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The Transnational Control of Atomic Energy: A Nuclear Ecology

I. Introduction

In its stormy career upon this planet, nuclear energy has astounded, terrified, and sobered mankind. Today, thirty years since its dramatic introduction on the global stage, it is hailed at once as our nemesis and savior. In its darker dimensions, one-thirty-millionth of an ounce of a common nuclear material can destroy a man; as few as eight diverted kilograms of the same substance can annihilate a metropolis or agonizingly poison far greater regions; the meltdown of a large reactor could mean the desertion of entire regions for years.[1] Alternatively the identical material can cleanly energize a city and vastly reduce the consumption of other energy resources.

The rapid emergence of this nuclear phenomenon puts to an extreme test the prescription expressed many years ago by Lord Mansfield: "[A]s the usages of society alter, the law must adapt itself to the various situations of mankind."[2] To what extent has the law adapted, or, indeed, is it capable of adapting, to solve the deep environmental, socio-economic, and political problems underlying global control of nuclear energy? Effective global regulation of nuclear power must be of visceral concern to the international and environmental lawyer. Current regulatory practices intone grave images of instability, irresponsibility, and danger. Resolution of the problem cannot come unilaterally: one nation could never control a technology that is shared by several of the world powers. It is a transnational problem calling for a transnational solution.

This essay attempts a broadly-based examination of global nuclear energy problems. Rather than relying upon a detailed analysis of one issue it conveys the spectrum of issues which confront transnational efforts at control. It does so upon

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[1]For more detailed examinations of these dangers see International Atomic Energy Agency, *Environmental Aspects of Nuclear Power Stations* (1970), hereinafter *Environmental Aspects; Report of the Secretary-General on the Possible Use of Nuclear Weapons*, U.N. Doc.A/6858 (1967).

[2]*Barwell v. Brooks*, 3 Doug. 371. 373 (1784).

the premise that efforts focusing upon only one band of that spectrum are inherently doomed. The interaction of these issues is inescapable; the law can resolve the extant problem only through a synthetic approach which acknowledges this interaction and complexity.

A. *Projections of Nuclear Energy Utilization*

In the world today there are approximately 425 nuclear power plants in operation or under construction. Reasonable projections of this figure have estimated a total of 2,000 power reactors by the year 2000. Exhaustive international study of the 1981-1990 decade in the developing countries, moreover, has revealed a market projection of 335 power units producing 220,000 megawatts in those countries alone.[3]

The United States, Canada, South Africa and the Soviet Union will play pivotal roles as major uranium suppliers in this development. Yet the vital roles remain for those exporting nuclear technology: West Germany, France, the United Kingdom, Canada, the United States, Sweden and the Soviet Union; in the next five years these nations will direct a 40 to 50 *billion* dollar nuclear export business.[4] It is thus apparent that within a few years today's developing countries will have enough fissionable material to manufacture thousands of bombs annually. It is equally indisputable that reactors to date have produced 45,000 kilograms of the most poisonous substance known to man, that the substance, plutonium, is being generated rapidly throughout the world, and that each gram produced will remain hazardous to its environment for over 100,000 years.[5]

B. *Global Implications of Nuclear Energy Development*

Although it is not inconceivable that Compton was correct in noting that its "eventual importance to mankind . . . can hardly be less than that of fire,"[6] nuclear energy is infinitely more destructive than traditional combustion. Its speculated agenda of misuse and Armageddon is well publicized; tales of its more negative capabilities are legion. It is beyond the scope of this endeavor to document them.

Yet three distinct areas of concern underlie any inquiry into transnational control: 1) proliferation of reprocessing technology and subsequent diversion of

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[3]International Atomic Energy Agency, *Market Study of Nuclear Power in Developing Countries* 19 (1974), hereinafter *Market Study;* for further discussion of current and projected utilization, see *Environmental Aspects, supra,* at 5; New York Times, 14 July 1974, IV at 17:3.

[4]New York Times, 17 August 1975, at 1:1; Japan, Italy, and Switzerland are also showing interest in entering the market. It should be further noted that significant uranium supplies lie also in Gabon, Australia, India, and Brazil.

[5]The half-life of plutonium is 24,360 years.

[6]A. H. COMPTON, ATOMIC QUEST (1956).

weapons material by governments; 2) diversion of weapons materials by terrorists; and 3) inherent environmental risks of nuclear energy.

The reality of the above three problems must be focused: In 1974 India diverted materials from a Canada-supplied reactor to explode a bomb near the Pakistani border despite an explicit agreement against such use.[7] France has recently sold to Pakistan the reprocessing technology necessary for an active weapons program.[8] In 1975, the United States narrowly averted a French-South Korean arrangement for supplying that Asian country with similar weapons capability.[9] Recent intelligence reports acknowledge a clandestine Israeli reprocessing plant which has produced an estimated ten to twenty nuclear bombs through materials from its French-built, unregulated Dimona reactor, as well as a clandestine reprocessing facility in Taiwan.[10] Negotiations for similar reprocessing plants are underway with the French in the volatile state of Argentina, and have been completed between West Germany and Brazil, where, after fierce international competition for reactor sales, the Germans clinched the 4 billion dollar sale by offering the "bonus" of a reprocessing plant.[11]

Diversion by nongovernment groups likewise looms real as reports are filed in the nation of the world's most stringent nuclear controls—the United States—of two incidents of reactor employees smuggling out enough fissionable material for weapons manufacture.[12] At the same time a high Nuclear Regulatory Commission official confides that a single power reactor was unable to account for 4,100 kilograms of enriched uranium.[13]

Environmental risks, notably from reactor meltdowns, carry the most popular concern: WASH 1400, the recent Reactor Safety Study, estimates the probability of such meltdown today to be approximately 1 in 20,000 per reactor per year.[14] In the world of 2,000 reactors projected by the end of the century such statistics indicate a terrifying possibility unless further steps are taken for transnational control of nuclear safety.

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[7]Agreement between Canada and India on Atomic Energy, December 6, 1963, Can. T.S. No. 10; 529 U.N.T.S. 45 (No. 7655). In essence the treaty provided that

1) The fissionable material used in the reactor would be used only for peaceful purposes.
2) No material produced by the reactor would be transferred beyond Indian jurisdiction.
3) Canada would be notified in advance of the disposition of nuclear material.
4) Records of materials used would be maintained to ensure accountability.
5) Canadian representatives would be given inspection rights at the reactor.
6) Quarterly reports of reactor activity would be issued.

[8]Although reprocessing provides an important link in the recycling of nuclear fuels, its huge expense is not justified by Pakistan's small power program.

[9]New York Times, 15 June 1975, at 1, col. 5.

[10]New York Times, 30 Aug. 1975, at 1:4; Boston Globe, 10 March 1976 at 1:5.

[11]New York Times, 15 June 1975, at 1:5.

[12]New York Times, 29 December 1975, at 26:1.

[13]*Ibid.*

[14]*Ibid.* at § 2.11.

II. Transnational Regulatory Framework

A. *Bilateral Treaties*

Since 1955, the United States, the United Kingdom, and Canada[15] have exported nuclear technology under bilateral agreements with recipient countries. The United States, as the most active exporter, shapes its agreements in accordance with the requirements of § 123 of the Atomic Energy Act of 1954, which demands guaranties by the cooperating party that "security safeguards and standards . . . be maintained" and that appurtenant materials "will not be used for atomic weapons, or for research on or development of atomic weapons or for any other military purpose."[16] Similar guaranties are called for in Canadian and British export treaties.[17]

The principal characteristic of these bilateral agreements is their delegation[18] —as required by the Non-Proliferation Treaty—of all safeguard activities to the IAEA. Sanctions against recipients who violate these safeguards are based upon the general principle of international law allowing suspension of a breached treaty;[19] yet major exporters, for political reasons, have proven hesitant to carry out such sanctions. Moreover, the fact that recipient countries can turn to exporters that have shown themselves less discriminate—and less responsible—in the global nuclear market, e.g., West Germany, France, and the Soviet Union,[20] severely limits the utility of bilateral agreements in general transnational control.

B. *The Non-Proliferation Treaty*

In March 1970 the most comprehensive attempt at the implementation of global safeguards was effected in the Treaty on Non-Proliferation of Nuclear Weapons. The treaty prohibits acquisition of nuclear weapons by any non-weapon signatory, calls for all non-weapon parties to accept IAEA safeguards on all peaceful nuclear activity, and requires all members to submit any nuclear exports to non-weapon states, including non-signatories, to IAEA safeguards.[21] The treaty contains no enforcement provisions beyond those

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[15]Other exporters similarly use bilateral agreements in their trade; the dominance of these three in nuclear trade simply makes them of the most consequence.

[16]42 U.S.C. § 2153(a).

[17]*See* note 7, *supra.*

[18]Bilateral treaties executed before the signing of the IAEA Statute have been generally amended to incorporate IAEA safeguards.

[19]*See Restatement (Second) of the Foreign Relations Law of the U.S.* § 158(a) and (c); 5 MOORE, DIGEST OF INTERNATIONAL LAW 356-58 (1906).

[20]West Germany and France are not members of the Non-Proliferation Treaty and thus not bound to require IAEA safeguards on nuclear exports. The Soviet Union has practiced a policy which allows wide discretion in any recipient nation over use of nuclear materials.

[21]Treaty on the Non-Proliferation of Nuclear Weapons, July 1, 1968 (1970) 21 U.S.T. 483, T.I.A.S. No. 6839.

incorporated by use of the IAEA, and significantly the parties most likely and most capable of developing nuclear weapons, including Japan, Pakistan and South Africa, are non-signatories. Furthermore, Israel, India and China are not members nor are the increasingly active exporting nations of France and West Germany.[22] One observer has pointed out that a nation could easily employ the treaty to receive nuclear equipment and then withdraw with the requisite ninety-day notice to develop a belligerent technology.[23]

C. *The International Atomic Energy Agency*

The heated debate and cold war following the failure of the Baruch Plan[24] ultimately led to President Eisenhower's "Atoms for Peace" plan presented at the U.N. in December of 1953. The plan proposed an International Atomic Energy Agency which despite initial Soviet opposition became an independent Vienna-based organization in 1957 with a membership that included the Soviet Union and all other major powers except the People's Republic of China. The 106 nations currently participating in the Agency form a General Conference which elects a Board of Governors and a Director General to fulfill the Agency's mandate:

> The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.[25]

The central characteristic of the Agency is that it exists as a regulatory framework which "floats" in the transnational legal structure, becoming activated only when fastened to separate legal instruments between nations or when a nation accepts Agency benefits such as research materials. The obligation to submit to Agency jurisdiction, then, has risen chiefly through bilateral export agreements or multilateral instruments, of which the Non-Proliferation Treaty is the most prominent.

The Agency's main task is to apply "safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities and information . . . are not used in such a way as to further any military purpose."[26] These "safe-

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[22]Other important non-signers include Argentina, Brazil, Cuba, Pakistan, and Spain.

[23]M. WILLRICH, GLOBAL POLITICS OF NUCLEAR ENERGY 180 (1971), hereafter GLOBAL POLITICS.

[24]This plan proposed by U.N. Representative Baruch envisioned an "International Atomic Development Authority" which would have managerial control of worldwide nuclear activity and materials.

[25]Statute of the International Atomic Energy Agency, Oct. 26, 1956 (1957), 8 U.S.T. 1093, T.I.A.S. No. 3873, 276 U.N.T.S. 3, Article II, hereinafter Statute.

[26]*Ibid.*

guards," although the marrow of the international control system, are extremely nebulous, being defined both in the IAEA Statute and IAEA practice as only measures "designed to ensure" peaceful use of nuclear energy.[27] In fulfilling this safeguard function the Agency operated within its staff of 1,000 a seventy-member inspection force. These inspectors conduct inspections of facilities, employing sophisticated auditing techniques designed to detect discrepancies in nuclear materials records. Although this auditing is the primary focus of inspection activity, further detention devices recently developed include seals in storage vaults, cameras, and neutron detectors which monitor the power level of a reactor and movement of irradiated fuel.[28]

Significantly, the invocation of IAEA safeguards in any agreement thus involves the admission of foreign nationals—the inspectors—to nuclear facilities. Such a surrender of national sovereignty, however slight, represents an important movement toward the transnational focus envisioned by the Agency founders. Should a diversion or other violation of a specific operative treaty be discovered by these inspectors, however, the Agency's sanctions consist solely of demanding compliance and reporting the violation to the U.N. If compliance is not effected, the Agency may suspend its own technical assistance and demand return of nuclear materials.[29]

A vital consideration lies in acknowledgment of the IAEA's fundamental role as a nuclear energy promoter. Prior to creation of the Agency, emphasis in international forums lay primarily upon *control* of nuclear energy. The Agency statute, however, reflected a reordering of priorities by providing an extremely broad base for promotion and development under IAEA guidance. Indicative of this are the open framework for research promotion in the Statute itself[30] as well as the ten to fifteen annual symposia sponsored by the Agency, the 30,000 pages of technical information published annually by it, the seventeen major IAEA technical assistance projects, and the International Nuclear Information System (INIS) of the Agency which utilizes a computer network for the distribution of nuclear technology to forty-seven nations.[31]

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[27]An obvious problem this lies in identifying the concept of "safeguards"; IAEA practice, as noted in the text, provides the essential definition. Thus safeguard systems are simply systems designed to detect diversion of materials from peaceful to military use. Prevention of diversion is not embraced by the IAEA Statute or practice; prevention measures thus lie only with individual nations in regard to terrorist diversion and international pressure with regard to governmental diversion. Prevention measures promulgated by the former AEC are found at 10 C.F.R. §§ 50, 70, 73. For a broader discussion of IAEA safeguard practice see A. McKNIGHT, ATOMIC SAFEGUARDS 196 (1971), hereinafter ATOMIC SAFEGUARDS.

[28]*See* New York Times, 11 May 1975, at 19:1.

[29]Statute, *supra,* note 25, at Article XII.

[30]*Ibid.,* at Articles III, VIII, IX, and XI.

[31]IAEA Director General, Statement of ECOSOC, July 1975, IAEA Doc. E/5679/ at 4 (1975), hereinafter ECOSOC.

III. Issues of Transnational Control

A. *Socio-Economic Dilemmas*

Notwithstanding the oft-discussed complex economic inquiries which are beyond the scope of this article, distinct but relatively unfamiliar issues surround the collision of the pre-industrial or developing society with the spectre of nuclear energy. As development continues toward the 335 new developing-country reactors of the next decade vast amounts of foreign capital, expertise, and general influence will be pumped into these societies. Due to the extreme capital-intensive nature of reactor projects, which discourages private capital, the financial influx will largely be from foreign governments and quasi-government financial institutions such as the Export-Import Bank. Expertise will similarly flow from governments and multinational corporations of America and Western Europe. The influx of such influence poses serious problems of distortion of indigenous decision-making and other societal processes.

Formal controls designed to combat this nebulous problem should probably go no further than to limit the role of foreign interests in indigenous decision-making; closer scrutiny of the role of multinational corporations in such societies obviously would be one such measure. Yet the creation of devices for the simple enunciation of such problems by perhaps an organized group of sociologists and even anthropologists would go far in serving such societies. Few have openly asked whether the rush into nuclear development meets the best *total* interests of such populations, whether nuclear development and its concomitant global responsibilities is the most intelligent immediate path. Hidden among the periodic nuclear energy scares, the indigenous decision-making apparatus of such nations, the race for development, the intermittent calls for reactor moratoriums, the spirited protest demonstrations, may well be a subtle "sociology" of nuclear energy—part of a broader sociology of twentieth century "progress," the study of which could only benefit world development.

B. *Political Response*

Typically the political controls found in the NPT, the bilateral agreements, and the IAEA Statute grew from sound, responsible ideas which by a formula of global politics were rendered impotent once enacted. Epitomizing this is the amendment to the latest foreign aid authorization approved by Congress that bars aid to any country that builds a reprocessing plant. The law is riddled with loopholes, including a presidential waiver authority, to such an extent that the section becomes no more than the dreamy expression of a spineless nuclear policy.

Thus it is that policies other than control dominate transnational nuclear development. Exporting nations find extensions of their foreign influence and tools of international diplomacy in nuclear facility exports. Recipient states find

in such facilities instant world status symbols, increased stature for incumbent leaders, and decoys away from strained domestic situations. Yet beyond these obvious misuses of nuclear energy in political powerplays there exists a deep problem on the political scene: a vast confusion of roles and institutional responsibilities in the structure of global nuclear policy.

The domestic situation in the United States provides a revealing microcosm of this dilemma. The Nuclear Regulatory Commission reviews and has veto power over all nuclear export licenses in the United States under the Atomic Energy Act and the Energy Reorganization Act.[32] Importantly this role fell to the NRC and not to the Energy Research and Development Administration in the 1974 reorganization of the old AEC; this was due to the strong congressional sentiment (as evidenced as 42 U.S.C. § 5801 et seq.) for separation of promotional and regulatory functions so that an exclusive expert and technically informed agency could perform the regulatory functions. Clearly the export of nuclear technology, in light of safety, safeguarding and fuel demand[33] problems, should fall naturally to an agency with non-political expertise in nuclear development. Yet the NRC often stumbles in this role, deferring to the executive branch for leadership. The Commission Chairman himself has complained that he feels his role as essentially the supervisor of nuclear exports is inappropriate for the head of an independent agency, that such responsibilities are so engulfed in foreign policy that they should belong to the State Department.[34] At the same time State Department officials warn of the complex technological issues involved in such exports, making them improper subjects for lay scrutiny. In the midst of this confusion members of Congress have claimed that Congress itself has abdicated its responsibilities in this area far too much to the State Department and the Export-Import Bank.[35]

History has evidenced again and again that political institutions tend to insulate technological advancement from the processes for change. Thus nuclear reactors are exported in the contexts of political stratagems rather than directed toward the welfare of the recipient nation. Political interests vesting in, for example, the development of plutonium reprocessing technology as a diplomatic tool, not only feed huge expenditures into it and protect it from opposing interests which could bring fresh approaches such as regional reprocessing plants, but use it to serve almost exclusively political concerns. Thus France has sold and

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[32]42 U.S.C. § 2011 *et seq.*; 42 U.S.C. § 580 *et seq.*, respectively.

[33]The fuel demand of various reactors becomes an important technical consideration in balancing fuel recycling problems—*e.g.*, what effect will an export have on reprocessing plant in the U.S. which will be used for recycling of materials used therein?

[34]Such an attitude has not only been enunciated but is obvious in many of the Commission's actions. *See* New York Times, 10 March 1976 at 6:3; New York Times, 8 March 1976, at 38:1; Boston Globe, 10 March 1976 at 1:5.

[35]120 CONG. REC. H7434 (daily ed. 31 July 1974).

Pakistan purchased a reprocessing plant which is completely impractical for Pakistan's fuel cycle needs. Senator Ribicoff has indirectly addressed this problem by calling for a new approach against the West German and French veto of a ban on reprocessing plant sales; the Senator suggested an appeal "over the heads of the leaders to the people of France and Germany."[36] As impractical as the statement may be, it represents an almost subconscious realization of the extent to which political institutions have insulated the real problems of nuclear development from the forces of rational change. The essence of the problem is clear: the institutional interests which ultimately benefit from nuclear energy, the interests that recognize the strengths and weaknesses of safeguards, are not the interests that promulgate nuclear energy.[37]

C. *Administrative Weaknesses*

The IAEA joins the ranks of most other international governmental organizations in failing to follow the authoritative course envisioned by its creators. Along with other inadequacies already touched upon, the fate of the initial central focus on the Agency as a world broker of nuclear materials is demonstrative of this failure. Despite the major weight placed on this brokerage role at the birth of the Agency, nearly twenty years elapsed before it could announce that it had actually served as a channel in supplying fuel to power reactors, and then only to small units in Mexico and Yugoslavia.[38] Notwithstanding such problems, however, the IAEA legal framework *could* provide a realtively strong global management system if properly exercised. In identifying the problems to be solved beyond the promotional-control dichotomy, basic concern must focus upon the Agency inspectorate, the orientation and practice of safeguards, and the IAEA financial basis.

1. THE AGENCY INSPECTORATE

The IAEA inspectors, "who shall have access at all times to all places and data . . . to determine whether there is compliance"[39] with safeguards, could in theory be a major regulatory force. The seventy-member inspectorate today follows Agency regulations which set the frequency of inspections according to the kilograms of nuclear material employed in a given reactor, providing up to five visits per year for small reactors and unlimited inspections for the largest units. These same regulations order one week's notice for routine inspections and

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[36]Boston Globe, 10 March 1976, at 1:5.

[37]In simplest terms—though perhaps oversimplified—this means that the scientists and the consumers who best know the true costs and benefits of nuclear power are, to large extent, not included in the decision-making process which spreads nuclear development.

[38]ECOSOC, *supra,* note 31.

[39]IAEA Statute, *supra,* note 25, Article XII.

twenty-four-hour notice for the rare "special" inspections warranted by unusual circumstances.[40] Yet nothing less than spontaneous inspection could reveal the true operational mode of any facility, particularly certain reprocessing plants from which materials could feasibly be diverted in a matter of hours. Furthermore, IAEA statistics reveal that no more than half the maximum allowable inspections are ever performed.[41] As has also been pointed out by an IAEA official, the vital materials records which support the inspection system do not flow continuously but come periodically, even sporadically, resulting in audits based on figures that may be up to 150 days old.[42] Most alarming of all is the fact that the current inspection force is severely undermanned. Realistic projections made by the U.S. Congress for the year *1975* and based solely on IAEA enforcement of its Non-Proliferation Treaty mandate called for an inspection force not of 70 but rather *755* inspectors.[43] The rigorous global inspection process inherent in effective international control necessitates a vast increase in the strength of the inspectorate.

2. SAFEGUARD FOCUS AND APPLICATION

Serious questions must also be directed towards safeguard practice, specifically towards both their general scope and their current application. It is paradoxical that while safeguards are aimed at nuclear facilities alone, the dangers they are designed to prevent may easily occur outside of such facilities; more precisely, the transportation of fissionable materials between reprocessing plants and reactors is keenly susceptible to the same diversion problems as facilities, perhaps even more so in regard to terrorist activity. As reactors multiply and the fuel cycle process greatly expands, the problem will acquire awesome dimensions: it is estimated that in twenty years, at current trends, there will be enough fissionable material in transit at any point in time to manufacture 20,000 nuclear bombs.[44] Contemporary practice leaves such transit problems in the hands of domestic governments in the assumption that mere security problems need be no concern of an international organization. Yet without sufficient guarantees of uniformly high security precautions throughout the world, an in-transit diversion becomes a very likely threat over the course of the next few years. Obviously the highly-trained inspection force need not fill the role of armed guards; yet just as obviously an international security force seems imperative.[45]

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[40]*Ibid.*

[41]P. SZASZ, THE LAW AND PRACTICE OF THE IAEA 611 (1970), IAEA Legal Series No. 7.

[42]LOVETT, NUCLEAR MATERIALS, ACCOUNTABILITY, MANAGEMENT, SAFEGUARDS 281, American Nuclear Society Monograph (1974), hereinafter LOVETT.

[43]GLOBAL POLITICS, *supra,* note 23 at 88.

[44]New York Times, 11 May 1975, IV at 19:1.

[45]For a brief discussion of this problem see ATOMIC SAFEGUARDS, *supra,* note 273, at 142. The

Parallel considerations must be given the basic definition of safeguards. The risks of nuclear energy entail more than division; its environmental dangers are equally as serious. In a very real sense the dangers of radioactivity in material transit, in reactors and reprocessing plants, in waste disposal, and, to a lesser extent, in uranium mining and processing are of an unavoidably global character.[46] Failure to recognize this fact will penalize every living creature on the planet. Beyond disjointed regulatory attempts by various UN organizations, there exists no real international effort to control this radioactivity. IAEA safeguards are firmly centered upon prevention of military use of nuclear materials. Yet true international control must embrace prevention of all the dangers inherent in international nuclear activity. Current safeguard definition or scope thus seems inadequate in any broad, long-range analysis. The problem calls for profound redefinition of the "safeguard" concept; its solution will be difficult due to the inertia of a thirty-year focus on military dangers alone.

More immediate concern must lie with the quality of safeguard application even in this military orientation. Comprehensive analysis of safeguard application has filled volumes already[47] and must be reserved for more technically oriented writers. Yet the system of auditing materials inventories remains questionable to even a cursory glance. A single example of the myriad problems adhering to safeguard application today sufficiently raises the issue.

In the IAEA inspections designed to alert the world to significant losses of nuclear materials, practice calls for concluding that no theft or environmentally dangerous loss occurred if the Materials Unaccounted For (MUF) can be explained by any measurement uncertainties or mistakes possibly stemming from earlier inventories.[48] As a result there have been thousands of pounds of plutonium and enriched uranium written off as MUF; knowledgeable observers consider them to be diverted.[49]

3. THE IAEA FINANCIAL BASIS

The most fundamental criticism of global control of nuclear energy must be reserved for the level of commitment as evidenced by the financial foundation of the IAEA. As fifty billion dollars in nuclear trade looms worldwide, twenty-eight

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U.S. Congress has shown interest in a formal national nuclear security force at 42 U.S.C. § 5844, which commissions a study of the problem.

[46]The strontium presently within all human bones (from nuclear fallout) throughout the world solemnly attests to the global implications of weapons testing; the wind and water currents which can carry radioactive leakages in peaceful uses mean that fissionable materials everywhere must be controlled.

[47]*See e.g.*, ATOMIC SAFEGUARDS, *supra*, note 27; LOVETT, *supra*, note 42; Stockholm International Peace Research Institute, *Safeguards Against Nuclear Proliferation* (1975), hereinafter SIPRI.

[48]LOVETT, *supra*, note 42, at 35.

[49]*See* New York Times, 14 July 1975, IV at 17:3.

of the Agency nations pay the annual sum of *754* dollars for the international control system.[50] The vast proportion of the Agency budget is provided for by a few Western nations: the United States alone pays 27 percent of the annual $29.6 million budget, plus another $5.7 million in technical assistance.[51]

Such fiscal practices render the Agency an international placebo. The budget is based upon a long-debated per-capita formula serving a certain notion of equality.[52] Yet the global commitment cannot be credible until the effort is adequately financed on a scale equitable to all concerns. A scale contoured to the whimpers of less-developed countries who otherwise scream for more power on the international scene is not the answer.

IV. Proposals

A. *Strengthening of the IAEA*

Ideally the world situation calls for bold new approaches and legal institutions to bring nuclear energy under effective transnational control; indeed, this has been inherent throughout the foregoing discussion and will be discussed subsequently. Viable efforts to reform the current regulatory scheme must first focus, however, upon the IAEA. Despite its deficiencies it remains the only practical vehicle for transnational control; its extant framework could support the far-reaching network of control originally envisioned in the IAEA Statute. Immediate reformation must center upon the obvious administrative weaknesses as outlined above: 1) financial commitment to control efforts; 2) inspectorate strength; 3) quality and scope of safeguards; and 4) dichotomy in Agency roles.

The IAEA financial basis as a determinative factor of reform deserves primary consideration. The total political responsibility to the international problems necessarily includes fiscal responsibility. Yet responsibility is clearly not fostered when a large portion of the participating nations pitch relative pennies into the international budget. A vigorous financial realignment and universal shouldering of increased responsibility in the Agency is imperative. An important part of this effort may lie in making the cost of safeguarding a particular reactor a part of the total cost paid by the nation using the facility; the sum of such safeguards would represent no more than a fraction of one percent of the value of electricity produced in a given reactor.[53]

Concomitantly the international inspectorate must be increased to the point where the concept of resident inspectors with spontaneous inspection rights is a reality. This idea, not unfamiliar in IAEA forums,[54] would transfer the current

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[50]SIPRI, *supra,* note 47, at 48.
[51]*Ibid.*, at 49.
[52]*Ibid.*
[53]GLOBAL POLITICS, *supra,* note 23, at 88.
[54]*See* LOVETT, *supra,* note 42, at 283; ATOMIC SAFEGUARDS, *supra,* note 27, at 156-58.

troupe of glorified accountants into an instrument of tremendous international consequence. The most intelligent development would find highly-qualified individuals of diplomatic stature who, assigned on a rotating basis to nuclear plants of a particular global region, would become experts on the nuclear energy problems of their region. With the introduction of more and more reprocessing plants where diversion may be possible in a matter of hours, such residence becomes vital. Experts within the IAEA have indeed admitted that resident inspection will become necessary when nuclear activity reaches a certain threshold.[55] It seems apparent that efforts to define that threshold must be made immediately. Obviously the resident concept entails a large increase in the inspection staff. Even without resident inspection such an increase is needed and long overdue; the IAEA will soon become meaningless without it.

Inherent in a vitalization of the IAEA must be careful evaluation of the quality of current safeguard practice. Reform in this area, however, lies in more technical sectors which are not immediate concerns of this investigation. The legal challenge of safeguards lies more in examination of their general scope. The integrated transnational control called for by present development must attend *all* the dangers of international nuclear activity. The diversion focus undoubtedly should remain the major concern of such efforts. Yet the institutions which ardently worked for these safeguards must be convinced to take the next step in the progression of global nuclear responsibility. Entailed in this redefinition of safeguards must be jurisdiction over hazardous aspects of uranium mining and processing, transportation of nuclear materials, and waste disposal.

The final basic change needed in the IAEA would breathe vitality into the image of the Agency as a control organ: the promotional aspect of the Agency must be divorced from the more vital control function. A division parallel to that of the old AEC into the NRC and ERDA is in order. As demonstrated by that U.S. change, the separation itself need not be painful; the existing promotional network can and should remain intact and reshaped into a parallel organization of exclusively promotional interests. In the final analysis, promotion must become a secondary concern; it has taken on a life of its own which needs no extrinsic support. Conversely, control functions must be heavily supported and quite deliberately developed. An international control agency can ill afford to juggle two roles: its business must be control and control alone.

Throughout the context of these IAEA reforms must lie a spirit of strong international authority. International ownership of fissionable materials must be pushed to the foremost of concerns; it becomes almost necessary to viable control. Perhaps even more effective, and more practical, would be the establishment of international reprocessing centers. Only when the fissionable material of all

[55] ATOMIC SAFEGUARDS, *supra*, note 27, at 157.

nations must be reprocessed by an international authority can the world be assured that reprocessed materials are not improperly employed. Attempted misuse would thus result in the cutoff of reprocessed fuel to the offender, an effective sanction when no such fuel is otherwise available. The concept is not quixotic: the United States and the Soviet Union have led global discussions on the problems of national reprocessing plants. Additionally, Secretary of State Kissinger and the Director General of the IAEA have called for regional plants, a substantial step in this direction, in international forums.[56]

B. *The "Ecology" of Nuclear Development*

The inter-relatedness of the problems facing global control of nuclear materials is inescapable. The issues adhering to the political and socio-economic concerns of the field cannot be severed for each in turn affects the other. This is the bottom line in transnational energy management. Any solution that addresses only one of these sectors is doomed. What is called for is a legal spirit which will respond to the myriad global interests, an eclectic approach which balances them with the maturity called for by the nuclear age. What is called for is a "nuclear ecology."

Just as ecology recognizes that the biological systems are inevitably connected, the law must recognize that the institutions and interests of the consumer, of the politician, the environmentalist, the administrator, and the world citizen are interlocked. Answers cannot look exclusively toward facilitating administration without ignoring the interests of the citizen and consumer; the environmentalist cannot cling to one institution which measures radiation leaks while from another the politician secretly fashions the greatest pollution of all in the form of a bomb. The analogy fits best with regard to ecology's vital interest in the "costs" to the entire cycle of life of isolated actions in one system. Just as environmental impact statements have served to evaluate environmental costs of U.S. government action, the world needs a mechanism by which the social, political, economic and administrative costs, as well as the environmental costs of nuclear development, are evaluated. This means that when a facility is proposed, sociological impact statements as well as statements of the political, economic and administrative costs—including the costs of non-action—should be reviewed by a single world authority.[57] Such statements not only would illuminate the role of the international legal sector but provide objective information for world

[56]Statement to ECOSOC, *supra,* note 38, at 2; New York Times, 29 Feb. 1976, at 2E, col. 1.

[57]As mentioned, an inherent element of this evaluative process must be the costs of non-development, *e.g.*, what would be the real costs of a nuclear power plant moratorium? The history of the Alaska pipeline controversy evidences the value of such considerations: the years lost in unsuccessful environmentalist attacks cost the U.S. an estimated balance of payments loss of over $25 billion. For cogent discussion of this point, see HERMAN KAHN, THE NEXT 200 YEARS 143 (1976).

decision-makers. The experience with U.S. environmental statements could go far in helping to streamline the process behind such reviews.

The concept in a sense is simply a paraphrase of Mansfield's prescription cited at the outset of this discussion: as the usages of society become more complex, the law must learn to integrate that complexity in "adapting to the various situations of mankind." A strong world regulatory authority must be generated, an authority which encompasses *all* the dangers of nuclear activity. The existing authority is not cognizant of the larger issues surrounding its role. The institutions behind those issues must affirm their links with one another.

V. Conclusions

Albert Einstein voiced wise concern over man's reaction to the age he had fathered:

> The unleashed power of the atom has changed everything save our modes of thinking, and thus we drift to unparalleled catastrophe.[58]

The foregoing discussion has sought to examine that change on a new level and represent its huge challenge to transnational law. Current transnational controls rest on unstable political winds and institutional placebos. They are inadequate. Above all they lack the global maturity incumbent upon those inhabiting a nuclear age.

The law must recognize and incorporate the many parts of the whole of nuclear energy. Dialogue between the technological, political, socio-economic, and administrative institutions involved is imperative. International structures must be forced to manage the planet's total energy production in an integrated fashion as nuclear energy control is eased from the hands of shortsighted diplomats. A transnational legal movement is vital to the planet's future. National sovereignty cannot and should not be rendered ineffective; but on questions involving the environment, the peace, the energy cycles of the world it must recognize a greater polity.

In practical concerns, the IAEA must be restructured, bringing an enlargement to its inspection force and expanding its financial base while re-evaluating safeguard application and scope. Inherent in such broad reordering must be a divorce of the promotional role from the Agency. The IAEA can and must become the vehicle of firm international control it was originally meant to be.

The spirit of nuclear "ecology" called for is not the short-term political shuffling which has characterized international controls. Rather it is a fresh,

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[58]Quoted in Willrich, *The Non-Proliferation of Nuclear Weapons: Nuclear Technology Confronts World Politics*, 77 YALE L.J. 1447 (1968) at 1519.

broadened perspective which builds upon the strengths of the IAEA and goes beyond with an authority cognizant of the political, socio-economic, and administrative problems involved, an authority using the interactions between these problems to cultivate secure interdependence.

The drift bemoaned by Einstein must be stopped.