THE UNITED STATES NUCLEAR POWER EXPORT PROGRAM: AN ASSESSMENT OF ITS NATIONAL AND INTERNATIONAL IMPACTS ON THE ENVIRONMENT

I. INTRODUCTION

In 1973 an action was brought by the Sierra Club to compel the Atomic Energy Commission (AEC)\(^1\) to prepare an environmental impact statement as required by the National Environmental Policy Act of 1969\(^2\) on its nuclear power export program.\(^3\) The United States District Court for the District of Columbia ordered the AEC to complete such an impact statement\(^4\) even though it did not actually adjudicate the question of whether NEPA's requirement of an environmental impact statement (EIS) was applicable to the AEC's activities, primarily because soon after the filing of the complaint AEC voluntarily decided to prepare an EIS on the overall nuclear power export process.\(^5\) Thus, the court merely ruled on the time limit for filing the final EIS, designated as 12 months from the date of its decision, August 3, 1974.

Although the decision in *Sierra Club v. AEC*\(^6\) may appear to be a victory for environmental advocates and for those concerned with the AEC's responsibility for the environmental effects of its nuclear power activities in foreign environments, some unanswered questions persist. One of these is the adequacy of the final EIS\(^7\) which was completed and circulated in April 1976. Another question concerns the scope of such an EIS; *i.e.*, whether it should include an analysis of impacts on foreign environments as well as impacts on the environment of the United States. In addition to these questions, there remains the pervasive dilemma of supplying increased world demands for energy while at the same time preserving the human environment against the adverse effects of nuclear power, with special emphasis on the maintenance of safety and prohibition of the proliferation of nuclear weapons. This Note will review the adequacy of the EIS in

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\(^1\) The AEC has been reorganized into the Energy Research and Development Administration (ERDA) and the Nuclear Regulatory Commission (NRC) by the Energy Reorganization Act of 1974, § 2, 42 U.S.C. § 5801 (1974).


\(^4\) Id. at 1983. The court's order was dated Aug. 3, 1974.

\(^5\) Id. at 1981. In a letter to the court dated Mar. 15, 1974, the AEC conceded that NEPA's EIS requirement was applicable to its actions.

\(^6\) Note 3 supra.

\(^7\) ERDA, FINAL ENVIRONMENTAL STATEMENT: U.S. NUCLEAR POWER EXPORT ACTIVITIES, (No. 1542, April 1976) [hereinafter cited as ERDA No. 1542].
reference to United States nuclear power export activities and its obligations to the international community concerning such nuclear exports. Also examined will be the controversy surrounding the existing systems of international and domestic safeguards on nuclear energy. Although there are no immediate answers to the problems associated with nuclear energy, numerous opinions have been posed concerning its benefits and risks to the human environment.

The importance of assessing the environmental effects resulting from nuclear power exports can be more fully appreciated by examining the nature of the United States export program. A series of interlocking transactions begins with AEC negotiation of a bilateral agreement for cooperation with a foreign government wishing to receive nuclear equipment. This government may then seek financing from the Export-Import Bank for the proposed purchase of nuclear equipment and fuel. Once the financing is approved, the foreign purchaser must obtain an export license from the AEC before completion of the transaction is effected. If a fuel supply contract is also executed, the fuel which is not consumed during the operation of foreign reactors is returned to the United States for reprocessing and storage. Thus, the AEC could be assuming responsibility for the maintenance of radioactive wastes from both domestic and foreign nuclear reactors. Almost 50 percent of the nuclear enrichment facility production of the United States is destined for foreign use and heavy demand is being placed on domestic energy supplies. Such facts emphasize the propriety of forcing AEC to file an EIS on its nuclear power export program.

II. Adequacy of the Environmental Impact Statement

A. Domestic and International Scope of NEPA

According to the express language of NEPA, the scope of the Act is intended to be global. All federal agencies are directed to "recognize the worldwide and long-range character of environmental problems." Thus, the purpose of NEPA, and its EIS requirement, is "to assure that the United States itself is never responsible for unanticipated environmental injury anywhere."

The AEC's decision in Sierra Club v. AEC to file an EIS constitutes a change from the previous assumption that NEPA's EIS requirement did not apply to the State Department and other foreign affairs agencies. The

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8 Environmentalists Challenge Nuclear Export Program, 3 Envt'l L. Rep. 10181 (1973) [hereinafter cited as Environmentalists].
9 Id.
10 Id.
principal justification for this previous position was that any attempt to apply NEPA's systematic, interdisciplinary approach to foreign territory would be very difficult to sustain against charges of encroachment.\\(^{13}\) Now, however, the State Department and the AEC recognize their duty to file an EIS.\\(^{14}\)

Although the Energy Research and Development Administration (ERDA) did file an EIS in compliance with NEPA, it nevertheless limited the scope of its assessments to the environmental impacts in the United States and on the high seas resulting from United States nuclear export activities. Several commentators on the EIS have criticized this limitation of its scope.\\(^{15}\) In justification of its position, ERDA states that expansion of the statement's scope to include environmental impacts from foreign nuclear power programs over which the United States has no decision making role is inappropriate.\\(^{16}\) While asserting that these problems are international in scope and require international solutions, ERDA states that a country-by-country evaluation would be too speculative.\\(^{17}\) The EIS further states that expanding the scope to include impacts on foreign environments would create risks of international repercussions arising from claims of encroachment by the United States. In effect, the United States would be making a substantive decision as to whether the decision by a foreign nation to pursue the nuclear power option was in the best interests of that nation and its citizens.\\(^{18}\)

Although ERDA's arguments sound convincing, there remains room for debate regarding the applicability of NEPA to federal actions outside the United States.\\(^{19}\) Since the nuclear power export program is relatively large and environmentally significant, application of NEPA to the program seems appropriate. There is little reason to believe that foreign governments would resent being informed of the environmental consequences of their purchases. This is especially important in nuclear sales to less developed nations which may lack the expertise necessary to conduct such analyses on their own.\\(^{20}\) A disclosure of foreign impacts would assist other nations in deciding whether and to what degree they should utilize nuclear power.\\(^{21}\)

One of the comment letters to ERDA concerning the EIS postulated that even though certain activities occur on foreign soils, the consequences of

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\(^{13}\) Id. at 261.

\(^{14}\) Id. at 266.

\(^{15}\) See generally ERDA No. 1542, supra note 7, app. E, comment letters: E-11, E-12, E-17.

\(^{16}\) ERDA No. 1542, supra note 7, at ii.

\(^{17}\) Id. at iii.

\(^{18}\) Id.

\(^{19}\) Environmentalists, supra note 8.

\(^{20}\) Id. at 10181-82.

\(^{21}\) Letter from Eldon V.C. Greenberg to W.H. Pennington (Oct. 22, 1975), reprinted in ERDA No. 1542, supra note 7, at app. E, E-17 at 6 [hereinafter cited as Greenberg].
those activities could directly affect the environment of the western hemisphere or of the entire world.\textsuperscript{22} Since the United States is part of this environment it would seem prudent for ERDA to assess environmental impacts on foreign surfaces. However, even if impacts on foreign countries are not assessed, ERDA should at least estimate the possible impacts on the United States resulting from the injection of radioactive material into the global or hemispheric atmosphere or by oceanic circulation.\textsuperscript{23}

Since ERDA obtains information regarding the recipient country's plans for nuclear development when it negotiates contracts to supply enriching services,\textsuperscript{24} it would be possible for ERDA to assess the impacts such facilities will have on that country's environment. An additional input of information to ERDA would result from the recipient's reports to ERDA of any shutdowns or accidents which may occur after the reactor is operating.\textsuperscript{25}

In summary, the basic difference between ERDA's position and that of its critics on the scope of the EIS appears to be one of perception. ERDA assumes that any United States assessment of foreign environmental impacts will be an impermissible direction to foreign countries of what they should do concerning their nuclear power policies. On the other hand, the critics suggest that such an assessment would serve as an analytical aid to these countries who would be free to accept or reject such aid.

Substantial support for claims that NEPA requires environmental analysis of an agency's impacts on foreign environments can be found in a recent case involving the United States Agency for International Development (AID).\textsuperscript{26} The Environmental Defense Fund instituted an action to compel AID to analyze the impacts on foreign environments resulting from the use of pesticides exported by AID. Included in AID's Commodity Eligibility List of pesticides to be exported were DDT, aldrin and dieldrin. Since the Environmental Protection Agency had banned domestic use of DDT in 1972 and suspended the use of aldrin and dieldrin in October 1974, it seemed obvious that these pesticides posed significant environmental risks.\textsuperscript{27} Consequently, the effects on foreign environments should have been included in AID's programmatic EIS.

In a response similar to the AEC's position limiting its EIS to the domestic impacts of its export program, AID sought to defend its own EIS by claiming that NEPA does not apply to the foreign impact of activities

\textsuperscript{22} Letter from Gene I. Rochlin to W.H. Pennington (Oct. 16, 1975), reprinted in ERDA No. 1542, supra note 7, at app. E, E-12 at 1 [hereinafter cited as Rochlin].
\textsuperscript{23} Id.
\textsuperscript{24} Greenberg, supra note 21, at 6.
\textsuperscript{25} Id.
\textsuperscript{27} International Application of NEPA: Environmentalists Challenge Pesticide Aid Program, 5\textsuperscript{th} ENVT'L L. REP. 10086 (1975) [hereinafter cited as Pesticide Program].
outside the United States. This defense, however, was rejected by the court. Instead, the parties agreed that AID would, within 10 months, file a programmatic EIS on its international pesticide activities. In its assessment AID was to analyze the environmental impact, including unavoidable adverse impacts, of current and reasonably anticipated pesticide activities “wherever such impacts or activities occur.” AID must also analyze reasonable alternatives and their environmental effects. By analogy the argument could be made that if one foreign affairs agency is required to assess the foreign environmental impacts of its activities, then all such agencies should be similarly forced to comply with this interpretation of NEPA. Thus, ERDA could possibly face the task of revising its EIS to include foreign impacts in its analysis. However, it should be noted that significant differences in both policy and value judgments exist between the export of pesticides and the export of nuclear technology. Although pesticides such as DDT are useful in controlling unwanted pests, the known risks of such substances causing cancer may far outweigh any benefits derived from their use. In contrast, the risks involved in using nuclear power may not outweigh the benefits of increased supplies of energy. This is especially relevant in view of the current fuel crisis in the United States and in many parts of the world.

B. Unavoidable Adverse Environmental Effects

While the subject EIS provides a detailed discussion of the environmental impacts on the United States and the high seas, an understandable and representative summary of these impacts is presented in its cost-benefit analysis. Included in the environmental considerations is the land committed for the mining and milling of uranium. Based on a 25 year cumulative index, a total of 20,000 acres is estimated to be committed by the year 2000. The comparable amount of land necessary to produce the equivalent amount of energy from coal is about 30 to 35 times more land, if used for strip mining. Although the ecology of these 20,000 acres will be totally destroyed, ERDA states that future state and federal regulations requiring mine-land reclamation will mitigate some of this impact.

Further commitments of land will be necessary for the operation of enrichment services. A total of 3,700 acres of land will be required for process buildings, power generating stations and other related on-site activities. About 37,000 additional acres will be needed to provide buffer zones

28 Id. at 10084.
30 Id. (emphasis added).
31 Id.
32 ERDA No. 1542, supra note 7, § 13 at 7.
33 Id. at 10.
around these facilities in order to minimize public exposure and access and to maximize security control. All of these aforementioned facilities will require 158 billion gallons of water per year in order to dissipate the heat associated with the enrichment process.\(^4\)

Assuming the prospective shortage of enrichment capacity, one commentator has suggested that ERDA should consider the pressure that might be exerted on domestic needs if the obligations to fulfill foreign orders are given high priority. Also, the capital required to expand enrichment capacity to fulfill foreign orders could have an indirect impact on the United States by diverting needed capital from other uses.\(^5\)

Another adverse effect would be the release of chemicals, both radioactive and nonradioactive. These releases are estimated to have little or no effect on the local environment surrounding fuel cycle facilities. This minimal effect is partly attributable to the process whereby state and federal regulatory agencies review both the preconstruction and operation phases of the facilities.\(^3\) Supposedly, these agencies would restrict chemical releases to tolerable levels.

Inherent in the nuclear energy process is the production of radioactive wastes. Public concern over nuclear safety is focused mainly on the storage of these radioactive wastes.\(^3\) This seems especially evident when one considers that these materials will remain radioactive or toxic, or both, for thousands of years. Presently in the United States, wastes are stored in solidified or liquified form at ground level in heavily shielded containers which will hold the wastes for hundreds of years.\(^3\)

ERDA’s EIS seems somewhat deficient in its discussion of the environmental effects of radioactive waste and waste management. Rather than discussing the problems involved with storage and possible accidents, the EIS focuses on the environmental effects of management events prior and up to the storage of wastes. Thus, it discusses three possible effects of waste burial facility construction.\(^9\) Although accidental openings of waste packages might occur at a commercial land burial facility, the environmental impact is estimated to be insignificant.\(^10\)

Evidence that neither the Nuclear Regulatory Commission (NRC) nor ERDA can lightly ignore the effects of waste disposal is shown in a recent

\(^{31}\) Id.

\(^{32}\) Rochlin, supra note 22, at 4-5.

\(^{33}\) ERDA No. 1542, supra note 7, § 13 at 11.

\(^{34}\) Doub & Dukert, Making Nuclear Energy Safe and Secure, 53 FOREIGN AFFAIRS 756, 767, 768 (1975) [hereinafter cited as Doub & Dukert].

\(^{35}\) Id. at 767. Germany uses underground storage, while Japan is considering all forms of long-term waste disposal.

\(^{36}\) ERDA No. 1542, supra note 7, § 5 at 96. These include the temporary dust and noise during construction of offices and laboratories, periodic evacuation and filling of trenches, and the presence of an exclusion fence around the area.

\(^{10}\) Id. at 97.
action brought by the Natural Resources Defense Council (NRDC).\textsuperscript{11} The court there held that the licensing of individual reactors must consider the effects of waste disposal as irreversible and irretrievable commitments of resources.\textsuperscript{12} Two appeals were consolidated and brought before the court challenging the decision of NRC not to prescribe mandatory consideration of the effects of radioactive waste disposal.\textsuperscript{13} The court rejected arguments that these issues were too speculative, or that they should only be considered when waste disposal facilities are themselves licensed. Adhering to the decision in Scientists' Institute for Public Information, Inc. (SIPI) v. AEC,\textsuperscript{14} the court recited again that the obligation to make reasonable forecasts of the future is implicit in NEPA, and held that the agency cannot shirk its responsibilities by labelling any and all discussions of future environmental effects as “crystal ball inquiry.”\textsuperscript{15}

Since plutonium is one of the most toxic substances known to exist and requires isolation from the environment for at least 250,000 years before it becomes harmless, the wastes generated by nuclear reactors are not “de minimis.”\textsuperscript{16} Consequently, waste disposal may become an ever increasing problem. Since seabed disposal of high-level wastes from foreign activities may prove too costly, hazardous or difficult, foreign recipients of nuclear power from the United States may rely upon the United States to store their wastes. Foreign policy considerations and the need for global environmental protection may eventually outweigh domestic reluctance to accept such foreign wastes.\textsuperscript{17} Since the United States may be forced to handle worldwide problems of waste disposal it seems imperative that the EIS consider the entire range of ramifications of this problem.

C. Alternatives to Nuclear Exportation

Also included in NEPA’s requirement for an adequate EIS is a discussion of “alternatives to the proposed action.”\textsuperscript{18} In evaluating the adequacy of ERDA’s discussion of alternatives in its EIS, it is helpful to consider the decision in NRDC v. Morton.\textsuperscript{19} Considering the Department of the Inte-

\begin{footnotesize}
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\item Id.
\item Id. at 20615-16. One of the appeals, No. 74-1385, involved a proceeding to license the Vermont Yankee Nuclear Power Station near Vernon, Vt., in which the Appeals Board held that Licensing Boards did not have to consider the operations of reprocessing plants or the disposal of wastes in individual licensing proceedings. In the second appeal, No. 74-1586, the Commission had stated in a rulemaking proceeding that the effects of waste disposal were relatively insignificant, but that it was preferable to take them into account.
\item 481 F.2d 1079 (D.C. Cir. 1973).
\item Id. at 1092.
\item 6 Env’t’l. L. REP. at 20616.
\item Rochlin, supra note 22, at 9.
\item 458 F.2d 827 (D.C. Cir. 1972).
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rior's EIS on its proposal for an oil and gas general lease sale, the court stated that NEPA requires the presentation of environmental risks incident to alternative courses of action which are reasonably available. More explicitly, the EIS should discuss such impacts even though it entails the weighing of numerous matters such as economics, foreign relations and national security. Thus, the agency should not be excused from discussing an alternative merely because it does not offer a complete solution to the problem.

Three main alternatives to the nuclear power export program were proposed by ERDA. These consisted of terminating nuclear power exports, imposing additional controls on nuclear exports, or continuing nuclear exports improved by technology designed to minimize adverse environmental impacts in the United States. There are certain possible advantages to a termination or reduction of exports. Potential customers may perceive such action as a signal that the United States considers the risks too great to continue the program, thus suggesting a reevaluation of their own nuclear power programs. Termination of exports additionally would help reduce the proliferation of nuclear explosives, since customers would either terminate or delay their nuclear power plans if nuclear materials could not be obtained elsewhere.

On the other hand, the EIS discusses potential disadvantages of a reduction or termination of the nuclear power export program. Since the United States has promoted the development of peaceful uses of nuclear energy under international safeguards and controls, such a reduction or termination would have an adverse effect on the use of adequate safeguards. The United States requires that its recipients accept such safeguards and controls while other suppliers do not. Therefore, the EIS assumes that recipient countries would not adhere to international safeguards if they were purchasing nuclear technology from countries other than the United States. A termination or reduction of United States exports would force these recipients to purchase from other countries, resulting in a decreased observance of international safeguards.

Termination could also cause a significant reduction in foreign policy influence and national security. According to former Secretary of State Henry Kissinger, "United States constraints by themselves will have little effect if other nuclear suppliers decline to exercise the same restraints."

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50 Id. at 834.
51 Id.
52 Id. at 836.
53 ERDA No. 1542, supra note 7, § 9 at 1.
54 Id. at 10.
55 Id.
56 Id. § 13 at 12.
Thus, the policy of ERDA appears to justify nuclear power exports by the United States on the assumption that if recipient countries do not buy from the United States, they will buy from another supplier. This underlying policy is also present in the discussion of the second alternative of imposing additional safeguards and controls on United States exports. This alternative is expected to induce purchasing nations to seek alternative sources for related materials and equipment, including the development of their own domestic capabilities. This would consequently reduce United States influence over foreign nuclear materials usage. Although a benefit would be the reduction of domestic environmental impact, there would be an adverse impact on foreign policy influence and national security.

The third alternative, upgrading technology to minimize adverse environmental impacts, would have little effect on the level of exports, economic benefits, or United States foreign policy and national security objectives. In fact, this third option could be implemented irrespective of export activities. This is essentially due to the fact that the upgrading of technology is primarily a domestic endeavor. Ideally, this could be accomplished within the United States, without involving any foreign policy determinations. This would also inadvertently minimize impacts abroad, since foreign exports are drawn from the present domestic supply of nuclear power.

One suggestion which has aroused considerable debate is a temporary moratorium on new nuclear export commitments. The EIS states that this is already occurring to some extent since ERDA has reached the limit of its uranium enrichment capacity and has ceased entering into new fuel supply commitments, pending a decision on the construction of new enrichment plants in the United States. In addition to causing a loss of future export revenue, a temporary moratorium would diminish American influence on the development of international safeguards and physical security policies.

A criticism of ERDA's stance in relation to such a moratorium is that "[i]t is by no means morally, ethically, or politically defensible to justify a dangerous U.S. policy on the grounds that if we do not do it, someone else will." Rather than improving United States influence abroad, the sale and distribution of a technology that "may prove to be neither useful nor cost-effective in the country that receives it will neither improve nor maintain credibility of U.S. promotional efforts abroad."

According to Adlai E. Stevenson III, a one-year moratorium would re-
duce competitive pressures to export. He suggests that the United States should sell nuclear reactors only to countries which conform all of their facilities to International Atomic Energy Agency (IAEA) safeguards. The scope of such a moratorium would include supplies of fuel, technology and nuclear-related materials, excepting those commitments under existing contracts. The end result may be to initiate efforts to obtain more effective safeguards and security systems.

Although ERDA seems to recommend using nuclear development along with other programs such as solar energy and geothermal energy, it does not formally present such forms of energy as alternatives to the nuclear power export program. This decision by ERDA, as evidenced in its draft EIS, drew much criticism from experts in the fields of both geothermal and solar energy. The Managing Director of the Geothermal Energy Institute stated that ERDA's view that geothermal and wind technologies are not sufficiently developed so as to make significant contributions to foreign energy needs is scientifically unsupportable. He continues his support of geothermal technology by pointing out that other countries would need United States aid only in bringing reservoirs on stream and in installing power plants, since these countries would already have the necessary fuel for such technology, geothermal stream. Thus, it would not be necessary to export extensive technologies or dangerous nuclear fuel, as in the case of nuclear energy exports.

Solar energy should also be seriously considered as a source of virtually unlimited quantities of clean power. However, ERDA failed to fully discuss this alternative and even expressly stated that "a systematic assessment has not yet been completed of direct and indirect environmental issues of the solar product life cycle." This apparently violates the mandate proclaimed in NRDC v. Morton, which stated that a federal agency must discuss the environmental impacts of reasonably available alternatives to the proposed course of action. One reason for this failure to discuss reasonable alternatives may be that ERDA is deeply entrenched in the practice of the nuclear power export program, which has continued for over 20 years. There are also strong financial investments in the nuclear

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63 Stevenson, Nuclear Reactors: America Must Act, 53 Foreign Affairs 64, 71 (1974) [hereinafter cited as Stevenson].

64 Id.

65 Letter from Donald F.X. Finn to W.H. Pennington (Aug. 18, 1975), ERDA No. 1542, supra note 7, app. E, E-1 at 1. Id. Although the United States possesses very competent geothermal engineering technology, it is not alone in its endeavors. At the May 1975 United Nations International Conference on Geothermal Resources, Japan, Italy, the Soviet Union, Mexico, New Zealand and Turkey all presented papers on their respective research in the geothermal energy area.

67 Greenberg, supra note 21, at 63.

68 ERDA No. 1542, supra note 7, app. D-2.

69 458 F.2d at 834.
energy field which are not present in such fields as geothermal or solar energy. It is interesting to note that comment letters submitted to ERDA from various investors in nuclear energy seemed to endorse the EIS as being fully adequate.70

D. Hazards of Nuclear Reactor Operations

The alternatives to the nuclear power export program must be analyzed in view of the hazards associated with the actual operation of nuclear reactors. Although the AEC has concluded that the consequences of potential reactor accidents are much smaller in many cases than those of non-nuclear accidents,71 there exists the possibility that a maximum melt down accident could kill as many as 2,300 people.72 The only way for large amounts of radioactivity to be released by the fission process is by melting the fuel in the reactor core. Although a series of sequential failures must occur before the fuel will overheat, the problem is grave. Even radioactive decay of fuel continues to generate heat, requiring the installation of redundant decay heat removal systems.73

While assessing the probability of a core melt accident as one every 17,000 years per plant, one reactor study states that all immediate and latent effects from such an accident are estimated to be very small.74 Delayed or latent effects of exposure could cause an increase in the incidence of cancer, genetic effects and thyroid gland illnesses over a 10-20 year period.75 Economically, the costs of such an accident would be about $100,000 in property damage.76 Another consequence of a major accident could be the forced evacuation of persons near the plant site, with such relocation lasting until the radioactivity either dissipated or was removed. An additional major concern would be the monitoring of farm produce to reduce the amount of radioactivity ingested through the food chain.77 This is especially important since the effects of radioactive doses are cumulative both in the individual and the offspring.78

72 Letter from L. Douglas DeNike to W. H. Pennington (Sept. 4, 1975), ERDA No. 1542, supra note 8, app. E, E-2 at 4. [hereinafter cited as DeNike]. Such an accident could also make 5600 persons acutely ill and cause 3200 latent cancers.
73 Reactor Study, supra note 71, at 187.
74 Id. at 193.
75 Id. at 192-93.
76 Id. at 199.
77 Id. at 198.
78 Dickstein, National Environmental Hazards and International Law, 23 Int'l & Comp. L. Q. 426, 428 (1974).
The extent of consequences arising out of a nuclear accident is dependent on conditions under which the accident occurs. The AEC study identifies three factors which may determine the seriousness of such an accident. One of these is the amount of radiation released into the atmosphere. Also important is the method by which radiation is dispersed by prevailing weather conditions and the number of people exposed to the radiation.\(^7\)

All these factors are significant in assessing the hazards of reactor operation.

E. Irreversible and Irretrievable Commitment of Resources

Another EIS requirement is that the agency must evaluate any irreversible and irretrievable commitments of resources.\(^8\) This has been accomplished by ERDA, although in perhaps a terse and abbreviated fashion. The most significant commitment of resources appears to be the use of electrical power. Out of an estimated 1400 billion kilowatt hours (kWh) required by gaseous diffusion plants, 575 billion kWh will be consumed by export activities. In addition to the utilization of 350 million tons of coal, 112 x 10^9 standard cubic feet of natural gas will be used by the year 2000. Also, the United States will mine 197,000 metric tons of natural uranium by the year 2000 for export activities.\(^9\)

Land irreversibly committed to nuclear export activities is limited by the EIS to land used for the storage of low level wastes resulting from uranium hexafluoride conversion, enrichment and fuel fabrication services. By the year 2000, this commitment will require 1,000 acres of land. Mention is also made of the commitment of human resources in the form of 10,000 to 23,000 highly skilled and trained persons working in fuel cycle activities related to projected exports.\(^10\)

F. Relationship Between Short-Term and Long-Term Productivity

These irreversible commitments of resources are directly related to the relationship between the short-term uses of man’s environment and long-term productivity. An analysis of this relationship is also required by NEPA.\(^11\) The principal long-term effect of nuclear power export activities is the management of low level radioactive wastes. The projected 1,000 acres needed for waste disposal is 2.7 percent of the land committed to total waste disposal, including domestic disposal, over the balance of the century. Since uranium ores constitute a finite resource, the export of

\(^7\) Reactor Study, supra note 71, at 194-95. All estimates were based on the assumption that evacuation procedures would be used to move most persons out of the path of airborne radiation.


\(^9\) ERDA No. 1542, supra note 7, § 12 at 1.

\(^10\) Id.

197,000 metric tons will hasten the depletion of domestic supplies of uranium and may also preclude the utilization of this ore by future generations. United States coal reserves are also a finite resource which will be reduced by the projected export related consumption of 350 million tons by the year 2000.84

Justification for such exploitation of industrial capacity and its natural resources for nuclear power export activities is based by ERDA on three factors. Primarily, the United States will increase its world influence in terms of its conduct of foreign policy and national security. Secondly, favorable revenues and balance of payments benefits are results of such activities. Finally, the additional employment of local workers will result from nuclear export activities.85

Important to discuss at this point is ERDA’s analysis of the costs and benefits of continuing the nuclear power export program. One prime benefit is that nuclear export revenues are predicted to account for 3.6 percent of the total United States export revenues by the year 2000. Other benefits include increased employment opportunities in the domestic nuclear industry and in the supporting materials supply organizations, as well as increased tax revenues from industrial, commercial and residential sectors of the economy.86 In comparison, ERDA asserts that the sole cost in achieving national security and foreign policy goals is the risk of increasing opportunities for diversion, theft or sabotage of potential weapons material. The EIS concludes that

continuation of United States nuclear export activities will be essential . . . to enable the United States to assert a position of leadership in international nuclear affairs sufficient to assure the maintenance and improvement of international safeguards and other national security controls on nuclear energy developments abroad, and to improve international environmental and safety standards.87

Since this conclusion seems to be based on the bottom line assumption that international safeguards and safety standards are presently inadequate, a review of present safeguards systems seems appropriate.

III. RISKS AND CONTROLS IN THE NUCLEAR POWER EXPORT PROGRAM

A. International Safeguards Systems

Since nuclear energy is an international concern, a balance between expansion and risk can only be achieved through a multinational framework for controlling nuclear facilities and materials. The already existing International Atomic Energy Agency (IAEA) provides the basis for such a

84 ERDA No. 1542, supra note 7, § 10 at 1.
85 Id.
86 Id. § 13 at 7.
87 Id. at 1 (emphasis added).
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framework. Established in 1956 as an affiliated agency of the United Nations, the IAEA sought to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world." The agency was also charged with the establishment and administration of safeguards designed to ensure that no nuclear materials or facilities were used for military purposes.

Primarily, the IAEA has never had authority to limit or influence military programs of countries which already possess nuclear weapons. Furthermore, IAEA safeguards have mainly focused on facility inspection and an accounting system. Consequently, such safeguards are helpful only to detect diversion of significant quantities of nuclear materials from peaceful activities.

Duties relegated to the IAEA were greatly expanded in 1970 by the Treaty on the Non-Proliferation of Nuclear Weapons (hereinafter referred to as NPT), which gave IAEA the responsibility for monitoring compliance with its provisions. Under the NPT, nonnuclear weapons states agreed to accept IAEA safeguards in order to prevent diversion of nuclear energy to nuclear weapons, while nuclear weapons states agreed not to transfer nuclear weapons to recipient states. However, the treaty also provided for the fullest possible exchange of equipment, materials, and scientific information for peaceful uses of nuclear energy.

Vitally important is the fact that 36 members of the United Nations have not signed the NPT, including France and China, while 15 signatories have not ratified the treaty. The provisions prohibiting transfers of weapons, while encouraging exchanges of nuclear material and technology, display a potential contradiction in the treaty as weapons can easily be made from certain nuclear materials and technology. The treaty also requires safeguards on the recipient country's nuclear facilities, but allows assistance to nations refusing to join the treaty. Although imposing limitations on transfers by nuclear weapons states, the treaty imposes no such limitations on subsequent transfers by recipients to other countries. Overriding all these potential contradictions is the fact that the treaty contains no sanctions.

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88 Doub & Dukert, supra note 37, at 757.
90 Id. art. 3, para. 5.
91 Doub & Dukert, supra note 37, at 758.
92 ERDA No. 1542, supra note 7, § 6 at 24.
94 Id. art. 3, para. 1.
95 Id. art. 1.
96 Id. art. 4, para. 2.
97 Doub & Dukert, supra note 37, at 759.
98 Stevenson, supra note 63, at 67, 68.
At the time the treaty was signed, no agreement existed as to what the safeguards would be, since this was left up to individual state agreements with the IAEA. The United States has voluntarily applied IAEA safeguards to its facilities, although it was not obligated to do so under the NPT. Such concern about the potential ineffectiveness of IAEA safeguards would not be warranted unless there were significant risks involved in the nuclear power process. According to ERDA's EIS, serious risks inherent in its export program are divided into three categories.

The first category includes the risk that nuclear materials are subject to theft either within the United States or in foreign countries by subnational groups which may wish to make explosive devices. Since there has been a recent increase in terrorist incidents throughout the world, this threat seems to be a realistic one. Such terrorists could use nuclear material to make explosives, to disperse radioactivity or merely to sell to other customers to finance further operations. The EIS treatment of this subject fails to predict the probability of such an event occurring and merely assumes that a serious threat is possible. Presently, primary measures to protect nuclear materials against diversion by criminals or political terrorists are being taken on a national basis, since the IAEA has not taken a direct role in this area. However, it may be possible to develop an IAEA safeguards system with the help of individual nations and their programs.

One commentator to the EIS has estimated that the malicious dispersal of very small amounts of plutonium could necessitate evacuation and decontamination of several square kilometers for long periods of time, thus costing millions of dollars. While the EIS does not fully evaluate consequential deaths or injuries resulting from radioactive dispersal, it does predict that the critical human area affected would be the lungs, due to inhalation. Dispersal could be accomplished in corridors or ventilation systems, from moving vehicles or aircraft, by explosion or by fire.

A second major category of risks identified by the EIS is potential sabotage of radioactive material shipments in transit within the United States or on the high seas. In 1974, there were approximately one million shipments in the United States of radioactive materials by all types of carriers, with 10-25 percent of these being special nuclear materials. Thus, considering a probable increase in the number of shipments, it is reasonable to assume that transportation risks are significant. International regulations

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99 Id. at 68.
100 ERDA No. 1542, supra note 7, § 6 at 3.
101 Doub & Dukert, supra note 37, at 765.
102 DeNike, supra note 72, at 5.
103 ERDA No. 1542, supra note 7, § 6 at 7.
104 Id. at 1.
105 Atchley, Air Transportation of Radioactive Materials and Passenger Protection Under International Law, 5 CALIF. W. INT'L L. J. 425, 426 (1975) [hereinafter cited as Atchley].
established by the IAEA require that radioactive materials be delivered to the shipper in containers specially designed to prevent leakage and approved by IAEA.\textsuperscript{106} Radioactive emissions have also been placed under limitations considered to be safe for passenger exposure during aircraft flights.\textsuperscript{107} Such international regulations lack strict enforcement since IAEA requires domestic regulations to conform to the agency’s recommended standards “to the greatest extent possible.”\textsuperscript{108} Conceivably a nation could choose not to follow these regulations on the basis that it is not feasible to do so.

Since regulations on the transport of radioactive materials are ultimately the responsibility of each nation, it is necessary to examine present regulations in the United States. Responsibility for such control is divided between the Department of Transportation and the Nuclear Regulatory Commission. Although there has been an increasing number of reported accidents in recent years, this increase in accidents has gone unchecked due to the lack of proper investigation and enforcement by both of these agencies.\textsuperscript{109} In fact, the Senate Commerce Committee has concluded that “noncompliance is the rule rather than the exception in this dangerous business.”\textsuperscript{110} It therefore seems imperative that domestic and international standards be strengthened in order to avoid injurious consequences resulting from transportation of radioactive material.

B. Proliferation Dangers and Domestic Safeguards

Probably the most serious risk attendant to nuclear power exports is the danger of diversion of nuclear material by foreign governments for the development of nuclear weapons or explosives.\textsuperscript{111} As of April 1976, 25 Agreements for Cooperation between the United States and 21 individual nations and two international organizations were in force. Included in these agreements are 13 NPT parties,\textsuperscript{112} two signatories that have not ratified the NPT,\textsuperscript{113} six nonparties to the NPT,\textsuperscript{114} and the two international organizations.\textsuperscript{115}

\begin{footnotes}
\item[107] Atchley, \textit{supra} note 105, at 428.
\item[108] Id. at 429.
\item[109] Id. at 431.
\item[111] ERDA No. 1542, \textit{supra} note 7, § 6 at 1.
\item[113] Japan and Switzerland.
\item[114] Argentina, Brazil, India, Portugal, South Africa and Spain.
\item[115] European Atomic Energy Community (EURATOM) and International Atomic Energy Agency (IAEA).
\end{footnotes}
Each Agreement for Cooperation must include, among other things, a guarantee that the cooperating party will not use any transferred material for atomic weapons or for any other military purpose. However, there is no prohibition on the use of nuclear energy for peaceful nuclear explosions. Additionally, a recipient country could decide to divert nuclear material into weapons regardless of the existence of its agreement with the United States.

The technology for diversion of nuclear material is readily available to most countries. The most critical stage of the nuclear process is the reprocessing stage. Since spent fuel contains uranium-235 and plutonium, both of which are potential bomb materials, it is possible to produce nuclear weapons from such fuel. It has been estimated that by 1980, recycling of plutonium can reduce the world's needs for fuel enrichment capacity by 10-25 percent. This would also reduce uranium mining requirements by 20-25 percent and simplify disposal of highly radioactive wastes. Enrichment facilities themselves could be a major point of diversion, although the enrichment process is expensive and power consuming. Consequently, the potential for nuclear weapons manufacture will probably increase.

Another source of domestic safeguards is the amended Atomic Energy Act of 1954. The Nuclear Regulatory Commission (NRC), which is given the responsibility of issuing licenses for nuclear reactors, must first find that the proposed activity will not be "inimical to the common defense and security" and will not constitute an unreasonable risk to the health and safety of the public. It is this language which prompted the first recorded dissent of a commissioner to the NRC's approval of the export of a nuclear reactor to Spain, a nation which has refused to ratify the NPT.

In his introduction of the NRC decision into the Congressional Record, Senator Ribicoff stated that this first dissent, voiced by Commissioner Victor Gilinsky, had made history. He further explained that the key issue raised by Gilinsky was the adequacy of IAEA safeguards in detecting surreptitious removal of plutonium, after it is separated from the spent fuel of a nuclear power reactor. Ultimately, Ribicoff predicted, the American people "will have to decide whether the safeguards system of the IAEA—or any safeguards system—can adequately protect against the potential for

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117 Doub & Dukert, supra note 37, at 761.
116 Id. at 762.
119 Id. at 760.
121 Id. § 2133.
122 Note 93 supra.
atomic bomb production that exists within the core of every nuclear power-
plant."\textsuperscript{124}

In approving the export to Spain, the Commission considered four fac-
tors, as set forth in the Atomic Energy Act. The first of these was a deter-
mination of whether an agreement for cooperation would apply to the
proposed export.\textsuperscript{125} Answering this in the affirmative, the Commission
found that the proposed export would occur under the terms and condi-
tions of the Agreement for Cooperation between Spain and the United
States. Entered into on June 28, 1974, this agreement provides for coopera-
tion in the peaceful uses of nuclear energy for a period of 40 years.\textsuperscript{126}

The second factor was whether the applicant was a foreign or alien
corporation.\textsuperscript{127} Since the licensee for the export of the nuclear reactor to
Spain is the Westinghouse Electric Corporation, the Commission stated
that Westinghouse is a domestic corporation neither controlled nor owned
by a foreign corporation or government.\textsuperscript{128}

Whether the proposed export would be inimical to the common defense
and security of the United States was the third factor involved in the NRC
decision.\textsuperscript{129} Although the Commission majority believed that the export to
Spain would not cause any danger to United States defense and security,
it is precisely on this point that dissenter Gilinsky disagreed.\textsuperscript{130}

In considering the fourth factor, the Commission ruled that the Spanish
export would not affect the health and safety of the population of the
United States. Furthermore, the NRC reiterated its view that to assess the
health and safety impacts on foreign countries would be beyond the Com-
mision’s jurisdiction.\textsuperscript{131}

While he did not oppose the export of the reactor to Spain, Gilinsky did
oppose the export under the conditions and terms of the license.\textsuperscript{132} Since
Spain did not agree to use only United States supplied fuel in its reactor,
Gilinsky believed that there would be a potential for the use of fuel not
supplied by the United States and thus without corresponding safeguards.
The IAEA safeguards would apply to the use of fuel not supplied by the
United States with the result that the United States would have no control
over whether and in what circumstances plutonium would be separated
from the Spanish reactor’s spent fuel.\textsuperscript{133}

\textsuperscript{124} Id. at 10043.
\textsuperscript{126} Ribicoff, supra note 123, at 10044.
\textsuperscript{128} Ribicoff, supra note 123, at 10044.
\textsuperscript{130} Ribicoff, supra note 123, at 10047.
\textsuperscript{131} Id.
\textsuperscript{132} Id.
\textsuperscript{133} Id. at 10048.
Any fuel supplied by the United States which may be processed in the Spanish reactor would be subject to anti-proliferation measures imposed by the United States. However, these measures would not apply to any plutonium produced in the reactor from fuel otherwise obtained. Thus, "Spain will have the option to use non-U.S.-supplied fuel in Asco II and consequently to produce plutonium not subject to reprocessing controls." Furthermore, the failure of Spain to join the NPT assumes additional significance.

Gilinsky's suggestion would be to place a condition in the license requiring Spain to exclusively use fuel supplied by the United States in the reactor. However, the majority refused since it felt that IAEA safeguards, which would apply to any non-United States-supplied fuel, would be sufficiently effective to prevent diversion into nuclear weapons. Although the majority speculated that IAEA safeguards would be adequate, Gilinsky believed that speculation was not sufficient to warrant relinquishing control over reprocessing to the IAEA. Rather, Gilinsky stated that "we must be confident that the Agency . . . will in fact bar reprocessing unless or until further measures can be implemented."

Although Gilinsky voiced grave concern as to the adequacy of application of IAEA safeguards to fuel not supplied by the United States, the majority believed that his projected inadequacy of IAEA safeguards was premature. By a vote of three to one the Commission approved the license of Westinghouse to export a nuclear reactor to Spain. Nevertheless, there is now an articulated doubt as to the adequacy of international safeguards.

Other evidence of the concern about the possible diversion dangers of reprocessed fuel is found in the recently enacted foreign aid bill. Under its provisions any country that sells or purchases uranium reprocessing facilities without international safeguards will lose all United States economic and military aid. Yet, even in this legislation, one could find significant apprehension in relying on currently inadequate international safeguards. Perhaps the most effective solution of the safeguards problem would be to strengthen international safeguards.

IV. Conclusion

One proposed solution to the problem of providing safe and peaceful production of nuclear power is to establish Regional Nuclear Centers.

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134 Id. at 10049.
135 Id.
136 Id.
137 Id. at 10047.
throughout the world.140 Financed by different nations, such centers could remove the temptation to expand national enterprises. If regional centers were established, then each individual nation would not be forced to expand its own nuclear facilities. Instead of racing to compete with each other, each nation could contribute to these centers and cooperate with each other for the common purpose of producing nuclear power. In addition, if participants in the facilities of the centers were limited to NPT parties and if the facilities were placed under IAEA safeguards, the perils of diversion would be curbed. An added benefit might be enhanced public support for the peaceful use of the atom.

At the present, reprocessing facilities are located in nuclear weapons nations. Consequently, nations which do not have nuclear weapons capabilities will feel the urge to develop them, perhaps because of a feeling of discrimination by and dependence on nations possessing nuclear weapons. However, if each nation proceeds to construct its own reprocessing and enrichment facilities, adequate inspection and regulation becomes much more difficult.141

Regardless of whether the United States continues exporting nuclear power or completely terminates its exports, it seems imperative that more research be undertaken in this potentially dangerous area. A slow phase-out of nuclear energy in favor of alternative sources of energy, i.e., solar and geothermal energy, could be a welcome development. If this is not deemed appropriate at present due to the pressures of economics, foreign policy and technology, a continued program of nuclear energy needs to be more stringently controlled. The use of nuclear energy and its export to foreign countries should and must be subservient to the health, safety and welfare of the worldwide human environment. Only then can the world be assured that its energy needs will be satisfied today, without injuring or destroying the natural and human resources of tomorrow.

Gwyn P. Newsom

140 Doub & Dukert, supra note 37, at 769.
141 Id.