what they perceive to be greater security of supply. COMM. ON GOVERNMENT AFFAIRS, U.S. SENATE, NUCLEAR POWER DEVELOPMENT IN FRANCE 17 (1981) (report of Sen. Charles Mathias, Jr.). For a breakdown of the ownership of EURODIF, see J. Yager, *supra* note 14, at 50 n.15.

83. See, e.g., Krugman, *supra* note 57, at 34; K. MIROW, *supra* note 44, at 143-48.

84. See STOCKHOLM INTERNATIONAL PEACE RESEARCH INSTITUTE, NUCLEAR ENERGY AND NUCLEAR WEAPON PROLIFERATION 61-62, 66 (1979).

uranium enriched through the jet-nozzle process non-competitive on world markets.⁸⁵ However, it should be remembered that (1) the jet-nozzle technology was the only one available for export to Brazil;⁸⁶ (2) once Brazil has an enrichment capability, it will be in a strong position to bargain for any new laser-separation technologies, since any political (*i.e.*, non-proliferation) reasons to thwart such an acquisition will no longer exist; (3) our scientists will gain valuable experience working on the jet-nozzle process at the Nuclear Research Center in Karlsruhe, Germany, and later in Brazil;⁸⁷ and (4) we shall own the process jointly with the Germans, and will be in a position to benefit from both technological advances and at least some long-term export possibilities.⁸⁸

Second, by proceeding with the construction of a pilot reprocessing plant, Brazil will avoid falling further behind in the commercial development of reprocessing. Only by the immediate development of a reprocessing system can we guarantee sufficient fuel supply for our breeder reactors. This advancement should enable Brazil to compete internationally in the sale of reprocessing services which could become a significant source of export earnings.⁸⁹

Finally, having acquired the national capacity to manufacture all of the components of nuclear reactors, Brazil will maintain a capacity to export not only enriched or reprocessed uranium, but also entire nuclear reactor systems and parts.⁹⁰ This export capa-

85. *Id.*

86. Courtney, *supra* note 10, at 244. Indeed, one should note that the Bechtel Corporation was forced to withdraw its offer to build an enrichment plant in Brazil following consultation with the United States Department of State in the spring of 1975. Betts, Courtney, *supra* note 66, at 378-80. Moreover, West Germany was unable to transfer gas centrifuge technology to Brazil because of the unwillingness of its partners in URENCO to go along. *See* Courtney, *supra* note 10, at 244.

87. *See Assinatura do acordo é anunciada no Senado*, 5 RESENHA DE POLITICA EXTERIOR DO BRASIL 19, 22 (1975); R. DE BIASI, *supra* note 70, at 93 (1979).

88. Courtney, *supra* note 10, at 244.

89. Reprocessing coupled with introduction of fast breeder reactors (FBRs) could stretch uranium supplies by a factor of up to 100. Reprocessing also results in a savings of 20-25% in separative work units required for enrichment. Opponents of reprocessing often downplay these facts and focus upon the savings in uranium in the next twenty years; the period before breeders are expected to come on stream. *See, e.g.*, Nye, *Non-Proliferation: A Long-Term Strategy*, 56 FOREIGN AFF. 601, 608-09 (1978).

90. *See* Courtney, *supra* note 10, at 273. This hope may be unrealistic, given excess capacity in the industry and the nature of the competition. *Id.* at 245, 273, 278.

bility will be particularly important within South America and Africa.⁹¹

3. Military Security

Military security represents a national interest second to none in importance.⁹² The response of Brazil to non-proliferation pressures from abroad could have a significant impact on our military posture and capabilities in the future. Consequently, in evaluating the various military options of Brazil, the following considerations should be kept in mind. First, Brazil currently enjoys clear conventional military superiority in South America.⁹³ In addition, we are rapidly moving towards self-sufficiency in arms production.⁹⁴ Second, Brazil has no territorial disputes with any of its neighbors⁹⁵ and, therefore, there are no potential causes of military conflict such as exist between Argentina and Chile,⁹⁶ and

91. R. SCHNEIDER, *supra* note 45, at 105 n.13.

92. For an overview of Brazilian strategic interests, see the classic formulation, G. DO COUTO E SILVA, *ASPECTOS GEOPOLITICOS DO BRASIL* (1957).

93. R. SCHNEIDER, *supra* note 45, at 3. Although devoting only 2.21% of its gross national product to defense, Brazil had the nineteenth largest military budget in the world in 1975, three times that of Argentina. Gorman, *Recent Threats to Peace in South America: The Territorial Dimensions of Conflict*, 33 *INTER-AMERICAN ECON. AFF.* 51, 65 (1979).

94. See Courtney, *supra* note 10, at 268-69. Brazil is producing increased amounts of all but the most sophisticated arms, including armored personnel carriers and the "Xavante" jet fighter-trainer. It also plans to build destroyers and submarines. *Id.*

95. Courtney, *supra* note 10, at 241, 253. Brazil owes its absence of territorial disputes to the far-sighted statesmanship of individuals such as Ruy Barbosa, who played a leading role in the drafting of the first republican Constitution on February 24, 1891, which included provisions for the settlement of disputes by negotiations or arbitration, and forbidding wars of conquest. See B. BURNS, *A HISTORY OF BRAZIL* 289 (2d ed. 1980); M. SEGURADO, *O DEREITO NO BRASIL* 428 (1973). With this constitutional mandate, Brazil's brilliant diplomat and foreign minister, the Baron of Rio Branco, proceeded through negotiations and arbitration to successfully establish the final delimitation of the country's frontier in only fifteen years (1895-1909). B. BURNS, *supra* at 321-23.

The provisions of the 1891 constitution referred to above are retained in the current Constitution of Brazil, establishing a high standard that other states might well emulate: "International disputes shall be settled by direct negotiations, arbitration, or other peaceful means, with the cooperation of the international agencies in which Brazil participates. War of conquest is forbidden." *CONSTITUIÇÃO* art. 7 (Brazil 1967, as amended 1969), *reprinted in* ORGANIZATION OF AMERICAN STATES, *CONSTITUTIONS OF MEMBER STATES* (English translation).

96. See Courtney, *supra* note 10, at 261-62, 266-67. Tensions between Argen-

among the Andean countries.⁹⁷ Though tensions could continue with Paraguay or Argentina over the Itaipu Dam⁹⁸ and hydroelectric development in the River Plata Basin,⁹⁹ such disputes certainly would not be of the type that can lead to war.¹⁰⁰ Therefore, our neighbors lack any conceivable motive to precipitate a military conflict.¹⁰¹ Third, Brazil is a beneficiary of the non-proliferation regime established by the NPT¹⁰² and the Treaty of Tlatelolco.¹⁰³ All of our neighbors except Argentina and Chile are legally prohibited from developing nuclear weapons or other nuclear explosive devices.¹⁰⁴ Should the non-proliferation regime come unraveled and countries such as Argentina, Bolivia, Peru, or Venezuela obtain nuclear weapons, the military security of Brazil would suffer a net decrease. Thus, obviously it will be to our ad-

tina and Chile reached a peak in 1978 when Argentina mobilized its forces in the south and almost pushed the dispute to war. *See id.*; note 97 *infra*.

97. Regarding territorial disputes between Argentina and Chile (Beagle Channel Islands); between Chile, Bolivia, and Peru; and between Peru and Ecuador, see Gorman, *supra* note 93, at 53-64. In December 1978, following Argentine rejection of an arbitral award, the two countries reached the brink of war as 100,000 Argentine and 45,000 Chilean troops mobilized along the border in the South, as did the naval forces of the two countries in the vicinity of the disputed islands. Fortunately, the crisis was defused by the timely intervention of the Vatican. *See Note, The Beagle Channel Affair: A Failure in Judicial Persuasion*, 12 VAND. J. TRANSNAT'L L. 971, 971-74 (1979). In early 1981, Ecuador and Peru fought a brief border war over a disputed area along the Marañon River. *See N.Y. Times*, Jan. 24, 1981, at 2, col. 4; *id.*, Jan. 30, 1981, at 6, col. 3 (Ecuador asks intervention of Organization of American States); *id.*, Feb. 3, 1981, at 3, col. 2 (foreign ministers of Organization of American States meet); *id.*, Feb. 8, 1981, § 4, at 4, col. 2 (review of conflict).

98. *See Courtney, supra* note 10, at 241-42, 266. For a Brazilian view of the problems in the River Plata Basin, see A. MELLO, *O BRASIL E A BACIA DO PRATA* (1980).

99. *See Courtney, supra* note 10, at 253.

100. *Id.* at 242, 261. Neither country, for example, seriously threatened military action even at the height of the Itaipu dam controversy. *Id.* at 266; *cf. Treverton, Latin America in World Politics: The Next Decade*, in *THE ADELPHI PAPERS*, ARTICLE No. 137, at 38 (1977) (substantial military confrontation between Brazil and Argentina in the near future is "extremely unlikely").

101. *See Courtney, supra* note 10, at 242. Brazil and Argentina have no motive to fight a conventional war. This is not to say, however, that Brazil could under all circumstances avoid becoming involved in a major conflict between, for example, Argentina and Chile. *See Gorman, supra* note 93, at 66-67.

102. Non-Proliferation Treaty, *supra* note 21.

103. *See note 18 supra*.

104. *See Courtney, supra* note 10, at 254-57.

vantage if the non-proliferation regime continues in effect. Fourth, given our conventional military power, Brazil has no continental incentive to construct nuclear weapons as long as no other South American country acquires such a capability.¹⁰⁵ Argentina is not under full-scope safeguards,¹⁰⁶ and it uses a technology which lends itself to diversion of irradiated fuel rods containing plutonium,¹⁰⁷ raising the question of whether that country may be seeking to acquire a nuclear weapons capability.¹⁰⁸ Though foreign perceptions of an Argentine-Brazilian race to build nuclear weapons are often exaggerated,¹⁰⁹ the question deserves serious consideration.

Argentina could decide to construct nuclear weapons for various reasons: (1) a desire to counter the perceived threat of Brazilian economic and political influence in the rest of South America,

105. *Id.* at 261, 277-78. A major military conflict between Chile and Argentina could create strong incentives to develop such a capability. *See id.* at 277-78. Moreover, Brazil's security is further enhanced because all of its neighbors except Guyana, Suriname, and French Guiana are signatories to the Inter-American Treaty of Reciprocal Assistance, entered into force Dec. 3, 1948, 21 U.N.T.S. 77. There may be some doubt as to the continued effectiveness of the treaty, however, in view of the failure to apply its provisions to the Beagle Channel dispute and the February 1981 conflict between Peru and Ecuador.

106. Courtney, *supra* note 10, at 247-50.

107. Heavy water reactors (HWRs) use natural uranium and do not need to be shut down for refueling. The proliferation risk increases because there is no need for enrichment. The insertion and removal of fuel elements in violation of international safeguards is more difficult to detect as a result of continuous operation. Finally, Argentina has been building its own unsafeguarded, heavy-water production plant which is scheduled to go into operation in 1981. Courtney, *supra* note 10, at 247-49, 275. In late 1979 Argentina granted a contract to Sulzer, a Swiss firm, for the construction of a \$300 million demonstration plant for the production of heavy water. A significant factor in the choice of the Swiss firm was that, unlike the Canadian competition, the Swiss did not insist on "full-scope" safeguards as a condition of the transaction (the Canadian bid was reported to be 30% lower than the Swiss bid). *Id.* at 248-49. Although Swiss technology will be under the same type of "replication" safeguards as that transferred under the Brazilian-German agreement, *id.* at 249, the same types of problems in interpreting such restrictions are likely to occur. *See* note 155 *infra*.

108. J. GOLDBERG, *supra* note 60, at 39, 76 (1978); *see* Waisman, *Incentives for Nuclear Proliferation: The Case of Argentina*, in *NUCLEAR PROLIFERATION AND THE NEAR-NUCLEAR COUNTRIES* 279 (O. Marwah & A. Schulz eds. 1975).

109. *See, e.g.*, Lowrance, *Nuclear Futures for Sale*, in *INTERNATIONAL ARRANGEMENTS FOR NUCLEAR FUEL REPROCESSING* 201, 201 (A. Chayes & W. Lewis eds. 1977). *See also* M. SCENNA, *ARGENTINA-BRASIL: CUATRO SIGLOS DE RIVALIDAD* (1975).

through acquisition of the presumed prestige and bargaining power accruing to a nuclear weapons state; (2) compensation for Brazil's conventional military strength in order to avoid falling into the situation of perceived military vulnerability; (3) fear that Brazil may be developing nuclear weapons, and a determination to preclude Brazil from acquiring a unilateral nuclear weapons advantage; (4) a decision to acquire a nuclear capability in order to be in a position of military dominance in any future disputes with Chile, or in any military confrontation involving Peru, Bolivia, and Chile;¹¹⁰ or (5) an attempt by one faction of the military to gain influence within the government by adopting a hardline posture and controlling development and deployment of nuclear weapons.¹¹¹

110. Argentina's bellicose attitude in the Beagle Channel dispute with Chile gives cause for reflection. See Courtney, *supra* note 10, at 261-62.

111. Argentina's perceptions of Brazil's intentions and capabilities are likely to have a considerable impact on Argentina's own decisions. The following statement in an Argentine military journal in 1975 is particularly revealing in this connection:

Given the available facts, *it is possible to affirm that (Brazil) has taken the firm decision to join the Nuclear Club, that is, to make an atom bomb under the concept of peaceful uses The decision to manufacture the nuclear explosive and the opportunity are critical for Argentina, since our neighbor's nuclear device, without a counterpoise, will affect our security palpably and decidedly.* (Emphasis in the original.)

J. Guglielmelli, *Y si Brasil fabrica la bomba atómica?*, ESTRATEGIA MAY 1975 at 13-14, quoted in Gall, *supra* note 70, at 188-89. See also J. GUGLIALMELLI, ARGENTINA, BRASIL Y LA BOMBA ATÓMICA (1976); d' Adesky, *Brazil's Rise to Dominance in Latin America*, 3 FLETCHER FORUM 46, 48 (1979). For an indirect suggestion from one of the chief defenders of the Brazil's nuclear program that the acquisition of an eventual nuclear weapons capability was one of the benefits of the 1975 German accord, see V. NOBREGA, *supra* note 66, at 224-25:

Other countries like France and India, were able to enter the nuclear field and build their atomic bombs. Thus, Brazil, upon entering the atomic era and considering her pacifist tendencies, which have been more than amply demonstrated in the course of history, acquired a greater capability to halt the expansion of Marxist imperialism—which is indispensable to provide for the security of the State, and hence the climate of tranquility, progress and peace for which we all yearn.

Such perceptions were certainly not diluted by a comment in an official Brazilian military journal that, "a simple agreement like Itaipu would be impossible if one of our neighbors had 20 kilos of plutonium." de Castro, *A Energia Nuclear no Brasil*, A DEFESA NACIONAL, Jan.-Feb. 1974, at 63, quoted in Gall, *supra* note 70, at 184.

Argentina has in the past possessed an unsafeguarded reprocessing facility,

Brazil presently has no extra-continental motive for developing nuclear weapons. Whether this will continue to be the case turns largely upon whether the nuclear weapons states attempt to freeze the international power structure, and on the type of world order, including economic arrangements, which develops in the next fifty to one hundred years.¹¹² Should vertical proliferation continue unabated while nuclear powers use their nuclear military advantage as an economic and political weapon,¹¹³ it would be de-

and a recent decision to proceed with the construction of a new one raises questions. See Courtney, *supra* note 10, at 249-50; Redick, *Regional Restraint: U.S. Nuclear Policy and Latin America*, 22 ORBIS 161, 167 (1978); Benjamin, *Nations Thinking Nuclear Worry About Neighbors*, Washington Post, Dec. 8, 1978, at A16, col. 1.

While Argentina publicly maintains it is not worried about Brazil obtaining nuclear weapons, officials have privately defended their decision to construct an experimental reprocessing plant on the grounds that Brazil will do likewise, and they cannot allow Brazil to get ahead in nuclear technology. Washington Post, Dec. 8, 1978, at A16, col. 1. During his visit to Brazil in November 1978, Secretary of State Vance reportedly transmitted to his hosts an Argentine message that if Brazil were to proceed with reprocessing, Argentina would do likewise. VEJA, Nov. 30, 1978, at 20, 23. With respect to Argentine intentions regarding the development of nuclear weapons, and early indications this was a strong possibility, see J. REDICK, *supra* note 71, at 15-17. Moreover, it should be noted that unlike Brazil, Argentina has never ratified the 1963 Limited Test Ban Treaty. J. REDICK, *supra* note 71, at 71; U.S. DEP'T OF STATE, TREATIES IN FORCE 320 (1981); Limited Test Ban Treaty, *supra*, note 17.

In May, 1980, Brazil and Argentina concluded agreements for cooperation in the field of nuclear energy, including cooperation in research on reactors, exchanges of nuclear materials, uranium prospecting, and the manufacture of fuel elements. See Courtney, *supra* note 10, at 258; Redick, *supra* note 54, at 129-33. While this agreement could help to moderate fears, should Argentina develop nuclear weapons Brazil would desire to do likewise. See Courtney, *supra* note 10, at 277-78; Treverton, *supra* note 100, at 41-45.

112. The following statement by a leading Brazilian strategist indicates that adverse developments in Africa could affect more than the security of shipping lanes and oil supplies:

[T]he moment that a military power hostile to Brazil occupies the Atlantic coast of Africa, at any point—from Morocco to South Africa—we will begin to feel a climate of uneasiness and of war-like pressure in our country without precedent in our history. That is because, today, even a base of intermediate-range rockets installed on the West African salient could easily threaten a long strip of our Northeast bulge.

C. DE MEIRA MATTOS, BRASIL: GEOPOLITICA E DESTINO (1975), *quoted in* R. SCHNEIDER, *supra* note 45, at 75.

113. See H. MÜLLER, ENERGIEPOLITIK, NUKLEAREXPORT UND DIE WEITERVERBREITUNG VON KERNWAFFEN 15-16 (1978). Failure to make real progress on the

sirable for Brazil to acquire the technological capability to produce nuclear weapons. If the world situation were then to deteriorate, Brazil would be in a strong position to defend itself and to bargain in economic and political arenas.¹¹⁴ A desirable strategy to maximize Brazil's military security would include the following elements: (1) acquisition of the technological base required to

halting of vertical proliferation (*i.e.*, quantitative and qualitative increases in the nuclear arsenals of the nuclear weapons states) has been severely criticized by non-nuclear weapons states. During his visit to West Germany in March 1978, Brazilian President Ernesto Geisel responded to United States pressure for Brazil to forego reprocessing by calling for "an urgent cessation of the arms race, above all in the nuclear area." *VEJA*, Mar. 15, 1978, at 16. The Non-Proliferation Treaty provides in article 6: "Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." Non-Proliferation Treaty, *supra* note 21, art. 6. Non-compliance with article 6 was the focal point of the deep divisions between the nuclear weapons states and the non-nuclear weapons states at the 1975 Non-Proliferation Treaty Review Conference. See W. EPSTEIN, *RETROSPECTIVE ON THE NPT REVIEW CONFERENCE: PROPOSALS FOR THE FUTURE* (1975); 1 M. SHAKER, *THE NUCLEAR NON-PROLIFERATION TREATY 447-70* (1980); STOCKHOLM INTERNATIONAL PEACE RESEARCH INSTITUTE, *THE NPT: THE MAIN POLITICAL BARRIER TO NUCLEAR WEAPONS PROLIFERATION 10-12, 34-38* (1980) [hereinafter cited as SIPRI]. Moreover, Yugoslavia threatened to withdraw from the NPT regime because of the attitude of the United States and the Soviet Union on implementation of art. 6. H. MÜLLER, *supra* at 16. For a summary of the 1980 Non-Proliferation Treaty Review Conference, see U.S. ARMS CONTROL AND DISARMAMENT AGENCY, *1980 REVIEW CONFERENCE OF THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS* (1980).

The failure of the United States to ratify the SALT II Treaty has clearly deepened the dissatisfaction of the non-nuclear weapons states over the failure to implement article 6 of the Non-Proliferation Treaty. A basic contradiction exists between the great priority given to the development of nuclear forces by the United States and the Soviet Union, on the one hand, and their insistence that non-nuclear weapons states permanently forego the development of such weapons. These nuclear powers do not recognize that the actions they take, based on the presupposition that military and nuclear power will be decisive in resolving disputes, have a profound impact on policy makers in non-nuclear weapons states. See generally H. MÜLLER, *supra* at 17, 36-37, 49.

114. Brazil has the most advanced rocket program in Latin America. After collaborating closely with West Germany, over 400 rockets had been launched by 1972. J. REDICK, *supra* note 71, at 24-25. In addition, its air force is the most advanced in Latin America. Rosenbaum, *Brazil's Nuclear Aspirations*, in *NUCLEAR PROLIFERATION AND THE NEAR-NUCLEAR COUNTRIES* 255, 265. (O. Marwah & A. Schulz eds. 1975).

build nuclear weapons, as a hedge against a breakdown in the non-proliferation regime or adverse developments in the evolution of the international economic and political order; (2) maintenance of a capability to use sufficient plutonium or highly enriched uranium to exercise the nuclear weapons option within a relatively short time of perhaps one to two years should such adverse developments occur;¹¹⁵ and (3) contribution to international efforts to maintain and strengthen the non-proliferation regime in order to avoid the medium or long-term spread of nuclear weapons.

4. Building a New International Order: International Relations Based on Non-Discrimination and Mutual Respect

To achieve its fundamental goal of occupying a position among the world's nations which corresponds to its size, population, and increasing national capabilities, Brazil must continue its efforts to avoid a freezing of the international power structure. Indeed, it must attempt to "thaw" the rigidities which currently exist.¹¹⁶ All foreign policy actions consequently must be examined in terms of whether they reinforce the discriminatory tendencies of the pre-

115. For the suggestion that Brazil is indeed pursuing the nuclear weapons option, see note 111 *supra* and accompanying text; Klein, *Lasst uns doch die Atombombe Fassen!*, in *DAS DEUTSCH-BRASILIANISCHE ATOMGESCHAFT* 29-36 (2d rev. ed. 1977).

116. See Araujo Castro, *supra* note 49; Araujo Castro, *O Congelamiento do Poder Mundial*, 33 *REVISTA BRASILEIRA DE ESTUDOS POLITICOS* 7-30 (1972).

Araujo Castro, a former foreign minister who served as Brazil's Ambassador to the United Nations from 1967 to 1975, repeatedly cited the Nuclear Non-Proliferation Treaty of 1968 as the key to the nuclear powers' attempt to freeze the current international power structure. R. SCHNEIDER, *supra* note 45, at 104 n.8. See also 47/48 *BOLETIM DA SOCIEDADE BRASILEIRA DE DIREITO INTERNACIONAL* 95-97 (1968) (aide-memoire delivered by Brazilian government to Latin American foreign ministries in April of 1968); Rosenbaum & Cooper, *Brazil and the Nuclear Non-Proliferation Treaty*, 46 *INT'L AFF.* 74 (1970)

Foreign Minister Azevedo da Silveira stressed this point in a speech given on November 18, 1975, on the occasion of the entry into force of the Brazilian-German Agreement:

After careful evaluation of the potentialities of our cooperation, we have both reached the conclusion that, in the world of today, only the courage to innovate and to make bold will permit us to break the vicious circle which condemns nations to an international social stratification, with the growing problems and inevitable dangers which attend it.

7 *RESENHA DE POLITICA EXTERIOR DO BRASIL* 96 (1975) (emphasis in original) (translated from Portuguese). See also J. REDICK, *supra* note 71, at 27-38.

sent international economic and political order, or rather contribute to an increasing fluidity in the various international "games" in which nations compete for wealth, power, and influence. To accede to unilateral demands based on threats such as those implicit in the United States Nuclear Non-Proliferation Act of 1978¹¹⁷ would be to weaken Brazil's credibility and capacity for coalition-building among both developing and developed nations. The acceptance of weighted voting formulas would similarly weaken Brazil's drive for more equitable voting procedures in international fora such as the United Nations Security Council.

5. The Maintenance of Good Relations with Both Developing and Industrialized Nations

Brazil must maintain good relations with the broadest possible range of nations, including the developing countries, in order to maximize its independence and freedom of action, and to promote the gradual restructuring of the international economic and political order. In the nuclear area, good relations should contribute to a significant export market for enriched uranium, reprocessing services, and eventually nuclear reactors and parts. Similarly, healthy relations with the industrialized countries are of vital importance in order to secure strong sources of technology, capital imports, and private investment. Industrialized nations also provide markets for manufactured as well as traditional exports. The following examples illustrate the importance of harmonious relations with countries possessing nuclear power.

(a) Federal Republic of Germany

West Germany is of obvious importance¹¹⁸ in view of our 1975 agreement for the acquisition of technology for the full nuclear fuel cycle.¹¹⁹ Under a subsidiary agreement, Germany has further

117. See, e.g., Hildenbrand, *A German Reaction to U.S. Non-Proliferation Policy*, 3 INT'L SECURITY 5 (1978); Williams, *The United States Congress and Non-Proliferation*, 3 INT'L SECURITY 45 (1978); notes 141-45 *infra* and accompanying text.

118. On Brazilian-West German relations in general, see W. GRABENDORFF & M. NITSCH, *BRASIL: ENTWICKLUNGSMODELL UND AUSSENPOLITIK* (1977); C. VON DOELLINGER, *A STUDY IN INTERNATIONAL ECONOMIC RELATIONS: THE BRAZILIAN-GERMAN CASE* (1979).

119. German-Brazilian relations in the nuclear field were underway well before the signing of the 1975 accord. Following the National Security Council

undertaken to supply Brazil with enriched uranium, produced in URENCO,¹²⁰ for our power reactors until national production meets our needs. This is of critical importance for the fuel supply for the Angra II and III reactors,¹²¹ and would be equally important for Angra I should the United States decide to renege on its obligations. In addition, the politicization of the world uranium market, brought about chiefly by the United States,¹²² will make Brazil an even more attractive source of natural uranium. Under our agreements with the Federal Republic, Brazil will supply Germany with twenty percent of its uranium production in excess of

resolution in October 1967, which established an independent nuclear energy capability as a permanent national objective, Brazil and Germany signed a scientific and technological cooperation agreement on June 9, 1969, and Brazil's National Nuclear Energy Commission entered into a cooperation agreement with Germany's Jülich Nuclear Research Center in April 1971. R. SCHNEIDER, *supra* note 45, at 91-92. Under the 1969 agreement, there was speculation that Brazil and West Germany were to cooperate in research on the gas centrifuge enrichment process. J. REDICK, *supra* note 71, at 20-24. Earlier efforts by Brazil in 1953 to acquire three prototype gas ultrafuges for uranium enrichment from West Germany were blocked by United States occupation authorities. R. SCHNEIDER, *supra* note 45, at 48-49.

For an overview of German nuclear policies and the economic and political considerations which support them, see H. MÜLLER, *supra* note 113; Häckel, *West Germany's Nuclear Export Policy*, in *NUCLEAR PROLIFERATION IN DEVELOPING COUNTRIES* 39-64 (J. Park ed. 1979); Hildenbrand, *Nuclear Energy, Nuclear Exports, and the Non-Proliferation of Nuclear Weapons*, in *INTERNATIONALIZATION: AN ALTERNATIVE TO NUCLEAR PROLIFERATION* 83-107 (1980); von Preuschen, *Nichtverbreitungspolitik und Nuklearexport*, 23 *RECHT DER INTERNATIONALEN WIRTSCHAFT* 741-44 (1977).

120. 5 RESENHA DE POLITICA EXTERIOR DO BRASIL 19, 22 (1975).

121. The Angra I and Angra II reactors are scheduled to begin operation before Brazil's production of enriched uranium (made possible by the 1975 agreement with Germany) is adequate to satisfy its fuel requirements. Principal factors behind Brazil's agreement with Germany were the temporary suspension by the United States Atomic Energy Agency of all new enrichment services contracts on December 8, 1972; the Agency's replacement of requirements contracts with fixed commitment contracts in September 1973; and in June 1974, the Agency's suspension of the signing of all new contracts for future supplies of enriched uranium, and retroactive classification as conditioning on available capacity of enrichment services contracts for forty-five foreign reactors, including two in Brazil. Coupled with the disruption in oil supplies during and after the Middle East war in October 1973, these actions deepened Brazil's sense of insecurity regarding future supplies of enriched uranium. Franko, *U.S. Regulation of the Spread of Nuclear Technologies Through Supplier Power: Lever or Boomerang?*, 10 *L. & POL'Y INT'L BUS.* 1181, 1183-94 (1978).

122. See generally Franko, *supra* note 121.

that needed for national consumption.¹²³

(b) France

The maintenance of good relations with France is of great importance to our nuclear program because of our agreement (concluded shortly after the German deal) to proceed with joint development of the COBRA fast breeder reactor.¹²⁴ The advanced nuclear technology supplied by France will help reduce our long-term dependence on the West Germans.¹²⁵

(c) United States

Despite present difficulties, good relations with the United States are of obvious importance for Brazil. In 1978 United States banks held between four and one-half and six billion dollars in Brazilian debts;¹²⁶ further, these banks are a vital source of the foreign investment needed to finance our industrial growth. At the same time, open access to United States markets for our manufactured products is highly desirable. The United States represents a valuable source of advanced technology in alternate energy fields and in the oil industry. We are at least ten years behind the United States in the development of solar energy, and we could benefit from the developing technology for the extraction of shale oil. In the future, Brazil will also desire access to fusion technology, in which the United States is quite advanced.

It is desirable for nuclear energy in Brazil that the United States comply with its commitment under our 1972 cooperation agreement to supply up to 12,300 kilograms of U-235 uranium for Angra I.¹²⁷ Although no longer essential in view of our agreement

123. VEJA, Nov. 8, 1978, at 130-31.

124. R. SCHNEIDER, *supra* note 45, at 116.

125. Brazil's cooperation with France began as early as May 1967 with a nuclear cooperation agreement between the two nations, which included research on thorium reactors, and apparently on gas centrifuge enrichment as well. See J. REDICK, *supra* note 71, at 20.

126. Figures were reported in VEJA, Mar. 29, 1978, at 22. In 1981 the United States reportedly held \$16 billion in loans to Brazil, and another \$7 billion in investments. U.S. NATIONAL INTEREST IN LATIN AMERICA: HEARINGS BEFORE THE SUBCOMM. ON INTER-AMERICAN AFFAIRS OF THE HOUSE COMM. ON FOREIGN AFFAIRS, 97th Cong., 1st Sess. 18 (1981) (statement of Constantine C. Menges).

127. Agreement Concerning Civil Uses of Atomic Energy, July 17, 1972, United States-Brazil, 23 U.S.T. 2477, T.I.A.S. No. 7439 arts. VII-IX [hereinafter cited as 1972 Cooperation Agreement]. United States restrictions on the supply

with Germany, an overabundance of assured supplies of uranium would be advantageous in view of the chaotic nature of the world market. More important than fuel supplies, however, would be access to advanced technology, including waste disposal technology developed under the United States military program and laser-separation enrichment technology,¹²⁸ which could prove much cheaper than our jet-nozzle process. The provisions of the Nuclear Non-Proliferation Act of 1978,¹²⁹ however, severely inhibit our access to United States nuclear technology. In fact, the Act could threaten our supply of URENCO-produced fuel from West Germany.¹³⁰ It is thus in our long-term interest to reach an accommodation with the United States.

6. Optimal Impact of Energy Choices on Brazil's Balance of Payments

A fifteen billion dollar cost for acquisition of full fuel-cycle technology and eight 1300 KWe reactors by 1990 is certainly not excessive compared to Brazil's present expenditure of some thirteen billion dollars a year for oil imports.¹³¹ These costs eventually would be recovered through exports of uranium, reprocessing services, reactors and parts, and reduced oil imports. Moreover, seventy-five percent of these sums for construction would be spent in Brazil.¹³² Nonetheless, competing capital imports, foreign debt service, and an adverse trade balance could pose short-term

of nuclear fuel to Angra I and perceived violation by the United States in July 1974 of a long-term commitment to supplying nuclear fuel for the Angra II and III reactors contributed directly to the search for alternate sources which ultimately resulted in the 1975 German-Brazilian accord (and rejection of Westinghouse reactors for Angra II and III). The ability to withhold fuel elements from Brazilian reactors, once they have begun to supply a significant portion of the nation's electricity, could pose a serious threat to the nation's economy. See R. SCHNEIDER, *supra* note 45, at 50-51, 92.

128. See K. MIROW, *supra* note 44, at 148 (Brazil's potential interest in laser-separation technology).

129. 22 U.S.C. §§ 3201-3282 (Supp. III 1979); see note 117 *supra*.

130. See note 145 *infra*.

131. See notes 64 & 65 *supra*.

132. In October 1978 the government estimated that the cost of constructing all eight reactors under the agreement with West Germany would be \$15 billion. VEJA, Oct. 18, 1978, at 33. See also VEJA, Nov. 8, 1978, at 35; O Estado de São Paulo, Oct. 11, 1978 at 8, col. 1. Since 1978, however, estimates have continued to soar, and it is now believed that the total cost may reach \$30 billion. Redick, *supra* note 54, at 124.

difficulties,¹³³ in which case the timetable could be extended and, if necessary, the total number of reactors could be reduced (Brazil was originally obligated to buy only two).¹³⁴ If possible, however, the full complement of reactors should be purchased in order to maintain a healthy working relationship with the West Germans.

7. Non-Proliferation and Disarmament

Beyond the purely military considerations discussed above, Brazil has a strong interest in avoiding the spread of nuclear weapons. A breakdown in the non-proliferation regime would require Brazil to divert scarce resources from economic development to the development of nuclear weapons and delivery systems. The international breakdown which might then ensue would require other military expenses as well. Horizontal nuclear proliferation would dim prospects for halting vertical proliferation, increase the importance of military as opposed to economic power in political bargaining, and make it much more difficult for Brazil to achieve its fundamental national goals.

B. *Establishment of an International Depositary for Separated Plutonium*

The International Fuel Cycle Evaluation (INFCE), which began in October 1977 and concluded in February 1980,¹³⁵ examined issues related to the availability of nuclear energy to meet the world's urgent energy requirements, and the mitigation of the dangerous spread of nuclear weapons. INFCE was divided into eight working groups. Working Group Four was charged with the task of evaluating issues concerning reprocessing, plutonium handling, recycling in thermal reactors, and special needs of developing countries.

After examining various aspects of a possible International Plutonium Storage regime, Working Group Four reported that the IAEA Expert Group on International Plutonium Storage was continuing its discussions regarding the establishment of such a re-

133. See *Atomgeschäft: Milliarden-Pleite in Brasilien?*, DER SPIEGEL, No. 38, at 124 (1978); O Estado de São Paulo, Oct. 11, 1978, at 8, col. 2.

134. T. WINKLER, DIE NUKLEARPOLITIK DER SCHWELLENMACHTE 41 (1980).

135. For a complete summary of International Nuclear Fuel Cycle Evaluation proceedings and findings, see SUMMARY, *supra* note 14. See also notes 34-37 *supra* and accompanying text.

gime. The following issues were under consideration:

the location of stores; the form in which plutonium should be stored; the management and operation of stores; the conditions that should be attached to its release; the legal basis for the scheme; and what form the scheme's controlling body should take and what powers it should have . . .¹³⁶

Working Group Four concluded:

International Plutonium storage appears an attractive proposition because it could co-exist with all of the other institutional models described (*i.e.*, other international arrangements) and it would reduce the proliferation risks of one of the sensitive features of reprocessing and recycling.

Assurance of supply of plutonium could be enhanced by the introduction of IPS, if it secured international agreement on universally applicable and non-discriminatory conditions, accepted by participants for the release and use of plutonium. In addition, IAEA involvement could increase international confidence in the system . . .¹³⁷

Deliberations on the establishment of an IPS regime are now continuing within the framework of the IAEA Expert Group on International Plutonium Storage.¹³⁸

Brazil has participated in INFCE and is currently participating in the deliberations of the Expert Group on IPS, which is expected to reach agreement on a draft IPS regime by the end of 1982.¹³⁹ Consequently, Brazil must determine which type of IPS regime it would be willing to support.

1. National Interests: A Recapitulation

The immediate question confronting Brazil is what general attitude should be adopted in the Expert Group on IPS during these continuing discussions. It is by no means certain that *any* international depositary for plutonium would be acceptable to us, although it is possible that a certain type of scheme could offer advantages through the simultaneous reduction of non-proliferation

136. INTERNATIONAL NUCLEAR FUEL CYCLE EVALUATION, REPROCESSING, PLUTONIUM HANDLING, RECYCLING 180-81 (1980).

137. *Id.* at 185. See also *id.* at 165-66, 188, 212; SUMMARY, *supra* note 14, at 43, 45-46, 48, 155.

138. See notes 38-41 *supra* and accompanying text.

139. See note 39 *supra* and accompanying text.

pressures and shoring up of the non-proliferation regime.

Moderate benefits could accrue from the establishment of a depository satisfactory to Brazil. First, under the terms of the United States Nuclear Non-Proliferation Act of 1978,¹⁴⁰ no plutonium transferred or produced through any facility pursuant to any new agreements for cooperation in the field of atomic energy "will be stored in any facility that has not been approved in advance by the United States."¹⁴¹ The statute mandates that the President immediately commence efforts to renegotiate existing cooperation agreements (e.g., the 1972 agreement with Brazil)¹⁴² in order to incorporate this new standard¹⁴³ and to "vigorously seek to obtain the application of such [new] provisions" with respect to nuclear materials and equipment already contracted for under preexisting agreements (e.g., the contract to supply enriched uranium to Angra I pursuant to the 1972 Brazilian-United States cooperation agreement).¹⁴⁴ United States approval is also required whenever Brazil imports such materials or equipment from a third state with which the United States has successfully renegotiated a corresponding cooperation agreement.¹⁴⁵ The establishment of an international depository for plutonium would remove at least this issue from contention, while perhaps contributing to international pressures for repeal of other objectionable provisions in the Act.

Second, and far more important, the establishment of an international depository for plutonium would satisfy the condition included, at Dutch insistence in our September 1978 agreement for the supply of enriched uranium from URENCO.¹⁴⁶ Under the terms of a 1975 agreement with West Germany, such uranium will

140. 22 U.S.C. §§ 3201-3282 (Supp. III 1979).

141. Atomic Energy Act of 1954 § 123(a)(8), as amended by Nuclear Non-Proliferation Act of 1978 § 401, 42 U.S.C. § 2153(a)(8) (Supp. III 1979).

142. See Agreement for Application of Safeguards, July 27, 1972, International Atomic Energy Agency-United States-Brazil, 23 U.S.T. 2526, T.I.A.S. No. 7440 [hereinafter cited as Tripartite Agreement]; note 127 *supra*.

143. See, e.g., Williams, *supra* note 117; Bettauer, *The Nuclear Non-Proliferation Act of 1978*, 10 L. & POL'Y INT'L BUS. 1105 (1978); Franko, *supra* note 121.

144. Nuclear Non-Proliferation Act § 404(a), 42 U.S.C. § 2153c(a) (Supp. III 1979); see *id.* §§ 2153d(b), 2153f(b).

145. *Id.* § 2153(a)(9).

146. See NUCLEAR NEWS, Oct. 1978, at 41-42; *id.*, Apr. 1978, at 13, 143; notes 120 & 121 *supra*.

be provided until we are self-sufficient in national production.¹⁴⁷ The agreement with the states participating in URENCO¹⁴⁸ provides that all plutonium produced with URENCO-supplied uranium must be protected by (1) the establishment by the IAEA of a universally applicable safeguards system for the storage of plutonium (the subject of current IPS discussions);¹⁴⁹ or (2) an ad hoc storage arrangement for such plutonium under IAEA safeguards, including those established in article XII(A) of the IAEA Statute.¹⁵⁰ Establishment of an acceptable international scheme for the deposit of plutonium would thus obviate the need for any ad hoc arrangements. Moreover, given the adamant attitude of the Dutch Parliament, a regime established pursuant to consensus in the Expert Group on IPS might be much less objectionable than an ad hoc arrangement negotiated with the British, Dutch, and Germans. On the other hand, any depositary that would be unacceptable to Brazil should be opposed in the IPS Expert Group, since it could become binding under the terms of the URENCO agreement.

While an international plutonium depositary might alleviate possible friction with the United States and the URENCO countries, perhaps ultimately facilitating technology transfer and good relations, no regime for the deposit of plutonium should be accepted if it entails substantial loss of control over the disposition of plutonium produced in Brazil and needed for our light water and breeder reactors. The surrender of such control to an international body, however benign the ostensible purpose, would defeat the central goal of energy independence for our nuclear program.¹⁵¹

Additional national interests must be weighed carefully in assessing any proposal. Considerations of military security cannot

147. See also notes 120 & 121 *supra* and accompanying text.

148. NUCLEAR NEWS, Oct. 1978, at 41-42.

149. *Id.* On current IPS negotiations, see notes 38-41 *supra*.

150. Statute of the International Atomic Energy Agency, Oct. 26, 1956, 8 U.S.T. 1093, T.I.A.S. No. 3873, 276 U.N.T.S. 3 [hereinafter cited as IAEA Statute]. Details on the Brazil-URENCO agreement of September 1, 1978, are found in NUCLEAR NEWS, Oct. 1978, at 41-42. For a comprehensive treatment of International Atomic Energy Agency safeguards, see INTERNATIONAL ATOMIC ENERGY AGENCY, NON-PROLIFERATION AND INTERNATIONAL SAFEGUARDS (1978).

151. See R. SCHNEIDER, *supra* note 45, at 50; note 76 *supra* and accompanying text.

be overlooked. The de facto full-scope safeguards¹⁵² to which we are subject apply only to material and technology acquired from the United States and West Germany.¹⁵³ Brazil consequently is under no legal restriction against the production of plutonium in non-safeguarded facilities such as research reactors, provided no use is made of United States or German nuclear materials and equipment or German technology¹⁵⁴ (the latter being susceptible to differing interpretations).¹⁵⁵ Similarly, there is at present no

152. "Full-scope" safeguards are those which apply to all nuclear activities within a country. De facto "full-scope" safeguards do not create a legal obligation to necessarily submit all future nuclear activities to IAEA safeguards. See, e.g., W. DONNELLY & B. RATHER, NUCLEAR WEAPONS PROLIFERATION AND THE INTERNATIONAL ATOMIC ENERGY AGENCY, S. DOC. NO. 402-3, 94th Cong., 2d Sess. 63-120 (1976); OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS, NUCLEAR PROLIFERATION AND SAFEGUARDS 151-74, 205-25 (1977).

153. See Tripartite Agreement, *supra* note 142; Agreement Between the International Atomic Energy Agency, Brazil, and the Federal Republic of Germany for the Application of Safeguards, Feb. 26, 1976, reprinted in G. FAHL, INTERNATIONALES RECHT DER RÜSTUNGSBESCHRÄNKUNG § 5.3.7.2 (1976) (German text and English translation) [hereinafter cited as Safeguards Agreement].

For the text of the 1975 cooperation agreement, see Brazilian-German Agreement, *supra* note 42. During the visit of Secretary of State Vance to Brazil in November 1978, Brazil stated that it would be prepared to accept any new safeguards established by the IAEA. VEJA, Nov. 30, 1978, at 20-22.

154. See notes 81-89 *supra* and accompanying text.

155. Under the tripartite safeguards agreement between Brazil, the Federal Republic of Germany, and the IAEA, all nuclear material and "relevant technological information" transferred to Brazil from West Germany is covered by IAEA safeguards which prohibit their use "for the manufacture of any nuclear weapon or to further any other military purpose or for the manufacture of any other nuclear explosive device." Safeguards Agreement, *supra* note 153, art. 2. The Safeguards Agreement is to remain in force until all nuclear material subject to safeguards under the agreement, including subsequent generations of produced special fissionable material, have been removed from safeguards established in the agreement (*i.e.*, by transfer to a foreign recipient under safeguards or by being consumed and no longer representing a proliferation risk). *Id.* arts. 13, 28. Moreover, even after the agreement has terminated, the design, construction, or operation of any facility or equipment for the preparation or processing of nuclear material with the use of transferred sensitive technology (relevant technological information) will cause the safeguards agreement to be automatically reinstated. *Id.* art. 28. Finally, for a period of twenty years following transfer of the technology, any nuclear facility or sensitive equipment that is designed, constructed, or operated on the basis of "the same physical or chemical process or processes" as those transferred from Germany to Brazil, "shall be deemed" to be the product of the transfer of safeguarded "relevant technological information." *Id.* art. 3(2).

legal restriction preventing Brazilian production and detonation of PNEs, provided only unsafeguarded resources are employed.¹⁵⁶

These safeguards are extremely comprehensive and have led many to conclude that the transfer of technology from Germany could not be used by Brazil to build nuclear weapons or PNEs without flagrantly violating the safeguards agreement. *See, e.g.,* Courtney, *supra* note 10, at 246. Unfortunately the issue is far more complicated than it first appears. While the "relevant technological information" protected by these replication safeguards applies to sensitive activities such as enrichment and reprocessing, this term is defined as "excepting technological information available to the public." Safeguards Agreement, *supra* note 153, art. 1(d). Consequently, Brazil might plausibly argue that the construction of an unsafeguarded enrichment or reprocessing plant was based on information in the public domain when the transfer took place, and consequently, the facility was not subject to the safeguards contained in the agreement. Brazil could even claim that a facility was based on information that had come into the public domain subsequent to the original transfer. This is a credible argument since

The necessary knowledge for going the plutonium route on a small scale is already in the public domain, as is much information about the Becker nozzle process. As for the other uranium enrichment processes, probably the best that can be expected is a slight delay in the diffusion of knowledge

Rathjens & Carnesale, *The Nuclear Fuel Cycle and Nuclear Proliferation in INTERNATIONAL ARRANGEMENTS FOR NUCLEAR FUEL REPROCESSING* 3, 6 (A. Chayes & B. Lewis eds. 1977).

Under the Safeguards Agreement, Brazil must notify the IAEA of "relevant technological information" which has been transferred. West Germany is under an obligation to consult with Brazil if it believes a notification to the Agency should have been made and was not, and to report any disagreement to the IAEA. Safeguards Agreements, *supra* note 153, art. 6. While one need not cynically infer that commercial incentives for such German consultations and notification to the Agency are lacking, the fact remains that the primary burden is on Brazil.

Any disputes which arise are to be submitted to an arbitral tribunal. If only two parties are concerned, each shall name an arbitrator and those so named will choose a third; if all three parties are involved, each is to select an arbitrator, and the three so selected shall name a fourth arbitrator as chairman, plus a fifth member of the panel. Decisions of the arbitral tribunal are to be made by a majority of two or three votes, respectively. *Id.* art. 23. Viewing these provisions of the agreement together, there would appear to be considerable room for Brazil to argue that its construction of an unsafeguarded enrichment plant or reprocessing facility did not violate any of the terms of the tripartite safeguards agreement of February 26, 1976.

156. Assuming a deliberate decision to build a bomb or PNE, IAEA safeguards on all commercial facilities would not prevent Brazil from constructing a plutonium production reactor and small reprocessing plant to produce weapons grade plutonium. A "dedicated" facility of this type could be constructed for as

Brazil may also store its plutonium as it chooses unless it is a product of United States material or equipment.¹⁵⁷ This situation could change drastically if Brazil were to agree to subject all of its plutonium to the authority of the international depositary, especially in view of the express language in article XII(A)(5) of the IAEA Statute which refers to use "for research or in reactors."¹⁵⁸ Furthermore, if Brazil were to agree to place all of its plutonium under the authority of the international depositary, it would be highly desirable, if not essential, that one of the plutonium depositories be located in Brazil and owned and operated by Brazilians. Only under such conditions would Brazil retain a feasible option

little as \$50 million. See Betts, *Paranooids, Pygmies, Pariahs and Non-Proliferation*, 26 FOREIGN POLICY 157, 161 (1977). For a comprehensive discussion of the range of possible dedicated facilities, including enrichment plants, see OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS, NUCLEAR PROLIFERATION AND SAFEGUARDS 174-85 (1977). Although illegal, the clandestine construction of such facilities would be an option available even to countries which had ratified the NPT. The response by other countries, however, probably would be much harsher in the case of a direct violation of the principal prohibition in the NPT by a signatory, than in the case of the legal construction of such a facility by a country not under full-scope safeguards. Finally, Brazil clearly recognizes that a dedicated facility would constitute the preferred route to nuclear weapons assuming a deliberate decision to build the bomb. This is demonstrated by the following statement made in the course of a general defense of the nation's nuclear program:

Reason suggests the lack of justification of such suggestions (that the Brazilian-German nuclear agreement could be used for the fabrication of "nuclear devices") since, if we wanted such a program, we would have followed another strategy that is more direct and quicker, as has been the case in all of the countries which possess atomic weapons. (Author's translation.)

O Estado de São Paulo, Oct. 11, 1978, at 8, col. 2. Indeed, the direct route option to a weapons capability would appear to dominate the choices available to potential new entrants to the nuclear club. See, e.g., RATHJENS & CARNESALE, *supra* note 155, at 6; H. MÜLLER, *supra* note 113, at 22-25.

157. An important and highly relevant exception is established in the 1972 Brazilian-United States Cooperation Agreement which provides that the United States shall have the right "to approve facilities which are to be used for the storage of . . . [plutonium produced from United States-supplied materials or equipment] which is not required for atomic energy programs in the Federative Republic of Brazil." 1972 Cooperation Agreement, *supra* note 127, art. XI(B)(3). This "safeguard right" is to be applied by the United States "[e]xcept to the extent . . . [it is] suspended by virtue of the application of safeguards of the International Atomic Energy Agency. *Id.* art. XI(B). It is also highly relevant to the proper interpretation of the term "excess" in IAEA Statute, *supra* note 150, art. XII(A)(5).

158. IAEA Statute, *supra* note 150.

in response to certain unlikely but possible emergency contingencies. International ownership, management, and physical possession of the depository would increase the risks in exercising this option to an unacceptable degree.

2. Three Options

An international depository for plutonium could take a number of different forms. It will be useful to consider briefly three options available to Brazil.

(a) Option I: International Control of Plutonium

Under this option, the purpose of the international depository would be to decide whether a state's failure to deposit or its request for release of plutonium was justified. Such decisions would be made following pertinent investigations by the international staff within the territory of the country concerned. The depository would occupy a semi-autonomous relationship to the IAEA, with membership limited to those states producing or using plutonium. Decisions concerning deposit and release would be made according to a weighted formula which would ensure nuclear weapons and supplier states a preponderant voice in decisions. All plutonium in non-nuclear weapons states would be subject to the terms of the agreement, while no restrictions would be imposed on the military use of plutonium by the nuclear weapons states.

The criteria for deposit and release would be based on, but not limited to, the requirements in article XII(A)(5) of the IAEA Statute.¹⁵⁹ This provision could be interpreted broadly, and additional criteria for deposit or release could be established. Such criteria might include: (1) rules governing the amount of plutonium which could be held for use in an existing reactor (government statements would not be accepted at face value, but rather would be subjected to careful investigation and factual analysis); (2) prohibitions against release of plutonium to any reactor not physically under construction; and (3) requirements that plutonium be released for use only during a given time period. Additionally, provisions probably would be included permitting the progressive strengthening and development of other non-proliferation conditions, although such amendment procedures would not be so labeled.

159. *Id.*

Option I is clearly unacceptable in terms of the overall national interests of Brazil. Such an international regime would surrender vital decisions affecting our energy security and independence, and perhaps even military security, to an unpredictable international body. This option might leave Brazil at the mercy of countries which have in the past sought to block Brazil's acquisition of an independent nuclear capability.

(b) Option II: International Accountability for Plutonium Use

The purpose underlying this option would be to detect the diversion of plutonium from acceptable peaceful uses and, through certain enforcement procedures, to secure compliance with the decisions of the depositary following an official determination that such a diversion had occurred. An individual depositary would be owned, operated by, and located in any reprocessing state desiring to establish one with the understanding that the state would be required to deposit plutonium from a foreign country either voluntarily or when such an allocation decision had been made by the central depositary authority. Pursuant to the Agency's Statute, the functions of the secretariat and a small staff of inspectors would be fulfilled by the IAEA.

The criteria for deposit and release would be clearly established. All plutonium in participating states preferably would be subject to the accounting procedures of the depositary. Nuclear weapons states would be required to declare the amount of plutonium currently held for military purposes, and transfers to or from the civilian sector would be prohibited. Each nuclear weapons state would be required to donate three percent of its military plutonium to the IAEA each year, and no new plutonium could be produced for military purposes. Civilian plutonium would be subject to the requirements applicable to non-nuclear weapons states. If acceptance of such an arrangement is not forthcoming, the depositary regime could apply only to plutonium produced or used in commercial nuclear power programs, under universally applicable rules. Deposit of excess plutonium might be required by the depositary authority whenever a thorough investigation has established that there is no present or planned use for such plutonium in commercial power programs (or in research programs as well, should the nuclear weapons states agree to accountability for all plutonium). Release of deposited plutonium would be automatic upon a request stating it was intended for a non-military use. If it is subsequently ascertained that the pluto-

nium has been diverted from the approved use, the depositary would require its redeposit.

The decisionmaking body governing deposit and release would include all members of the depositary, and would be established as a special committee of the IAEA General Conference. Decisions requiring deposit would be made by a two-thirds majority, and appeals by a state would be made first to the Board of Governors, and finally to the General Conference of the Agency. A decision ordering deposit would have to be upheld by a two-thirds majority of the Board before physical deposit actually would be required. Should the General Conference fail to uphold the original decision, the plutonium would be returned immediately to the appellant state.

The depositary would be established pursuant to an amendment to the IAEA Statute establishing a special committee of the General Conference (to be known as the Committee on Uniform Plutonium Accountability or CUPA). Membership and voting requirements of CUPA, procedures for appeal, related matters, and the obligations of member states would be set forth in a special Protocol to the IAEA Statute, and would be included by reference in the amendment to the Statute itself. The Protocol would have the status of a treaty and would come into effect only after it had been ratified by four-fifths of all states engaged or planning to engage in the commercial production or use of plutonium.

(c) Option III: Non-Participation in Any International
Depositary for Plutonium

Should the Expert Group on IPS reach a consensus on the establishment of a depositary, and should such a depositary come into being with broad participation, Brazil would always have the option of not participating. However, such a decision might entail certain costs. First, the details of the ad hoc storage arrangement with URENCO would have to be worked out and thus could affect the supply of fuel to Angra II and III.¹⁶⁰ Second, Brazilian non-participation could lead to an increase in non-proliferation pressures. Should a seventh state explode a PNE, these pressures might even bring our agreements with West Germany into question.¹⁶¹ This is not likely, however. Third, Argentine anxieties

160. See note 121 *supra* and accompanying text.

161. The Israeli raid on the Iraqi Osirak reactor on June 7, 1981 suggests

might well be increased by such a decision, and a local nuclear arms race could ensue. Finally, if Brazil's refusal to participate persuades other states to follow suit, the depositary may not work, and the existing non-proliferation regime may begin to unravel. These disadvantageous results are not likely. Brazil and other countries could probably block consensus on an unacceptable regime. The matter could be referred for study to the IAEA General Conference or to a United Nations Conference on Problems of Non-Proliferation and Disarmament. By the time those bodies reached any decision, the whole idea could well be moot.¹⁶² However, should obstruction or refusal to participate be chosen as the course of action, Brazil would pay the costs involved in the unraveling of the non-proliferation regime.

3. Recommendation

Option II is the preferred alternative for Brazil. Details are provided in the draft Brazilian proposal, *infra*, which could be presented to the Expert Group on International Plutonium Storage. Certain provisions in our proposal (*e.g.*, CUPA authority over all plutonium in all countries), which are designed to shift the ground of debate in our favor, can be used as bargaining chips and dismissed if an acceptable scheme is offered. Our proposal makes no mention of the IAEA study on "The International Management of Plutonium."¹⁶³ The omission is deliberate, for we do not wish to call attention to proposals for international *control* of plutonium, but rather would prefer to shift the debate to schemes for international *accountability* for plutonium use.

Several other issues not fully discussed in the proposal for tactical reasons deserve mention here. First, article XII(A)(5) refers only to plutonium use "for research or in reactors,"¹⁶⁴ which raises the question of how Brazil can protect its capacity to manufacture and detonate PNEs.¹⁶⁵ It would not be advisable to drive

other events may fuel non-proliferation concerns and pressures as well. For details of the raid, see N.Y. Times, June 9, 1981, at 1, col. 6.

162. Following a Yugoslav initiative, the United Nations Conference on the Peaceful Uses of Nuclear Energy has been convened for 1983. J. YAGER, *supra* note 14, at 140.

163. See, *e.g.*, M. JAMES, THE INTERNATIONAL MANAGEMENT OF PLUTONIUM (1977).

164. IAEA Statute, *supra* note 150.

165. Brazil might argue, for example, that because no mention of PNEs is

for a broad interpretation of this term in order to include PNEs.¹⁶⁶ Rather, plutonium for research was excluded from the authority of CUPA and the depositary on the assumption that the best way to secure plutonium for PNEs would be through the construction of a reactor specially designed for plutonium production and not subject to IAEA safeguards. The inclusion not only of plutonium produced in commercial nuclear facilities but also of that produced in "other IAEA-safeguarded facilities" was adopted in order to strengthen the non-proliferation regime in other countries.¹⁶⁷ Our commercial reprocessing plant will remain under safeguards in any event.¹⁶⁸

Second, while our strict interpretation of the term "excess" in article XII(A)(5) is set forth in the text of the draft Brazilian proposal,¹⁶⁹ we did not draw attention to the issues raised by it. The purpose of such interpretations, of course, is to ensure that Brazil retains control over all plutonium that it will eventually need for its power programs.

Third, there is a danger in the release language of article XII(A)(5) which refers to a "request . . . of the members concerned." This could be interpreted to mean a request not by the state itself, but rather by an international authority. We stress the need to avoid such an interpretation; however, there is no reason to point out this possibility to others.

Finally, we have suggested that article XII(A)(5) be accepted, despite its limitations regarding PNEs, because it categorically states that release must be automatic upon request. Moreover, all of our commercial activities fall within the accepted end-uses under article XII(A)(5);¹⁷⁰ thus, the difficult burden of demonstrating any new conditions not already contained in the article will be on the complaining parties, who must convince two-thirds of the members of the IAEA to approve their proposals in order for article XII(A)(5) to be amended.¹⁷¹

made in art. XII(A)(5), that provision does not prohibit the release of plutonium for such "peaceful" purposes.

166. To take this position publicly would arouse suspicion of Brazil's intentions and contribute to an increase in non-proliferation pressures.

167. See note 21 *supra*.

168. See notes 152 and 153 *supra* and accompanying texts.

169. See text accompanying notes 172-92 *infra*.

170. IAEA Statute, *supra* note 150.

171. *Id.* art. XVIII(C).

4. Hypothetical Draft Brazilian Proposal for the Establishment of an International Plutonium Depository

(a) Introduction

The Government of the Republic of Brazil is pleased to introduce the present proposal for the establishment of a plutonium depository under IAEA auspices. Brazil has been a firm proponent of non-proliferation measures for many years¹⁷² and favors continued efforts to control the spread of nuclear weapons. This proposal is intended to form the basis for agreement on international arrangements based on the principles of non-discrimination, mutual respect, and the sovereign equality of states. The International Nuclear Fuel Cycle Evaluation (INFCE) represented an admirable effort to reach a consensus on questions related to energy independence and non-proliferation which can be solved, if they can be solved at all, only on the basis of international consensus and agreement. For this reason, we feel obliged to call the attention of participants in the Expert Group on International Plutonium Storage (IPS) to our original understanding, shared by all parties, that during the two-year duration of the INFCE study, no new measures were to be adopted by any state which would endanger existing programs or agreements on the peaceful use of nuclear energy.¹⁷³ Regrettably, by seeking unilaterally to impose political restrictions on the export or subsequent transfer of nuclear materials, equipment and technology,¹⁷⁴ certain states adopted legislation which violated this understanding. Such actions flagrantly violate article IV of the NPT as parties to that treaty have pointed out.¹⁷⁵

The spread of nuclear weapons cannot be controlled by pro-

172. Brazil was in fact an early leader in the movement for the establishment of a nuclear-free zone in Latin America. Its leadership waned considerably, however, following the 1964 coup which brought the military to power. See J. REDICK, *supra* note 71, at 28; *O programa nuclear brasileiro, un dossiê histórico*, 12 RESENHA DE POLITICA EXTERIOR DO BRASIL 14-16 (1977).

173. See, e.g., Hildebrand, *supra* note 117, at 53; Franko, *supra* note 121, at 1198-99.

174. See, e.g., notes 140-50 *supra* and accompanying text.

175. Betts, *Paranoids, Pygmies, Pariahs and Non-Proliferation*, *supra* note 156, at 157, 171. An embargo of sensitive fuel facilities could be interpreted as a violation of the Non-Proliferation Treaty by affected parties and possibly used as an excuse for violating the treaties themselves. *Id.* On the background and reach of the Non-Proliferation Treaty art. 4, see 1 M. SHAKER, *supra* note 113, at 293-337 (1980).

ceeding on such a basis. Unilateral restrictions can only introduce uncertainty and chaos into world markets for nuclear energy supplies and technology, and may ultimately contribute to a dangerous international environment which promotes the manufacture and use of nuclear weapons. Brazil believes that in order to avoid such unilateral actions in the future, any agreement establishing a plutonium depositary should entail mutual obligations and include sanctions against any supplier state which unilaterally establishes political requirements for the export of nuclear materials and technology.¹⁷⁶

Mutuality of obligation dictates that we view horizontal proliferation in tandem with vertical proliferation and the need for nuclear disarmament in general.¹⁷⁷ Accordingly, we propose that the depositary arrangements cover all plutonium produced or held anywhere in the world, whether for military or for civilian use. We further propose that all nuclear weapons states be required to declare the amount of plutonium in their military arsenals and that each be required to donate and deposit three percent of its original declared stock of military plutonium to the IAEA each year.¹⁷⁸ Transfer between the military and the civilian sectors must be totally prohibited.¹⁷⁹ In all other respects, the rules of the international depositary for plutonium are to apply to all participating states. Finally, participants in the Expert Group on IPS should bear in mind that our objective is to minimize proliferation without jeopardizing energy supplies or affecting the full and free development of nuclear energy for peaceful purposes.

176. See Courtney, *supra* note 10, at 254-55; note 116 *supra*.

177. See note 113 *supra*.

178. This is not a novel idea. On April 20, 1964, the United States announced reductions of 20% in its production of plutonium and 40% in its production of enriched uranium (*i.e.*, for nuclear weapons), while the Soviet Union announced that it would stop construction of two plutonium production reactors. 1 M. SHAKER, *supra* note 113, at 639. On the cutoff of production of fissile materials for weapons purposes, see *id.* at 639-43. In 1978, the United States Arms Control and Disarmament Agency reportedly developed a plan calling for a ban on the production of fissionable material for nuclear weapons; the Defense Department, however, blocked further consideration of the plan. *Id.* at 641, see note 246 *infra*.

179. The chief problem with such a proposal, of course, is the potential difficulty of verification.

(b) Purpose of the Depository

The purpose of an international depository for plutonium shall be to decrease the risk that plutonium will ever be used again, *by any country*, for military purposes.¹⁸⁰ To achieve this end we suggest that the Statute of the IAEA be amended to establish a special Committee on Uniform Plutonium Accountability (CUPA), whose powers would include supervision and initial enforcement of the mutual duties and obligations undertaken under the depository arrangements by nuclear weapons states, supplier states, and other states engaged in or planning to engage in the production or use of plutonium. CUPA would be charged with the maintenance of effective accountability for all plutonium subject to its authority and would be responsible for applying investigatory and dispute resolution procedures whenever it appears that plutonium subject to its authority has been diverted from peaceful to military uses.

(c) Organizational Structure

The international plutonium depository would form an integral part of the IAEA and, except, where otherwise expressly established, would be subject to the terms and provisions of the Statute of the Agency. CUPA, created as a special committee of the General Conference, would have primary responsibility for the oversight of all international arrangements establishing a plutonium depository. The international regime for plutonium accountability under the direction of CUPA would be known as "the international depository for plutonium," and the individual stores of plutonium in participating countries would be known as "plutonium depositories."

CUPA will be comprised of one representative from every IAEA member state which produces or uses plutonium. Any CUPA member which has acquired or is in the process of acquiring a reprocessing facility may establish a CUPA-affiliated depository under its own ownership and management. Plutonium will be stored in the depository in the following circumstances: (1) under the terms of a contract with another state; (2) pursuant to an allocation decision by CUPA ordering the depository to accept for deposit plutonium from another state; or (3) pursuant to a

180. Brazil would not necessarily oppose the use of plutonium in nuclear submarines, however.

decision by CUPA that plutonium belonging to the state owning the depository is "excess" (*i.e.*, not destined for research, reactors, or other peaceful uses)¹⁸¹ and must, therefore, be deposited in a facility under the authority of CUPA. Each state may maintain the plutonium it owns but is not required to deposit at the same or at an adjacent site, as long as all deposited plutonium is maintained separately for safeguards accounting purposes. International depositories and national stores of plutonium ideally would be located next to reprocessing facilities, in physically secure nuclear parks, in order to eliminate the risks inherent in plutonium transportation.

The small cadre of additional inspectors and secretariat personnel needed to perform CUPA-related functions will form a part of the regular IAEA Secretariat. They will be subject to the authority of the Director General, who will be charged with cooperating fully with CUPA, in accordance with article VII(B) of the IAEA Statute as amended.¹⁸²

The above arrangements are advantageous for several reasons. First, establishment of the depository (including CUPA) within the existing structure of IAEA avoids the unnecessary duplication of effort and proliferation of bureaucracy which would result if the depository were to be established as independent from the Agency. Second, the Agency is superbly equipped to apply the safeguards established in article XII(A)(5),¹⁸³ which will constitute the basic criteria for deposit and release to be applied by CUPA. Third, the creation of a separate organization would weaken and perhaps lead to the balkanization of the Agency.¹⁸⁴ Finally, we believe that the Agency represents a forum in which the developing countries can effectively voice their concerns.

(d) Criteria for Deposit and Release

The plutonium that is to be subject to the authority and decisions of CUPA must be defined before the criteria for deposit and

181. Brazil might view "other peaceful purposes" to include PNEs. See notes 164-69 *supra* and accompanying text.

182. See text accompanying note 191 *infra*.

183. IAEA Statute, *supra* note 150.

184. Another Brazilian consideration is that a new organization might be dominated by weapons and nuclear supplier states and thus have a membership or voting formula which would be less sympathetic to Brazil than the IAEA General Conference and Board of Governors.

release are established. We shall propose two acceptable options. Under the first and preferred option, all plutonium in the world would be subject to the authority of CUPA. Each nuclear weapons state would be required to declare the amount of plutonium currently held for military purposes, and would be obligated to donate and deposit three percent of its original military stock of plutonium to the IAEA annually.¹⁸⁵ Such a measure would constitute a *minimal* step toward compliance with the provisions of article VI of the NPT by parties to the treaty.¹⁸⁶ The production of new plutonium for military purposes in nuclear weapons states would be prohibited, and transfers of plutonium from the civilian to the military sector would be proscribed. Finally, all non-military plutonium would be subject to the authority of CUPA in accordance with universally applicable norms and procedures. This option represents a balanced approach to the international risks caused by the use of plutonium; we can imagine no legitimate reason for any nuclear weapons state to refuse to participate in such a scheme.

Under our second option, all plutonium produced or used in commercial power programs or in other IAEA-safeguarded facilities would be subject to the authority of CUPA. Since the major risks of proliferation are related to potential diversions of plutonium from commercial programs, the second option would serve principal non-proliferation objectives. The criteria for deposit and release to be applied by CUPA would be those currently established in article XII(A)(5) of the Statute of the Agency. These criteria, which are particularly appropriate since the depositary forms an integral part of the Agency, could be changed only by amending the Statute by a two-thirds vote in the General Conference and ratification by two-thirds of all IAEA members.¹⁸⁷ The provisions in article XII(A)(5) must be strictly interpreted in accordance with the terms of article III(C) of the Statute, which provides: "In carrying out its functions, the Agency shall not make assistance to members subject to any political, economic, military, or other conditions incompatible with the provisions of this Statute."¹⁸⁸

Article XII(A)(5) specifically requires that plutonium not desig-

185. A figure as high as 5% would be possible.

186. See note 113 *supra*.

187. IAEA Statute, *supra* note 150, art. 18(c).

188. *Id.*

nated for research purposes must be used in reactors which already exist or are in some stage of planning or construction.¹⁸⁹ It further requires deposit with the Agency (*i.e.*, in a CUPA-affiliated depository) of any "excess" special fissionable material (*i.e.*, plutonium) which is not destined for research or for use in specified reactors under continuing Agency safeguards. Such deposit is required to prevent stockpiling (not mere storage for future use) in order to avoid the risks of diversion to illicit end-uses. The criteria for release of deposited plutonium are clearly stated in article XII(A)(5). At the request of the member concerned, deposited plutonium is to be returned promptly for use in research or specified reactors under continuing IAEA safeguards. The criteria stated in article XII(A)(5) are sufficient to detect, in a timely manner, any illicit use of plutonium; should a diversion occur, the enforcement procedures can be activated to secure compliance with the decisions of the CUPA. There is no need to amend article XII(A)(5) in order to introduce political factors into deposit and release decisions. Any attempt to do so would only introduce further insecurities into the world plutonium market.

(e) Decision Process on Questions of Deposit and Release

Decisions on questions of deposit and release would be made by CUPA. As noted above, the decision on a request for release of deposited plutonium would be automatic, in accordance with the express terms of article XII(A)(5). The decision to require deposit of excess plutonium would constitute the basic enforcement mechanism of the depository. Such a decision could be made by a two-thirds vote of members present, whenever the results of an investigation by the CUPA staff revealed that plutonium had been diverted by a member from the accepted end-uses stipulated in article XII(A)(5), and the respective state had failed to satisfy CUPA either that the results of the investigation were erroneous or that the plutonium in question had been returned to a proper channel for an accepted end-use.

Should CUPA's decision be adverse to a state member, the latter would have the right to appeal the holding to the Board of Governors of the Agency. If the Board upholds the CUPA decision by a two-thirds vote, the state member would then be required to make a physical deposit of the plutonium in question to

189. *Id.*

a CUPA-affiliated depository. The affected member would have the further right to appeal the decision to the General Conference, and should the latter fail to uphold the decision of the Board of Governors by a two-thirds vote, the deposited plutonium would be returned to the appellant state.

This procedure would be also be applied whenever investigation reveals that released plutonium has been diverted from an accepted end-use. In such a case, CUPA may require redeposit of the plutonium in question. In order to verify the use of plutonium under its authority, CUPA may send inspectors to the various depositories as often as it so decides; a permanent inspector might even be assigned to each depository. Since inspections currently may be carried out only once or twice a year, the increased frequency of inspection would significantly enhance the capability of IAEA to detect diversion of plutonium. The assignment of inspectors and the initiation of investigations, however, would have to be carried out on a non-discriminatory basis; thus, depositories in nuclear weapons states, supplier countries, and other states would receive equal scrutiny from CUPA inspectors.

Investigations and the deliberations of CUPA, the Board, and the General Conference would be confidential in order to avoid unfair publicity and to protect member states which may be guilty of no more than an honest or bureaucratic mistake. The objective of the verification and enforcement procedures is not to generate adverse publicity, but rather to secure voluntary compliance by all states with the decisions of CUPA. Public pressures are to be employed only when a state refuses to comply with Agency decisions following exhaustion of the appeals process. At that point, the sanctions contemplated in article XIX of the Statute may be applied.¹⁹⁰

(f) Decision Process on Questions Related to the Obligations of Nuclear Weapons States and Supplier States

Should CUPA become aware of discrepancies in safeguards accounting records or of other evidence indicating a nuclear weap-

190. *Id.* art. XIX(B), which provides as follows:

A member which has persistently violated the provisions of this Statute or of any agreement entered into by it pursuant to this Statute may be suspended from the exercise of the privileges and rights of membership by the General Conference acting by a two-thirds majority of the members present and voting upon recommendation by the Board of Governors.

ons state has transferred military plutonium to or from the civilian sector, it may require deposit of the plutonium in question in accordance with procedures similar to those described above. If a nuclear weapons state should fail to donate and deposit three percent of its military plutonium to the IAEA each year, CUPA may seek compliance (as *infra*). In the event that a supplier nation unilaterally imposes political restrictions on the export or retransfer of nuclear materials (and perhaps technology), any member of CUPA may bring a complaint before the Committee. If, following an investigation, a violation is found by a majority vote of CUPA, then a Special Conference of all CUPA member states would be convened immediately in order to adopt by majority vote one or more of the following measures: (1) suspension of the offending member from CUPA; (2) recommendation to the General Conference that the state concerned be suspended from membership in the IAEA, in accordance with article XIX(B) of the Statute; or (3) suspension of the operation of CUPA and the international depositary regime, pending compliance by the state concerned with the decisions of CUPA.

The Government of Brazil believes that this set of provisions will preclude discriminatory aspects of depositary arrangements. These provisions stress that we are embarking upon a joint enterprise, the goal of which is to reduce the risks to humanity which result from military use of plutonium.

(g) Legal Authority for the Depositary

The regime described above can be implemented with only minor amendments to the IAEA Statute.¹⁹¹ The details of provisions

191. The following provisions could be added to the Statute, pursuant to the procedures for amendment established in article XVIII:

Article V

.....

G. The General Conference shall appoint from among its members a Committee on Uniform Plutonium Accountability (CUPA), which shall be comprised of one member from each state engaged or planning to engage in the production or use of plutonium.

H. The Committee on Uniform Plutonium Accountability shall have the duties and responsibilities assigned to it in the Protocol for the Establishment of Uniform Plutonium Accountability, once that instrument has entered into force.

Article VI

.....

governing duties and obligations, decision processes, and voting procedures of the regime would be contained in a separate Protocol for the establishment of uniform plutonium accountability. The Protocol would enter into force when four-fifths of the eligible states had deposited their respective instruments of ratification. It would continue in force indefinitely unless suspended as a result of violation by a nuclear weapons or supplier state. Finally, any party could withdraw from the regime after giving one year's notice.

(h) Conclusion

The Government of the Republic of Brazil presents the above proposal for consideration by the Expert Group on International Plutonium Storage. We believe that because it involves mutual obligations on the part of all states concerned, it offers a viable basis for significant progress in the attempt to limit the military use of plutonium. Unlike some proposals, it is fully in agreement with the principle of the sovereign equality of all members of the IAEA, a fundamental principle of the Agency set out in article IV(C) of the Statute. The proposal provides a solid foundation for international consensus and agreement, and accordingly we urge that it be adopted.

F. (bis). The Board of Governors shall also exercise those powers and duties assigned to it in the Protocol for the Establishment of Uniform Plutonium Accountability.

.....

Article VII

.....

B. (bis). The Director General shall also be responsible for cooperation with and carrying out the functions assigned to him by the Committee on Uniform Plutonium Accountability referred to in Article V(G) *supra*.

IAEA Statute, *supra* note 150, art. XVIII. An Amendment may be proposed by any state, *id.* art. XVIII(A), and shall enter into force for all members when (1) approved by the General Conference by a vote of two-thirds of those present and voting, and (2) accepted by two-thirds of all members in accordance with their respective constitutional processes, to be effected by deposit of an instrument of acceptance. *Id.* art. XVIII(C). If a member is unwilling to accept an amendment as approved, it may withdraw from the Agency. *Id.* art. XVIII(D).

C. *Full Entry into Force for Brazil of the Treaty of Tlatelolco*

Signed in 1967, the Treaty of Tlatelolco,¹⁹² prohibits the production, testing, or use of "any nuclear weapons," as well as their storage or deployment in a delimited zone surrounding and including Latin America.¹⁹³ Brazil ratified the Treaty on January 29, 1968, but the Treaty has not come into force in Brazil due to the absence of all of the ratifications required under the terms of article 28(1).¹⁹⁴ During the negotiations, Brazil successfully insisted upon adoption of the mechanism contained in article 28(2),¹⁹⁵ which permits waiver of the unanimous ratification requirement, in which case the Treaty enters into force for the state waiving this requirement.¹⁹⁶ While Brazil has stated that it is bound under international law not to frustrate the objectives of

192. See note 18 *supra*. Brazil initiated the measures in the United Nations which ultimately led to the adoption of the Treaty of Tlatelolco. See Courtney, *supra* note 10, at 255. On the Treaty of Tlatelolco in general, see 2 M. SHAKER, *supra* note 113, at 906-17 (1980); Espiell, *The Treaty for the Prohibition of Nuclear Weapons in Latin America (The Tlatelolco Treaty); Present Situation and Future Prospects*, 20 IAEA BULL. 25 (1978); Robinson, *The Treaty of Tlatelolco and the United States: A Latin American Nuclear Free Zone*, 64 AM. J. INT'L L. 282 (1970); Redick, *Regional Nuclear Arms Control in Latin America*, 29 INT'L ORGANIZATION 415 (1975); Redick, *Regional Restraint*, *supra* note 111; Redick, *The Tlatelolco Regime and Non-Proliferation in Latin America*, *supra* note 54.

193. Treaty of Tlatelolco, *supra* note 18, arts. 1, 4. Pending ratification of the Treaty, its two protocols, and the agreements for safeguards by all required parties, the Treaty will apply only to the territories for which it is in force. *Id.* art. 4(1). Once these requirements are met, the Treaty will extend to a broad geographical area defined in article 4(2).

194. Treaty of Tlatelolco, *supra* note 18, art. 28(1), provides that, absent a waiver under article 28(2), see note 241 *infra*, the treaty will come into force upon (1) ratification by all of the Latin American states in existence in 1967, (2) ratification of Additional Protocol I by all states having international responsibility for territories within the zone of application of the treaty, (3) ratification of Additional Protocol II by all powers possessing nuclear weapons, and (4) conclusion of the corresponding safeguards agreements in accordance with article 13 of the Treaty. *Id.* All of these requirements must be satisfied before the Treaty enters into effect for a ratifying Party, unless the latter waives these requirements under the terms of article 28(2) of the Treaty. See notes 240 & 241 *infra* and accompanying text.

195. See note 194 *supra*; notes 240 & 241 *infra* and accompanying text.

196. Treaty of Tlatelolco, *supra* note 18, art. 28(2); see notes 240 & 241 *infra*.

the Treaty,¹⁹⁷ it has made no waiver under article 28(2).

Recent developments suggest that full entry into force of the Treaty is now a real possibility. On May 26, 1977, the United States signed Protocol I,¹⁹⁸ which involves a commitment to observe the terms of the Treaty on the part of non-Latin American countries which have possessions in the zone covered by the Treaty.¹⁹⁹ France announced in May 1978 that it too would adhere to Protocol I, and has since ratified it.²⁰⁰ At the same time, on December 12, 1978, the Soviet Union ratified Protocol II²⁰¹ (in which nuclear weapons states agree to respect the aims and provisions of the Treaty, and pledge not to use or threaten to use nu-

197. See *O programa nuclear brasileiro*, 12 RESENHA DE POLITICA EXTERIOR DO BRASIL 1, 15 (1977); cf. Vienna Convention on the Law of Treaties, art. 18, opened for signature May 23, 1969, U.N. Doc. A/Conf. 39/11/Add. 2, reprinted in 63 AM. J. INT'L. L. 875, 880 (1969) [hereinafter cited as Vienna Convention] (state is obligated not to defeat the object and purpose of a treaty prior to its entry into force).

In October 1978 a government statement in response to criticisms in the German and Brazilian press reaffirmed its position:

The position of the Brazilian government on the subject of nuclear arms has already been manifested many times by [the Foreign Ministry] and by the President of the Republic himself. Brazil is a firm defender, on the international level, of the principle of non-proliferation of nuclear weapons, and interprets this principle in the most comprehensive manner possible.

O Estado de São Paulo, Oct. 11, 1978, at 8, col. 2 (author's translation). Nonetheless, one should note that this statement does not exclude the possibility of future development of peaceful nuclear devices.

198. U.S. ARMS CONTROL AND DISARMAMENT AGENCY, ARMS CONTROL AND DISARMAMENT AGREEMENTS 57 (1977) [hereinafter cited as DISARMAMENT AGENCY]. For the hearing and report of the Senate Foreign Relations Committee, see *Treaty of Tlatelolco: Hearings Before the Senate Comm. on Foreign Relations*, 95th Cong., 2d Sess. (1978). Ratification by the United States has been prevented by a dispute between the Foreign Relations Committee and the Executive over a question of executive privilege. See Redick, *The Tlatelolco Regime and Non-Proliferation in Latin America*, 35 INT'L ORGANIZATION 103, 107-109 (1981).

199. Treaty of Tlatelolco, *supra* note 18, Additional Protocol I, art. 1, reprinted in DISARMAMENT AGENCY, *supra* note 198, at 74. See *Treaty of Tlatelolco: Hearings Before the Senate Comm. on Foreign Relations*, 95th Cong., 2d Sess. (1978); note 198 *supra*.

200. B. WESTON, R. FALK & A. D'AMATO, INTERNATIONAL LAW AND WORLD ORDER 439 n. (1980).

201. Petrov, *The Soviet Union and the Denuclearized Zone in Latin America*, 55 INT'L AFF. 95, 98-99 (1979).

clear weapons against the contracting states),²⁰² thus removing a major obstacle to full entry into force of the Treaty. Of particular interest to Brazil are indications from Argentina that it will sign the Treaty.²⁰³

These developments suggest that Brazil should carefully consider whether it should (1) exercise a waiver under article 28(2), or (2) actively promote full entry into force of the Treaty for all remaining parties. Before considering which of these steps might best be taken if this general option is chosen, let us consider the benefits and costs for Brazil which full entry into force could entail.

1. Benefits

The major benefit of the Treaty to Brazil would be a reduction of non-proliferation pressures which represent a potential threat to Brazil's long-term development of nuclear capabilities. A number of specific benefits also should be taken into account. First, full-scope safeguards are not clearly required under the Tlatelolco Treaty. Article 13 provides only that each contracting party shall negotiate agreements with the IAEA for the application of safeguards to "its nuclear activities." While it might be argued that this includes all nuclear activities, the preparatory work reveals that a proposal for full-scope safeguards was rejected due to the

202. Treaty of Tlatelolco, *supra* note 18, Additional Protocol II, done Feb. 14, 1967, 22 U.S.T. 754, T.I.A.S. No. 7137, 634 U.N.T.S. 364, [hereinafter cited as Additional Protocol II]. Article 1 of Additional Protocol II provides that the Treaty of Tlatelolco itself "shall be fully respected by the Parties to this Protocol in all its express aims and provisions." Parties to the Protocol undertake "not to contribute in any way to the performance of acts involving a violation of the obligations of article 1 of the Treaty (*i.e.*, testing, use, manufacture, production, acquisition, receipt, storage, or installation of any "nuclear weapons"). *Id.* art. 2. Parties to Additional Protocol II expressly "undertake not to use or to threaten to use nuclear weapons" against the parties to the Treaty. *Id.* art. 3.

203. See Espiell, *supra* note 192, at 26. Thus, the only steps required to satisfy the ratification requirements of article 28(1) are deposit of the respective instruments of ratification by the United States (Protocol I); by Argentina and Cuba (The Treaty); and possibly by Guyana (the Treaty). All except Cuba and Guyana have declared they would ratify the respective instruments. Given the Soviet interest in non-proliferation, Cuban ratification should be forthcoming, and the dispute between Venezuela and Guyana should be amenable to rapid solution, at least for purposes of Tlatelolco. The Treaty would then enter into force for all parties concerned. See Redick, *supra* note 54, at 106-109.

opposition of Brazil and Argentina.²⁰⁴ Moreover, article 13 must be interpreted in light of article 12, which provides that the "control system" (including that portion established by article 13) "shall be used in particular for the purpose of verifying" that devices, services, and facilities "are not used in the testing or manufacture of nuclear weapons."²⁰⁵ Hence, the safeguards requirement of article 13 is less comprehensive than that contained in article III(1) of the NPT. Given our 1972 tripartite safeguards agreement with the United States and the IAEA,²⁰⁶ and our 1976 agreement with the Federal Republic of Germany and the IAEA,²⁰⁷ Brazil could forcefully argue that: (1) these agreements, in conjunction with the special inspections system established by the Treaty, satisfy the requirements of article 13; (2) in view of the foregoing, any new agreement pursuant to article 13 must not require significant additional undertakings on the part of Brazil; and (3) any additional safeguards requirements, beyond those strictly required by article 12 and 13, must be fully applicable to all parties to the Treaty and each of its two Protocols. Finally, early waiver under article 28(2)²⁰⁸ should be used as a bargaining tool with the IAEA in negotiating any new safeguards agreement which may be required to satisfy article 13.

Second, peaceful nuclear explosions are permitted under the terms of the Treaty.²⁰⁹ Article 1 prohibits the detonation only of "nuclear weapons" as further defined in article 5 ("any device which is capable of releasing nuclear energy in an uncontrolled manner and which has a group of characteristics that are appropriate for use for warlike purposes"). Article 5 cannot be interpreted to include peaceful nuclear devices, however, in view of the language of article 18(1), which expressly provides: "The Contracting Parties may carry out explosions of nuclear devices for peaceful purposes—including explosions which involve devices similar to those used in nuclear weapons"²¹⁰ While the

204. See Redick, *supra* note 192, at 427-28 (1975).

205. Treaty of Tlatelolco, *supra* note 18, art. 12(2).

206. Tripartite Agreement, *supra* note 142.

207. Safeguards Agreement, *supra* note 153.

208. See notes 240-41 *infra* and accompanying text.

209. Upon signing the Treaty of Tlatelolco, Brazil stated its understanding that "article 18 authorizes . . . explosions of nuclear devices for peaceful purposes . . . including explosions which involve devices similar to those used in nuclear weapons." Rosenbaum & Cooper, *supra* note 116, at 77 n.7.

210. Treaty of Tlatelolco, *supra* note 18.

United States has made statements interpreting articles 5 and 18 as prohibiting PNEs,²¹¹ such an interpretation is untenable and without legal force.²¹²

A third benefit under the Treaty is that it would strengthen the legal position of Brazil as it proceeds with enrichment and reprocessing in the face of non-proliferation pressures from abroad. Article 17 expressly provides that nothing in the Treaty "shall prejudice the rights of the Contracting Parties, in conformity with the Treaty, to use nuclear energy for peaceful purposes, in particular for their economic development and social progress"²¹³ In view of Protocol II's undertaking to fully respect the Treaty "in all its express aims and provisions,"²¹⁴ the United States could be accused of violating, by its efforts to prevent Brazilian acquisition of enrichment and reprocessing facilities, its international obligations not only under article IV of the NPT²¹⁵ but also under Protocol II and the Treaty of Tlatelolco²¹⁶ as well. Brazil's rights to develop nuclear energy for peaceful purposes are implicitly protected under article 17 on a basis of equality and

211. See Additional Protocol II, *supra* note 202, Understandings and Declarations Attached to Senate Advice and Consent, reproduced in DISARMAMENT AGENCY, *supra* note 198, at 61-62.

212. Given the express terms of articles 5 and 18 of the Treaty of Tlatelolco, this is untenable on logical grounds. It is without legal force because the Treaty itself is not subject to reservation. Treaty of Tlatelolco, *supra* note 18, art. 27; cf. Betts, Courtney, *supra* note 66, at 388 ("Although the United States is on uncertain legal ground in interpreting the Tlatelolco treaty as precluding peaceful nuclear explosions, it should make efforts to encourage other parties to the treaty to accept this interpretation"). The question of the legality of PNEs must ultimately be answered not by majority vote of the parties in 1981, but by the rules of customary international law which are incorporated, at least in part, in the Vienna Convention on the Law of Treaties. *Supra* note 197, arts. 31-33; see I. BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW 623-30 (3d ed. 1979); NGUYEN QUOC DINH, P. DALLIER, & A. PELLET, DROIT INTERNATIONAL PUBLIC 245-50 (2d ed. 1980).

213. Treaty of Tlatelolco, *supra* note 18, art. 17.

214. See Additional Protocol II, *supra* note 202, art. 1.

215. The United States has no obligation to Brazil under the Non-Proliferation Treaty, for the latter is not a signatory. The violation, if any, would have to be of the United States obligation under the treaty vis-a-vis the Federal Republic of Germany, presumably by interfering with German development of peaceful uses of nuclear energy under the terms of its 1975 Agreement with Brazil.

216. See Additional Protocol II, *supra* note 202, art. 1. Even if the United States were to ratify Additional Protocol I, it is doubtful that the argument in the text would be taken seriously.

non-discrimination (in contrast with the NPT), and foreign attempts to foreclose the exercise of those rights may themselves constitute violations of treaty provisions under international law. The forcefulness of such arguments, which have broad appeal to developing countries, should significantly increase the leverage of Brazil against the United States, whether in international forums or in bilateral negotiations related to our nuclear cooperation agreement of 1972 and the Nuclear Non-Proliferation Act of 1978.²¹⁷ Since it is not a party to the NPT, Brazil cannot argue strongly that the United States is violating article IV of that instrument; with Tlatelolco fully in force, however, Brazil will have strong legal arguments in defense of its national sovereignty.

Fourth, under the Treaty of Tlatelolco, Brazil will have a strong voice in all decisions made within the Agency (OPANAL) established by the Treaty. Voting in the General Conference will be on an equal basis (one nation, one vote) and will be limited to the Latin American states.²¹⁸ Brazil surely will occupy a seat on the five-member Executive Council. Due to its influence in Latin America, it should be in a strong position to avoid adverse decisions in connection with any special inspection which may be initiated in order to verify a suspected violation of the Treaty. Moreover, the rules cannot be changed without Brazil's consent, for unanimous ratification or optional waiver is required for the adoption of any amendment.²¹⁹ Finally, any disputes over the terms of the Treaty which are not settled shall be referred to the International Court of Justice, with the prior consent of the parties.²²⁰

Fifth, Brazil would have a right to request that a special inspection be ordered by the Council to verify any suspected violation of the Treaty by any Latin American country which may be involved in the production of nuclear weapons.²²¹

Sixth, under Protocol II Brazil may be protected to a significant degree from the deployment of nuclear-weapons submarines by the Soviet Union or any other hostile nuclear weapons state.²²²

217. See notes 140-45 *supra* and accompanying text.

218. Treaty of Tlatelolco, *supra* note 18, art. 9(5).

219. *Id.* arts. 28, 29(2).

220. *Id.* art. 24.

221. *Id.* art. 16.

222. See Additional Protocol II, *supra* note 202, arts. 1-3; Treaty of Tlatelolco, *supra* note 18, Preamble, arts. 1, 3-4.

Seventh, full implementation of the nuclear-free zone would eliminate the potential threat of Cuba serving as launching area for nuclear weapons. Soviet adherence to Protocol II and Cuban ratification of the Treaty (the latter still in doubt) could significantly increase long-term security in the Western Hemisphere.

Eighth, entry into force of the Treaty for Brazil would help deter an unraveling of the existing non-proliferation regime. While most of our neighbors have ratified both the Treaty of Tlatelolco and the NPT,²²³ without certain minimal reinforcement there is a danger that states may withdraw from the non-proliferation regime established under these treaties.

Ninth, should Brazil decide in the future to explode a PNE, it would have an airtight justification under international law for so doing. While a strong international reaction could be anticipated, the strength of Brazil's legal case would help to dilute its intensity and provide a legal defense against arguments used to justify reprisal action.

Finally, Brazil may withdraw from the Treaty if, in its opinion "there have arisen or may arise circumstances . . . which affect its supreme interests or the peace and security of one or more Contracting Parties."²²⁴ Similarly, the rise of a new nuclear weapons state would suspend operation of the Treaty until that nation ratifies Protocol II, *provided* Brazil has not waived the requirements of article 28(1)(c) of the Treaty²²⁵ (requiring ratification of Protocol II by all nuclear weapons states).

223. Columbia has ratified the Treaty of Tlatelolco and accepted its operative force, but has not ratified the Non-Proliferation Treaty; Chile has ratified the Treaty of Tlatelolco, but has not exercised the waiver which would bring it into force for that country; Argentina has not ratified the Non-Proliferation Treaty, and has signed but not yet ratified the Treaty of Tlatelolco. Redick, *supra* note 54, at 306-07.

224. Treaty of Tlatelolco, *supra* note 18, art. 30(1). This provision provides for withdrawal "if, in the opinion of the denouncing State, there have arisen or may arise circumstances connected with the content of this Treaty or of the annexed Additional Protocols I and II which affect its supreme interests or the peace and security of one or more Contracting Parties." *Id.* Denunciation of the Treaty under the previous clause will take effect three months after delivery of the respective notification to the General Secretary of the Agency. *Id.* art. 30(2). Presumably, this delay will allow time for diplomatic pressures to be brought to bear.

225. See notes 194-96 *supra* and accompanying text; notes 240-41 *infra* and accompanying text.

2. Disadvantages

The Treaty of Tlatelolco is not without disadvantages from Brazil's point of view. The very ambiguity of the safeguards requirement contained in article 13²²⁶ could create a focal point for renewed pressures on Brazil to adopt full-scope safeguards over all of its nuclear activities.²²⁷ Nonetheless, Brazil could decide that full-scope safeguards are acceptable in order to obtain guarantees from Argentina and other neighboring states or concessions from the United States. Even under the assumption that the risks of industrial espionage, the discriminatory nature of such safeguards²²⁸ (requiring IAEA access to our research laboratories but not to those of the United States),²²⁹ and national security considerations suggest the desirability of rejecting full-scope safeguards, international pressures could be countered by reiterating the readiness of Brazil to adopt any safeguards accepted by all parties to the Treaty and its Protocols.²³⁰

Second, article 18 of the Treaty permits thorough observation by Agency and IAEA personnel of activities related to the detonation of any peaceful nuclear device.²³¹ Under exceptional circum-

226. See notes 204-08 *supra* and accompanying text.

227. See note 166 *supra*.

228. See Treaty of Tlatelolco, *supra* note 18, art. 13. The terms of article 13 call for "the application of safeguards to its nuclear activities," which arguably include *all* of its nuclear activities (*i.e.*, full-scope safeguards). *But see* notes 204-08 *supra* and accompanying text. On the other hand, the United States-I.A.E.A. agreement applies only in a selective manner to the civilian sector with the United States retaining the unilateral right to withdraw a safeguarded facility from coverage of the agreement. See *U.S.-I.A.E.A. Treaty: Hearings on Ex. B. 95-2 Before the Senate Comm. on Foreign Relations*, 96th Cong., 1st Sess. (1979); SENATE COMM. ON FOREIGN RELATIONS, U.S.-I.A.E.A. TREATY FOR SAFEGUARDS IN THE UNITED STATES, EXEC. REP. NO. 96-42, 96th Cong., 2d Sess. (1980) [hereinafter cited as EXEC. REP.].

229. See, *e.g.*, Agreement between United States and the International Atomic Energy Agency for the Application of Safeguards in the United States, Sept. 17, 1976, reprinted in 16 INT'L LEGAL MATERIALS 25, 50 (1977) (the agreement was submitted to the Senate on Feb. 9, 1978); Nash, *Contemporary Practice of the United States Relating to International Law*, 72 AM. J. INT'L L. 913 (1978); see EXEC. REP., *supra* note 228; *Hearings on Ex. B. 95-2*, *supra* note 228.

230. See note 153 *supra* (Brazil stated its willingness to accept any new safeguards established by IAEA).

231. The Treaty of Tlatelolco, *supra* note 18, art. 18. The state carrying out the explosion must notify the Agency as far in advance as possible of the circumstances and date of the explosion, supply detailed information on the nature and origin of the device, and allow Agency personnel to observe all preparations,

stances—not presently deemed likely to occur—such observations could prove to be excessively intrusive.

Third, under the terms of article 16 of the Treaty, any party may request a special inspection within the territory of a contracting party when it “suspects that some activity prohibited by this Treaty has been carried out or is about to be carried out.” Upon receipt of such a request, the Council of the Agency “shall immediately arrange” for a special inspection to be conducted. Under certain circumstances, such an inspection could produce negative effects. For example, if Brazil were to prepare a peaceful nuclear device, it might be accused of building a nuclear weapon. There are, however, inherent limitations on unfounded charges. The request for a special inspection must pass an implicit “reasonableness” test before the Council orders an inspection, as evidenced by the requirement that the reasons underlying the request must be stated.²³² Any such request could occasion an extremely grave diplomatic crisis and, therefore, would be unlikely. Also, Brazil would be required to grant inspectors free access only to places “directly and intimately connected with the suspicion of violation of [the] Treaty.”²³³ Finally, the only direct measures which could be taken in the case of a negative report would be: (1) the transmittal of the report to the contracting parties, the United Nations, and the Organization of American States (OAS);²³⁴ (2) the convening of a special session of the General Conference of the Agency to consider the special inspection report;²³⁵ (3) recommendations to the contracting parties by the General Conference, and submission of reports to the United Nations;²³⁶ (4) a finding by the General Conference that a contracting party “is not complying fully with its obligations under [the] Treaty” together with appropriate recommendations to the party concerned;²³⁷ and (5) a finding by the General Conference of a violation “which might endanger peace and security,” and

including the explosion itself. Agency personnel “shall have unrestricted access to any area in the vicinity of the site of the explosion in order to ascertain [compliance with information furnished and other provisions of this Treaty].” *Id.* art. 18(3).

232. *Id.* art. 16(1)(b)(i).

233. *Id.* art. 16(4).

234. *Id.* art. 16(5)-(6).

235. *Id.* art. 16(7).

236. *Id.* art. 16(8).

237. *Id.* art. 20(1).

transmittal of this finding to the United Nations, the OAS, and the IAEA.²³⁸ Thus, even in the extremely unlikely event of an unfavorable inspection report, Brazil would have ample opportunity to clarify the facts and reach an accommodation with the Latin American states represented at the General Conference.

Many factors mitigating the potential disadvantages of a special inspection within Brazil simultaneously tend to weaken the effectiveness of Brazil's right to request a special inspection within the territory of any other contracting party which might be suspected of violating the Treaty. Nonetheless, whatever the decisions of the General Conference, special inspections potentially could be very useful in detecting prohibited activities.

Finally, withdrawal from the Treaty could entail certain political costs. There would be no reason for withdrawal, however, unless: (1) there were a serious breakdown in the non-proliferation regime; (2) nuclear weapons states were to direct their military power against Brazil and other developing nations; or (3) Brazil were to decide, in the absence of either of the above conditions, to proceed with the testing of nuclear weapons and delivery systems. Only in the latter case would the political costs of withdrawal be high. However, the costs of proceeding with the tests would be very high regardless of whether the Treaty of Tlatelolco is in force for Brazil.

3. Exercising the Option

If the Tlatelolco option is selected, it can be exercised by waiving the unanimous ratification requirement under article 28 or by actively promoting ratification of the Treaty and its Protocols by all parties who have not yet done so.²³⁹ The best approach would be a combination of these. Brazil should waive all the ratification requirements of article 28(1), except those relating to Protocol II,²⁴⁰ for a period of two years.²⁴¹ If all of the ratifications re-

238. *Id.* art. 20(2).

239. See Redick, *supra* note 54, at 106-07; note 203 *supra*.

240. This limited waiver would preserve the option out under article 28(4) of the Treaty of Tlatelolco. That provision establishes that in the event of "the rise of a new power possessing nuclear weapons," the treaty shall be suspended for those states which have not waived the requirements of article 28(1)(c) and which request such suspension. This suspension would remain in effect until the new nuclear weapons state ratifies Additional Protocol II to the Treaty of Tlatelolco. *Id.* art. 28(4); see note 194 *supra*.

quired by article 28(1) have not been deposited by the end of this period, the Treaty will no longer be in force for Brazil unless it extends its waiver. In the meantime, Brazil should actively promote full ratification of the Treaty and its Protocols. Its own good faith will have been demonstrated to the international community, and it will have contributed significantly to the momentum toward final and full entry into force of the Treaty of Tlatelolco. The result should be a considerable reduction in non-proliferation pressures, thereby avoiding potential threats to the nation's acquisition of the full nuclear fuel cycle as provided under the terms of the agreement with West Germany. Finally, Brazil should use full ratification of the Treaty as a bargaining chip with the United States and in negotiations with the IAEA over a safeguards agreement which satisfies the requirements of article 13.

III. CONCLUSION

A principal conclusion to be drawn from the preceding hypothetical view from Brazil is that a central relationship exists between the horizontal and the vertical proliferation of nuclear weapons. Although hardly a novel finding, the reader may now be able to appreciate more fully the degree to which the perception of such a connection is eminently rational from the point of view of Brazil—and perhaps other threshold nuclear powers. Whether Brazil will endeavor to build nuclear weapons will depend largely on the evolving nature of the international economic and political order. To the extent that order is characterized by vertical proliferation between the superpowers and new entrants into the nuclear weapons club, and by political bargaining based on coercive diplomacy and the threat or use of force, Brazil will have strong inducements to establish a nuclear weapons capability. In addition, under a type of worst-case analysis similar to that employed by the United States military planners, Brazil's decision whether to develop nuclear weapons will also depend largely upon its perceptions of Argentina's potential for developing a nuclear weapons capability.

Denial strategies will not prevent Brazil from acquiring the ca-

241. The requirements of the Treaty of Tlatelolco, article 28(1), may be waived "wholly or in part" under the terms of article 28(2), which provides in pertinent part: "All signatory States shall have the imprescriptible right to waive, wholly or in part, the requirements laid down in [article 28(1)]." Here it is assumed that waiver "in part" may be interpreted in a temporal sense.

pability of pursuing the direct route to nuclear weapons through the construction of dedicated facilities. Similarly, given Brazil's acquisition of enrichment and reprocessing facilities and technology, further attempts at denial by nuclear supplier states will not prevent Brazil from retaining the option to seize such facilities in order to develop nuclear weapons within a very short time. Certain steps might be taken, however, which could raise the threshold for the exercise of either the direct route or the seizure option. Any treaty providing for the acceptance of full-scope safeguards and the prohibition of the development of any nuclear explosive device could significantly raise the domestic commitment to forego the development of nuclear weapons²⁴² and simultaneously increase the costs of exercising any nuclear weapons option. Such legal commitments could not guarantee that Brazil would never construct a nuclear bomb, but they could significantly reduce the probability of such an occurrence. In addition to such political and legal commitments, the establishment of an IPS regime, under which excess plutonium would be stored at an internationally managed and staffed depository in Brazil, would significantly increase the threshold for the exercise of the seizure option.

The inherent problem is how to induce Brazil to agree to these commitments. This will not be an easy task. The preceding hypothetical memorandum is suggestive with respect to those aspects of both the IPS and the Tlatelolco options where the strongest resistance from Brazil is likely to be encountered. In terms of Brazil's own interests, it would certainly appear desirable to proceed toward full acceptance of the Treaty of Tlatelolco and participation in a limited IPS regime. These, however, are limited steps, and one must inquire further into the types of measures that might induce Brazil and other threshold powers to accept the broader prohibitions referred to above, as well as a stronger IPS regime. The best hope for drawing Brazil into such binding legal commitments is to develop a nuclear "bargain" containing the following elements: (1) non-discriminatory commitments between nuclear and non-nuclear weapon states; (2) measures having the immediate effect of either halting or greatly slowing vertical proliferation; (3) provisions mandating the reduction of

242. On the effect of arms control agreements on building internal commitment to a treaty regime and on utilizing bureaucratic processes to inhibit its violation, see Chayes, *An Inquiry Into the Workings of Arms Control Agreements*, 85 HARV. L. REV. 905 (1972).

nuclear weapons held by the nuclear weapons states; and (4) a combination of measures reducing the possibility of Argentine development of nuclear weapons.

Five possible components of a new non-proliferation "package" might be acceptable to Brazil and other potential nuclear weapons states. The first of these, a comprehensive test ban treaty (CTB), would prohibit all nuclear explosions by any state. A non-discriminatory ban would represent a major advance in strengthening the legal commitments by non-nuclear weapons states to forego the development of any nuclear explosive device. Although the nuclear weapons states might object that a CTB would reduce the reliability of their nuclear arsenals, the potential loss would apparently not be great;²⁴³ indeed, such a ban might actually increase the security of the United States and the Soviet Union by reducing the reliability of first-strike weapons.²⁴⁴ Negotiations between the United States, the Soviet Union, and the United Kingdom are well advanced on this issue and should be pressed to a prompt conclusion with the participation of other states.²⁴⁵ Second, a treaty could be adopted by both nuclear weapons and non-nuclear weapons states banning the production of highly enriched uranium or plutonium for the manufacture of nuclear weapons. Given their current stockpiles, the superpowers have no real need to build additional nuclear weapons. A ban on the production of weapons grade fissionable materials may present verification problems, but these may be surmountable in view of the highly sophisticated means of verification at the disposal of the superpowers.²⁴⁶

Third, in accordance with the hypothetical Brazilian proposal presented above, nuclear weapons states could undertake binding

243. See, e.g., Zimmerman, *Quota Testing*, 44 FOREIGN POL. 82, 84-86 (1981).

244. *Threshold Test Ban and Peaceful Nuclear Explosion Treaties: Hearings on Exec. N. Before the Senate Comm. on Foreign Relations and the Subcomm. on Arms Control, Oceans and International Environment of the Senate Comm. on Foreign Relations*, 94th Cong., 2d Sess. 25-26 (1977) (testimony of Paul C. Warnke).

245. U.S. ARMS CONTROL AND DISARMAMENT AGENCY, 1980 ANNUAL REPORT 70-76 (1981).

246. See generally Epstein, *A Ban on the Production of Fissionable Material for Weapons*, 243 SCIENTIFIC AM. 213 (1980), reprinted in SUBCOMM. ON ENERGY, NUCLEAR PROLIFERATION AND FEDERAL SERVICES, SENATE COMM. ON GOVERNMENTAL AFFAIRS, 96TH CONG., 2D SESS., READER ON NUCLEAR NON-PROLIFERATION 102 (Comm. Print 1980).

legal commitments to fully declare their existing military stocks of highly enriched uranium and plutonium, and contribute to the IAEA three percent per year of the stocks originally declared. Parallel commitments would prohibit the transfer of any state's nuclear material for civilian uses to a military nuclear program.

Fourth, an effective IPS regime might be established in order to avoid the stockpiling of plutonium by any state. Military stocks of plutonium held by nuclear weapons states would be subject to the second and third components described above. With these exceptions, all excess separated plutonium in all countries would be subject to the deposit requirements of the IPS regime. To be effective, any IPS scheme should include a "no explosive use" commitment, release standards that would prevent the use of plutonium in research facilities which could be disguised dedicated facilities, and streamlined decision and dispute resolution procedures to facilitate immediate international responses in cases of clear violations (particularly seizure of an IPS depository). This regime should be established in a treaty in order to achieve the highest level of domestic and international commitment.

Last, the Treaty of Tlatelolco should be brought into force for all Latin American countries at the earliest possible time. This will require the Soviet Union to exert its influence to promote Cuban ratification. Diplomatic pressure must be placed on Argentina, preferably from the Latin American states, in order to secure its ratification of the Treaty. United States ratification of Protocol I should occur immediately.

Even if agreement on these five measures were achieved, two additional steps would be required to ensure the continued maintenance of a strengthened non-proliferation regime. The first is a prompt stabilization of the strategic nuclear arms race. Immediate resumption of the SALT process with a view toward early agreement on mutual limits and reductions in nuclear forces is an urgent necessity. The second and more time-consuming step involves the development of post-detonation deterrence strategies and accompanying international legal machinery. Detonation of a nuclear device need not lead to an unraveling of the non-proliferation regime as other states react by pursuing their own nuclear weapons options. Rather, legal commitments and mechanisms should be established which will induce a violator to return to the status of a non-nuclear weapons state at the earliest opportunity. Additional deterrent mechanisms must be established in order to

halt any progression from an initial explosion to the mass production of nuclear weapons and the development of the delivery systems and defense capabilities which will make the use of nuclear weapons a militarily viable option.

Finally, the prohibition of the threat or use of force contained in article 2(4) of the United Nations Charter is of extreme importance. The vigor with which states seek to uphold this norm directly affects the security environment within which decisions whether to produce nuclear weapons will be made by threshold nuclear states. A lack of interest in bringing the ongoing war between Iran and Iraq to a halt, and potential military action against Nicaragua, Cuba, or Poland, for example, represent events which will foster a climate of insecurity promoting the acquisition of nuclear weapons by non-nuclear weapons states.

Even if the proposals outlined above are not immediately adopted, the two steps discussed in the hypothetical Brazilian memorandum could add needed momentum to the strengthening of the non-proliferation regime. The Treaty of Tlatelolco would provide ample warning before the detonation of any PNE to allow diplomatic pressures seeking to reverse any initial decision to join the nuclear club. The potential contribution of an IPS regime, however, is somewhat more problematical, for arrangements to be proposed by the Expert Group on IPS will not be finalized until the end of 1982. At the Fifth Meeting of the Expert Group on IPS, held in Vienna in May 1981, experts from twenty-eight countries and the European Community discussed whether an IPS regime should be established by multilateral treaty or by bilateral safeguards agreements between the IAEA and each participating state. Although a final agreement was not reached, there was strong sentiment in favor of the bilateral approach. Bilateral agreements would follow a model agreement adopted by collective decision²⁴⁷ (perhaps initially by the Expert Group and eventually by the Board of Governors). The Expert Group also considered whether implementation of an IPS scheme should involve a Committee of States. A majority favored the establishment of a new advisory committee to assist the Director General in managing the IPS arrangements, yet most experts sought to deny the committee decision-making authority with respect to deposit or release of plutonium.²⁴⁸

247. EXPERT GROUP, *supra* note 38, at 7.

248. *Id.* at 8.

The Expert Group also discussed whether verification of the stated end-use should occur before or after release. There was general agreement that some prior checking should occur, but disagreement over whether verification should extend to the quantity involved. Some experts believed that verification should occur only after release and return of plutonium to the requesting state.²⁴⁹ In addition, there was a consensus that there was no need to develop guidelines relative to what constitutes the stockpiling of completed fuel elements containing plutonium.²⁵⁰ The decision process for release and questions relating to research and development applications of plutonium were referred to working groups for further study.²⁵¹ Finally, it was agreed that the Sixth, Seventh, and Eighth Meetings of the Expert Group would be held in November 1981, June 1982, and November 1982.²⁵²

It is too early to predict the shape of the IPS scheme that the Expert Group might propose. The regime ultimately proposed by the Expert Group is likely to be weaker than that contained in the hypothetical memorandum. This development is not surprising in view of the need for near-universal participation in IPS and the fact that deliberations based on consensus decisions tend to dilute the proliferation resistance of proposed provisions.²⁵³ Given this tendency, how weak might an IPS regime be and still be acceptable to states intent on strengthening the non-proliferation regime? A number of states are likely to demand a lifting of national restrictions on the export of reprocessing or a surrender of prior-consent rights for the reprocessing of supplied nuclear fuel in exchange for their participation in IPS; therefore, it is important to understand what an IPS regime can and cannot accomplish. The basic trade-off is between easing restraints against the spread of reprocessing facilities and acquiring legal commitments to use plutonium only for research and in reactors. If reprocessing plants will be built at the same rate in any event, the principal cost associated with IPS would be that it might create a false sense of security.

249. *Id.* at 10-11.

250. *Id.* at 12.

251. *Id.* at 12-13.

252. *Id.* at 14.

253. See Lodgard, *The Role of Non-Proliferation Measures in Strengthening the Non-Proliferation Regime*, in *INTERNATIONALIZATION TO PREVENT THE SPREAD OF NUCLEAR WEAPONS* 109 (SIPRI ed. 1980).

The benefits to be derived from an IPS regime include the political and legal commitments undertaken by non-nuclear weapons states and the enhanced probability of detection of any use of plutonium to build nuclear weapons or PNEs. A commitment to submit all separated plutonium to the authority of IPS would raise the threshold for any exercise of the "direct route" to nuclear weapons option. It would also strengthen internal forces operating to restrain the development of nuclear weapons. Similarly, a comprehensive definition of excess plutonium would assure that any use of plutonium for explosive purposes would be transparent and immediately detected. Acceptance of prompt decision processes capable of imposing or authorizing unilateral imposition of serious sanctions would strengthen confidence in the regime by providing it with greater deterrent force. Furthermore, the nature, strength, and depth of the legal commitments involved might also affect their ability to deter prohibited actions. For example, a multilateral treaty is likely to be more effective than bilateral agreements with the IAEA. Any violation would directly affect all participating states, both in terms of the lawful actions they might take in response to a serious breach of the underlying obligations,²⁵⁴ and in terms of the political commitment which might be generated to support collective measures designed to sanction any violation and uphold the regime.²⁵⁵

In conclusion, Brazil is not the only threshold nuclear power whose decision whether to build nuclear weapons will depend upon the degree of vertical proliferation and the evolving nature of the international economic and political order. Before the nuclear weapons states summarily dismiss the above proposals, they should contemplate carefully the probable consequences of Brazil and other threshold nuclear powers proceeding with the development of nuclear weapons and delivery systems. If that is a "worst-

254. Such actions might include non-forcible reprisals, the possibility of which could greatly strengthen the deterrence of fundamental violations such as seizure of an IPS depository. On the lawfulness of non-forcible reprisals, see A. VERDROSS & B. SIMMA, *UNIVERSELLES VÖLKERRECHT* 652-54 (1976); Bowett, *Economic Coercion and Reprisals by States*, in *ECONOMIC COERCION AND THE NEW INTERNATIONAL ECONOMIC ORDER*²⁷, 14-17 (1976). While the legality of non-forcible reprisals is a highly controversial issue, parties to a multilateral treaty might, depending on its provisions, have at least a fair legal argument justifying such measures taken in response to seizure of an IPS store.

255. On the question of sanctions, see Szasz, *Sanctions and International Nuclear Controls*, 11 *CONN. L. REV.* 545 (1979).

case" scenario, it is one toward which the world is steadily drifting, and which all nations must urgently act to avoid.