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International Legal Perspective on the Conduct of Abnormally Dangerous Activities in Frontier Areas: The Case of Nuclear Power Plant Siting, An

Gunther Handl

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INTRODUCTION

The phenomenon of increasing pressure on available land resources and thus sharpened competition among different land uses is well known. As populations expand and expectations about the standard of living rise, the demand for food, energy, and housing continues to grow. This trend has been reflected in a general shift from extensive forms of economic activities to increasingly intensive ones. For example, chemical fertilizers, insecticides, and weather control techniques are well-established features of modern intensive agriculture that have brought about a revolutionary growth in food production. At the same time, they have also had a detrimental impact on other utilizations of natural resources.

A similar correlation between an increase in benefits and in actual or potential costs can be found in many industrial applications of advanced technology and scientific processes. Potential preemption of concurrent resource uses is a frequently encountered risk associated with such industrial activities. Thus, a major accident at an industrial site may have a dramatic impact over a wide area, curtailing alternate land use, releasing toxic substances into the environment, and perhaps threatening human and animal life.
Accordingly, the siting of industrial facilities such as chemical plants\(^1\) and liquefied natural gas tanker terminals,\(^2\) the choice of routes for sea and pipeline transportation of oil,\(^3\) the designation of disposal areas for highly toxic industrial waste materials,\(^4\) and the siting of nuclear fuel cycle facilities have become matters of national controversy. Decisions about siting hazardous industrial facilities or the conduct of hazardous activities in general become even more complex and controversial when they involve an area near an international boundary. In these situations, the problem confronting decision makers concerns siting such facilities in a manner compatible with environmental resource uses in neighboring states.

Although several European states are examining collectively the procedural problem of establishing national siting policies for industries with transnational risk-creating potential,\(^5\) basic questions concerning the international legality of such activity in frontier areas have not yet been addressed adequately. These more fundamental questions are likely to grow in importance with the expansion and proliferation of potentially hazardous activities.\(^6\) Without coherent and realistic international legal norms, siting

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1. For example, the very severe environmental and health consequences of an accident at the ICMESA chemical plant located in a densely populated area north of Milan prompted the president of the Lombardy region to say: "This is a warning to all the advanced systems of the world to take another look at their industry." N.Y. Times, Aug. 13, 1976, § A, at 3, col. 1. For a detailed review of the environmental and health effects of this accident, see Hay, *Toxic Cloud over Seveso*, 262 *Science* 639 (1976).


4. E.g., the plans by the Allied Chemical Company to bury tons of the highly toxic pesticide Kepone in Idaho. N.Y. Times, Nov. 14, 1976, at 34, col. 1.


6. An illustrative example is the possible connection between the incidence of arteriosclerosis in North Karelia and Kuopio (two rural districts in southeastern Finland with the world’s highest and most rapidly increasing rate of heart attacks) and radiation emanating from a powerful Soviet over-the-horizon radar complex, the transmissions of which are being reflected and enhanced by the surface of Lake Ladoga. Brodeur, *A Reporter at Large: Micro-
disputes are likely to increase in both number and complexity because of different levels of economic and social development among national societies. Nations developing at different rates and with different priorities are likely to differ in their willingness to accept environmental risks, their sensitivity to safety considerations, and their desire to regulate potentially hazardous activities.  

This Article examines whether, in the absence of special authorizing circumstances,8 the conduct of hazardous activities9 in frontier areas may be impermissible under international law even if the activity (1) is lawful per se10 and (2) carries a remote—in terms of probability—but obvious risk of serious transnational harm. Alternatively stated, the question addressed is whether imposition of a major risk of transnational environmental harm is
permisible under international law where benefits to the risk-exposed state are either non-existent or unacceptable because of the associated risks.11

In the following section, this Article surveys existing international law on the conduct of frontier activities carrying risks of substantial transnational harm.12 Section III builds upon this body of precedent to develop international standards for evaluation of siting decisions. Section IV applies these standards to the complex issue of nuclear power plant siting. Finally, section V draws some tentative conclusions about this new but important area of international law. By clarifying the fundamental legal relationship between risk-creating and risk-exposed states and by elucidating mechanisms for adjusting conflicting claims to the use of internationally shared natural resources, this exposition seeks to offer a basis for efficient and early resolution of environmental disputes.

The problem of transnational risk creation should be approached from two international legal perspectives. The first is the doctrine of territorial sovereignty.13 This doctrine has two aspects with conflicting implications for our inquiry. First, a state is sovereign within its own boundaries, and therefore should be permitted to conduct any activity not per se illegal within its own territory. Second, however, sovereignty also implies freedom from outside interferences and externally caused harm. A decision to conduct a potentially dangerous activity near an international border pits these two characteristics of sovereignty against each other, with the risk-creating state on one side and the risk-exposed state on the other. From this perspective, the question becomes whether the activity carries a transnational risk of such magnitude that it overrides the sovereignty claim of the risk-creating state, or, alternatively stated, whether the risk is compatible with the sovereign equality of states and therefore with fundamental principles of international law.

11. There exists, of course, what appears to be the accepted practice among a number of states, particularly within the EEC region, of siting nuclear power plants in the immediate vicinity of national boundaries. But this action often amounts to reciprocity of risk creation, because benefits accrue to the risk-exposed state either directly as a power importer or indirectly as a member of a group of states that is highly integrated and hence interdependent, both politically and economically. Note, however, that even in these circumstances attention is increasingly focusing on the transnational safety aspects of the siting of nuclear power plants in both areas of member states. See EEC Draft Study, supra note 5, at 3, 16, 20; Nuclear News, Feb., 1977, at 58; European Economic Community Commission, Technological Problems of Nuclear Safety, Nuclear Safety 7, C.O.M.(77) 168 [Final] (1977).

12. Several hazardous activities being carried on in areas beyond national jurisdiction or control are not included in this paper due to space constraints and the availability of well established state practice examples of transnational risk creation. A survey of that sort would indeed call for an entirely separate study. For examples, including deepwater ports, nuclear powered ships, and offshore multipurpose platforms, see, e.g., E. Brown, Environmental and International Legal Analysis of Offshore Multipurpose Platforms (unpublished thesis, on file at Harvard Law School library, March, 1975). See also U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, COASTAL EFFECTS OF OFFSHORE ENERGY SYSTEMS (1976).

13. Max Huber's observation in the Island of Palmas case that territorial sovereignty is "the point of departure in settling most questions that concern international relations," Island
A second principle guiding development of legal norms in this area may be drawn from international environmental law. Specifically, nations have recognized the overwhelming importance of rational management of environmental resources irrespective of national boundaries. International environmental law has generally addressed instances of continuous transnational pollution causing immediate actual damage. The speculative potential damages relating to hazardous border activities may initially appear to negate any useful legal comparisons between ongoing transnational pollution and hazardous facility siting. Yet both involve competing direct and indirect uses of shared air and water resources. To the extent potential extraterritorial damage from facilities may be severe, catastrophic, or irreversible, any distinction between actual and potential consequences of frontier activities that dismisses the legal significance of the latter seems largely unwarranted.

The primary goal in management of internationally shared resources would seem to be maximization of net benefits from the resource or minimization of transnational pollution costs, i.e., pollution control and pollution damage costs. This goal requires balancing pollution damages against the alternative abatement and regulation costs to reach an optimal level of environmental and resource protection. Failure to recognize and minimize potential disasters from hazardous activities would result in inefficient resource use, even if the probability of an accident were relatively low. Applying this efficiency approach, an optimal international border siting policy should allow for the maximization of net benefits from the resource.

of Palmas Case (Netherlands v. United States), 2 R. Int'l Arb. Awards 831, 838 (1928), has only partially lost its validity.

Indeed, as many observers have noted, the discrepancy between the state of all-pervasive interdependence among nation-states and the state of development of transnational functional organizational structures for the management of the problems of interdependence is still a major one.

14. Thus, while a given utilization of the waters of an international watercourse would constitute a "direct use" of an internationally shared natural resource, an "indirect use" would include the incidental impact of the operation of a nuclear power station on the environment as a result of an accidental release of radioactivity.

15. The definition adopted here reflects an emerging international consensus on the desirability of distinguishing between resources which are common to all mankind and resources which are shared by a limited number of states only. The notion of "shared natural resources" used in the latter sense thus includes "a common air mass above the territories of a number of States, adjacent waters whether facing the open sea or in an enclosed or semi-enclosed sea, stocks of fish which move between or through two or more States." Swedish Government Proposal for a Definition Submitted to the Executive Director of the United Nations Environment Programme, in Co-Operation in the Field of the Environment Concerning Natural Resources Shared by Two or More States, Report of the Executive Director, U.N. Doc. UNEP/GC/44, at 3 (1975). For further possible definitions, see id. at 3-5.

16. For the application of this economic cost concept to transnational pollution, see Note by the Secretariat, Study of Different Cost-Sharing Formulas for Transfrontier Pollution, in ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT, ECONOMICS OF TRANSFRONTIER POLLUTION 31 (1976). For the corresponding application of the cost concept to torts in general, see G. CALABRESI, THE COSTS OF ACCIDENTS 17-33 (1970).
considering both known and potential environmental costs irrespective of national boundaries.

While environmental efficiency can be considered a basic tenet of international law,\textsuperscript{17} it operates in a system in which narrow national self-interest and notions of "sanctity of national boundaries" and "absolute territorial sovereignty" continue to be frequently encountered obstacles to implementation. This political reality unquestionably shapes the approach toward a systematic resolution of international siting conflicts. However, any final system must promote maximization of values shared by the community at large rather than those which are expressive only of particular national interests.\textsuperscript{18} These international political realities compel an essentially inter-state approach to the legal issues associated with transnational risk creation. This viewpoint does not ignore possible alternative approaches to transnational pollution and hazard controversies.\textsuperscript{19} Rather it is based on recognition that the concept of territorial sovereignty and the concomitant symbol of international borders play a decisive role in the present inquiry, thus raising basic issues of distributional justice among nation-states.

\section{II TRANSNATIONAL RISK CREATION AND INTERNATIONAL LAW: PAST TRENDS}

Because of its comparative novelty, the problem of transnational risk creation has found relatively little articulate reflection in state practice and has been given scant attention by writers in the field of international law.

\textsuperscript{17} See, e.g., Marquand, \textit{A Note on Some Problems of Transfrontier Pollution}, in \textsc{Organization for Economic Cooperation and Development}, supra note 16, at 17. See also notes 217-26 infra.

\textsuperscript{18} For a basic exposition of this policy, see McDougal, \textit{The Impact of International Law upon National Law: A Policy-Oriented Perspective}, in M. McDougal \& Associates, \textsc{Studies in World Public Order} 157 (1960). Specifically, such a policy underlies the international law on transnational pollution. For an example of an environmental conflict resolution consistent with these policy guidelines, see Comment (b) to Article X of the Helsinki Rules on the Uses of Waters of International Rivers, in \textsc{International Law Association (ILA), Report of the Fifty-Second Conference} (1966), \textit{Helsinki, 484, 499 (1967) [hereinafter cited as Helsinki Rules]}: "The optimum goal of international drainage basin development is to accommodate the multiple and diverse uses of the co-basin States." \textit{See also Comment (a) to Article IV}, \textit{id.} at 487: "The idea of equitable sharing is to provide the maximum benefit to each basin State from the uses of the waters with the minimum detriment to each." \textit{See further Article 3 of the Charter of Economic Rights and Duties of States, U.N. Doc. A/RES/3281 (XXIX), reprinted in 14 Int’l Legal Materials} 251, 255 (1975). For further details, see text accompanying notes 222-226 infra.

After all, the increase in transnational hazards accompanying the tremendous world-wide surge in industrial and scientific development has been only a recently experienced or, perhaps more accurately, recently perceived phenomenon. The empirical base for an inductive approach to the question of the permissibility under international law of abnormally dangerous frontier activities might be expected to be exceedingly narrow. Yet, close examination reveals a pattern of claims and counterclaims that have a distinct bearing on the problem. Contrary to assertions by some commentators, there exists a fledgling state practice which, together with other evidence, promises to provide grounds for some firm conclusions.

The following pages contain an examination of the relevant international judicial and arbitral decisions and a survey of pertinent state practice. Analogies from municipal law, germane international literature, and any additional indicia for an existing or emerging pattern of community expectations with respect to transnational risk creation will be considered.

Again, the question under consideration is: Barring situations in which the neighboring state is estopped from protesting by its own risk-creating activities or actually consents to the risk creation, is it permissible under international law for a state to engage in or to allow the conduct of an abnormally dangerous activity near an international border where an accident, however unlikely, could produce extremely severe environmental and health consequences in the neighboring state's territory?


21. “The rationale of estoppel is expressed in the maxim *allegans contraria non audit dum est*; its essential aim is to preclude a party from benefitting by his own inconsistency to the detriment of another party who has in good faith relied upon a representation of fact made by the former party.” Bowett, *Estopel before International Tribunals and its Relation to Acquisescence*, 33 BRIT. Y.B. INT'L L. 176, 177 (1957). In the present context, this means that a state would be estopped from contesting the legality of a neighboring state's decision to build a nuclear power plant within its own border area if the former had itself located a plant along its national border.

For an example of estoppel by conduct involving a transboundary pollution problem, see the United States Supreme Court's decision in Missouri v. Illinois, 200 U.S. 496, 522 (1906): "Where, as here, the plaintiff . . . deliberately permits discharges similar to those of which it complains, it . . . offers . . . a standard to which the defendant has a right to appeal." See also Randelzhofer & Simma, *Das Kernkraftwerk an der Grenze*, in FESTSCHRIFT FÜR FRIEDRICH BERBER 389, 431 (D. Blumenwitz & A. Radenlzhofer, eds. 1973).

For discussion of the close kinship between estoppel, or the principle of *venire contra factum proprium*, and equity as part of the legal decision-making process, see Friedmann, *The Uses of "General Principles" in the Development of International Law*, 57 AM. J. INT'L L. 279, 287-89 (1963).

22. A case in point is a power station located in a border area that supplies energy to the potentially risk-exposed states, or that is jointly operated.
A. **International Judicial and Arbitral Decisions; The Federal Law Analogy**

The relative scarcity of relevant international case law with regard to the present problem is striking. Of the three cases often referred to in an international environmental law context, namely, the *Trail Smelter*,23 *Lake Lanoux*,24 and *Corfu Channel*25 decisions, only the first two are of marginal importance to this discussion.

In the *Trail Smelter* case, the tribunal was charged with determining, among other things, whether the smelter should be prevented from causing transnational damage. Once the court decided to forbid smelter activity causing transnational pollution,26 the court also was required to determine what measures should be adopted or maintained at the plant to assure compliance.27 In answering these questions the tribunal relied on the fact that the smelter's operation during certain periods of the year resulted in inevitable transfrontier pollution because of the particular meteorological and topographical characteristics of the location.28 Thus, the smelter operation posed more than a mere potential or remote risk of pollution; rather, the activity actually generated transnationally harmful pollutants. In this crucial aspect, the probability of risk realization, the factual situation underlying the *Trail Smelter* case is different from the conduct of an abnormally dangerous frontier activity. This observation indicates that the *Trail Smelter* holding does not apply to risk-creating activities. However, it has been suggested that *Trail Smelter* essentially applied a reasonableness standard which might be modified to include risk-creating activities "with potentially greater harm calling for abstention from conduct under a proportionately lesser showing that harm will occur."29 Although such an approach finds support in other evidence discussed below, this interpretation is difficult to reconcile with a careful reading of the decision itself.

A detailed analysis of *Trail Smelter* must begin with the tribunal's pronouncement that, as a general principle of international law,

[n]o State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another State or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.30

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23. 3 R. Int'l Arb. Awards 1911 (1938).
27. *Id.* at 1907, 1908 (art. III of the *compromis*).
28. *Id.* at 1923-24.
30. 3 R. Int'l Arb. Awards at 1965. As to recognition of this dictum as a principle of international law in the pertinent international legal literature, *see*, e.g., Wildhaber, *Die Oldestil-*
"To illustrate the relativity of the rule" that it is a state's duty to protect other states against injurious acts by its citizens, the tribunal relied on Aargau v. Solothurn. The dispute in Aargau involved two Swiss cantons and the legal question whether one canton was entitled to absolute protection from the trans-border risks emanating from a rifle range in the adjacent canton. There was no allegation of actual damage from stray bullets crossing the boundary between the two cantons. Rather, the defendant sought protection against any risk created by target practice in the border area. The risk-exposed canton argued that the range might conceivably result in injury to its citizens in a manner inconsistent with its territorial sovereignty. The Swiss Federal Court rejected this claim. The context within which the decision is cited by the Trail Smelter tribunal is instructive. The Swiss Court admitted the probability, established by clear and convincing evidence, that continued use of the range could result in stray bullets crossing into the neighboring canton's territory, causing loss of life, physical injury, or damage to property. Nevertheless, for reasons which will later become apparent, the court did not consider it appropriate to prohibit further use of the rifle range. Thus, the extensive citation to the Aargau decision by the Trail Smelter tribunal may be taken to indicate that, for the tribunal, risk creation alone did not merit prohibition of the activity. In other words, mere conduct of a hazardous activity involving a transnational risk might not have been viewed as an injurious act that the risk-creating state would have been obligated to prevent under international law. Admittedly, this conclusion is speculative; and therefore, Trail Smelter's implications for our inquiry are ambiguous.

An analysis of the Lake Lanoux case produces only marginally better insights into the international law of risk-creation. The dispute concerned a diversion of the waters of an international river by France, the upper riparian, opposed by Spain, the downstream state. Although the decision is remarkable for highlighting both the procedural and substantive restraints on a state's use of shared natural resources, it does not deal specifically with the basic issue of this inquiry. The tribunal did address indirectly the question of abnormal risk creation in frontier areas. But in so doing it

...
remained well within the strictures of the compromise and the very narrow treaty-determined context of that controversy between France and Spain.\(^{38}\)

Nevertheless, the attention the tribunal paid to the notion of hazardous activities in relation to the principle of good neighborliness is worth noting. In reviewing the legal relevance of Spain's contention that its rights to the waters of the Carol River, as guaranteed by the treaty, would be jeopardized by construction of a power project planned by the upper riparian, France, the court stated, *inter alia*:

> It has not been clearly affirmed that the proposed works would entail an abnormal risk in neighbourly relations or in the utilization of the waters. As we have seen above, the technical guarantees for the restitution of the waters are as satisfactory as possible. If, despite the precautions that have been taken, the restitution of the waters were to suffer from an accident, such an accident would be only occasional and, according to the two Parties, would not constitute a violation [of the relevant provision of the governing treaty].\(^{39}\)

Apart from Spanish water rights under the treaty, the tribunal did not consider the legal implications of a possible Spanish claim that the French water works constituted an abnormally dangerous activity in violation of the principle of good neighborliness. However, the passage above conveys the impression that the tribunal thought that abnormally dangerous activities in border areas constituted a special problem in international relations. Unfortunately, there was no opportunity or necessity for the tribunal to elaborate on this issue.

The *Nuclear Tests* cases,\(^{40}\) on the other hand, presented a clear occasion for an authoritative statement on the international legality of state activities, which, although carried out within national boundaries and not illegal *per se*,\(^ {41}\) involved an obvious risk of harmful transnational effects. To the disappointment of many,\(^ {42}\) the International Court of Justice (ICJ) failed to seize an opportunity to decide a case which held important implications for international environmental law in general and transnational risk creation in particular.\(^ {43}\)

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38. As to the narrow interpretation by the tribunal of its own jurisdiction, see *id.* at 301.
40. The *Nuclear Tests Cases* (Australia v. France) and (New Zealand v. France), [1974] I.C.J. 253. Because of the similar arguments made by the two plaintiffs, reference will hereinafter be limited to *Australia v. France*.
41. One of Australia's arguments was clearly based on the premise that atmospheric nuclear testing might be found not to be unlawful under customary international law. See Handl, *supra* note 19, at 52.
43. For the characterization by Australia of atmospheric nuclear testing as an ultrahazardous activity, see *Nuclear Tests Case, Request for the Indication of Interim Measures*
One of the plaintiffs' objectives was a declaratory judgment regarding the legality of French atmospheric testing. However, over a strong dissent, the Court declined to reach the merits, holding that the controversy had been mooted by the French declaration of intent to discontinue such tests. The Court's indication by the thinnest of possible majorities (8 to 6) of interim measures, provides, of course, no reliable guide to what its decision on the merits might have been. After all, it is the issues of prima facie jurisdiction and threat of irreparable damage to the alleged rights of one of the parties which stand in the foreground of the proceedings concerning interim measures. Comments on the merits of the case in dissenting opinions, therefore, do not necessarily reflect a minority viewpoint. Thus, passages in Judge Ignacio-Pinto's dissenting opinion in the interim measures order may or may not represent the opinion of the court:

I see no existing legal means in the present state of the law which would authorize a State to come before the Court asking it to prohibit another State from carrying out in its own territory such activities [i.e., nuclear testing in the atmosphere] which involve risks to its neighbours.

Later in his opinion, one finds this telling passage:

The point is that if the Court were to adopt the contention of the Australian request it would be near to endorsing a novel conception in international law whereby States would be forbidden to engage in any risk-producing activity within the area of their own territorial sovereignty.

In other words, "the risk of atomic radiation" to which France exposed other nations did not, in his opinion, justify limiting the sovereignty of the testing state. As a logical extension of this view, the operation of nuclear fuel cycle facilities in border areas a fortiori would be permissible under international law because atmospheric testing per se presents a strong basis for a finding of illegality, while, in general, the operation of fuel cycle facilities on national territory undoubtedly is legal. This view of risk-creating activities appears to have been shared by at least one other member...
of the Court. Inferences with regard to concurring or dissenting opinions of the other judges remain speculative.

On balance, the Nuclear Tests cases simply did not advance the question of availability of prior restraint where the transnational damage is only a possibility. In any case, it is worth emphasizing the fundamental factual difference between testing in the Nuclear Tests cases and operation of nuclear fuel cycle facilities in frontier areas. In the Nuclear Tests cases, one of the main issues was whether actual transnational pollution, without proof of certain or ascertainable material damage, could give rise to a valid international claim for a restraint of the polluting activity. In the case of frontier siting of a nuclear power plant, the basic question is whether, in the absence of an actual transfrontier crossing of pollutants the mere possibility of serious accidental transnational radioactive contamination suffices to render such a siting impermissible under international law.

The implications of these three international law decisions for the issue of transnational risk creation are ambiguous at best. The decisions indicate awareness and concern about the problem, but no clear solutions emerge because the courts never squarely faced the issue. Before turning to an examination of state practice, however, one national court's decision under circumstances analogous to transnational risk creation merits further attention. The case, already discussed above, is Aargau v. Solothurn, which the Trail Smelter tribunal considered a relevant precedent in defining territorial relations among sovereign states, even though it involved federal territorial entities.

There is little doubt about the significant role national courts play in the articulation and growth of international law. Specifically, the applicability of decisions of domestic courts in disputes between federal states can be

50. Judge Petren, in his dissenting opinion in the Fisheries Jurisdiction Case (United Kingdom v. Iceland), [1973] I.C.J. 302, stated: "This indication of interim measures was apparently founded on the possible existence of a new general rule of international law prohibiting States from carrying out atmospheric nuclear tests causing the deposit of radioactive fall-out, however slight, on the territory of other States." Id. at 310 (emphasis added).

51. "Pollutant" here refers to the "introduction by man, directly or indirectly, of substances or energy into the environment resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems, and impair or interfere with amenities and other legitimate uses of the environment." Organization for Economic Cooperation and Development, Recommendation of the Council on Principles Concerning Transfrontier Pollution, OECD Doc. C(74) 224, reprinted in 14 INT'L LEGAL MATERIALS 242, 243 (1975). Apart from the completely separate issue of the management of radioactive wastes by, e.g., environmental dilution and dispersion, what little radioactivity escapes into the environment during normal operations is quite insignificant.

52. 41 BGE I 126. See text accompanying notes 38-40 supra.


defended on the minimal basis that "decisions of national courts can be a
source of knowledge of the contents of international law." At the same
time, this argument is subject to the caveat that the "essentially different
circumstances of international life from those within a federal system"
may affect the findings of domestic courts. In particular, with respect to
the relief granted, domestic constitutional provisions are likely to influence
a decision which otherwise may be based entirely on international legal
principles.

This was indeed the case with Aargau v. Solothurn. In the first phase
of this conflict, Solothurn v. Aargau, the Swiss Federal Court upheld the
plaintiff's sovereignty-based claim to complete protection from the risks
associated with target practice in the neighboring canton's border area,
based on applicable principles of international law. In the second phase of
the dispute, however, the Court reversed itself and, as noted above, permitted
continued operation of the range. The court found that if, in spite of
additional safety measures, the extremely small probability of stray bullets
could not be eliminated, the continued use of the range entailed a "practi-
cally inevitable, in a sense a natural risk," one that had to be tolerated
between neighbors.

Apparently, this reversal was due to federal legislation passed after the
first decision. These laws compelled local communities to provide target
practice facilities for the military. In view of the unavailability of absolutely
safe practice facilities in the community concerned, the Court found that the
neighboring canton's demand for absolute protection against transboundary
crossing of bullets was in conflict with implementation of the federal laws.
Consequently, in rejecting the claim of the risk-exposed canton, the Court
apparently subjected what it originally acknowledged to be the sovereign
right of the endangered canton to the requirements of federal law.

It is thus hardly arguable that this latter decision constitutes a valid
illustration of the "relativity of the rule" that "a State owes at all times a

55. Andrassy, *Exposé préliminaire, Project de Résolution sur l'Utilisation de Eaux*, 48
    *INTERNATIONAL LAW ANNUNCIUM* (Vol. 1) 213, 250 (1959) (translation provided).
    (1971).
57. For possibly the strongest opposition to the precedential relevance of national deci-
    sions in the international arena, see F. BERBER, *RIVERS IN INTERNATIONAL LAW* 173-75
    (1959).
58. For an example of the preponderance of constitutional considerations, see the stan-
    dard used by the United States Supreme Court in *Missouri v. Illinois*, 200 U.S. 496 (1906).
59. Judgment of Nov. 1, 1900, 26 BGE I 444.
60. Id. at 452.
61. Id. at 450-51.
63. Id. at 137.
64. In other words, this decision stands for the proposition that sharing in transcantonal
    benefits (the improvement in the federal military defense preparedness as a result of the target
    practice) entails also a sharing in potential transcantonal costs (in the form of injuries and
damage due to the occasional stray bullet).
duty to protect other States against injurious acts by individuals from within its jurisdiction."

Elucidation of the true nature of the second Aargau holding enhances the international legal relevance of the first decision and lends support to the argument that the creation of a clear risk of serious transnational damage is unlawful under international law.

B. State Practice

The difficulty in determining the probative value of a given instance of state practice, often epitomized by the question of whether such instance amounts to a "source" or an element of "evidence" of customary international law, is the result of the nature of the transnational legal order. Apart from the fact that emphasis on the alternative of "source" or "evidence" is hardly the appropriate angle from which to conceptualize state practice, it is, of course, "the belief that [a given] practice is rendered obligatory by the existence of a rule of law requiring it," that makes the essential difference. But as long as states represent both creators and addressees of transnational legal norms, the line between state practice as evidence of the existence of an international legal custom and as evidence of the process of the formation of such a custom will be difficult to draw. In this situation it is worthwhile to recall the fundamental mechanism of the formation of new customary law as part of the general process of the continuous evolution of international law. Rarely has this process been more succinctly described than in McDougal and Schlei's discussion of the development of international customary law relating to the uses of the high seas:

[It] is a continuous process of interaction, of continuous demand and response, in which the decision-makers of individual nation-states unilaterally put forward claims of the most diverse and conflicting character . . . and in which other decision-makers, external to the demanding nation-state and including both national and international officials, weigh and appraise these competing claims in terms of the interests of the world community and the rival claimants, and ultimately accept or reject them. The requirement of careful contextual analysis of instances of state practice relating to abnormally dangerous frontier activities emerges from this characterization of the process.

Basically, two types of situations can be distinguished. First, either the

66. For a discussion of the terminological ambiguities surrounding "source," see C. Parry, THE SOURCES AND EVIDENCES OF INTERNATIONAL LAW (1965). Insofar as "evidence" is concerned, it appears to be well-established that application of "the law" is not merely reaffirmation of an immutable "set of rules" but rather an instance of the further evolution of the law. Therefore, a distinction between "evidence" and a "source" of international law seems to make little sense.
neighboring state objects during or after the initiation of the hazardous activity in the frontier area, or the protest precedes initiation of such activities. Secondly, a state may decide to abstain from conduct of an abnormally dangerous activity in frontier areas in anticipation of diplomatic protests by the neighboring states. In the former type of situation, the response will be more readily ascertainable as being supportive or unsupportive of the claims by the risk-exposed state.

In the latter case, abstention is decidedly more ambiguous from the standpoint of an external observer who tries to determine its legal implications since abstention obviously is also attributable to causes unrelated to any anticipated action by the neighboring state or other members of the international community. Hence, the requirement of a contextual examination applies even more forcefully to this type of situation.

Mere practice of abstention without careful consideration of alternative reasons for it is, as the ICJ and its predecessor have repeatedly explained, insufficient proof of the existence of an international legal custom requiring abstention. To test the legal significance of abstentions from per se lawful activities carrying a clear risk of transnational harm, Kirgis suggests a convincing, if simple formula: "If freedom of action might plausibly be asserted, and if purely selfish interests would normally be served by action (or by less restraint than is observed), inaction or restrained action is legally significant." These initial clarifications help to provide a sufficiently critical approach to the following examples of state practice.

1. Hazardous Military or Industrial Activities in Frontier Areas

An early incident of hazardous military border activity, analogous to the conflict in the Aargau litigation, occurred in 1892 when French troops staged target practice exercises near the Swiss border. After Switzerland protested the danger to a nearby Swiss community, French military authorities halted the exercises until steps had been taken to avoid accidental transnational injuries.

In 1948, a munitions factory explosion at Arcisate, Italy, five kilometers from the Italian-Swiss border, caused varying degrees of damage in


70. Kirgis, supra note 29, at 295.

71. Although a review of international claims and counterclaims concerning hazardous activities carried on in areas beyond national jurisdiction and control would reveal valid analogies, this survey will be limited to a consideration of cases where activities within national territory actually or potentially entail detrimental consequences in other states' territory, e.g., noxious effects on natural resources common to two or more countries. For a definition of the latter notion, see note 15 supra.

several Swiss communities. The Swiss government, invoking the principle of good neighborliness,\textsuperscript{73} demanded reparation from the Italian government for the damage sustained. The Swiss argued that Italy was liable since Italy tolerated the existence of an explosives factory as well as its attendant hazards in the immediate vicinity of an international border.\textsuperscript{74}

Since in any event the international responsibility of the Italian government could have been argued persuasively on the basis of the \textit{Trail Smelter} and eventually the \textit{Corfu Channel} decisions,\textsuperscript{75} it is of little consequence in this context that despite reiterated Swiss diplomatic efforts the reparation question had not been settled by 1956.\textsuperscript{76} The interesting aspect of this incident is that Switzerland chose to base its claim on an allegation according to which the conduct of abnormally dangerous activities in frontier areas was \textit{per se} violative of international law.

In a recent Swiss-French incident, France protested blasting operations in a private quarry on the Swiss side of the river Doubs near the community of Le Noirmont.\textsuperscript{77} The river constitutes the Swiss-French border in this area. The exact contents of the complaint by the French ambassador are difficult to ascertain. It seems established, however, that the French protest stressed the risk of future damage to the whole area and to inhabitants from landslides caused by the blasting, rather than emphasizing the actual damage to nearby French communities.\textsuperscript{78} If the French protest was indeed based on mere risk creation, the Swiss termination of the hazardous activity suggests recognition of international legal implications of industrial activities creating transnational risks.\textsuperscript{79}

2. \textit{Supertanker Traffic}

A United States-Canadian dispute has developed over use of Canadian waters as a route for supertankers serving a proposed refinery in Eastport, Maine. The only feasible access route includes a treacherous channel between two Canadian islands and hence through Canadian territorial waters.

\begin{itemize}
  \item \textsuperscript{73} An early formulation of the principle of good neighborliness can be found in the \textit{River Oder} case:
    
    [A] community of interest in a navigable river becomes the basis of a common legal right, the essential features of which are the perfect equality of all riparian States in the use of the whole course of the river and the exclusion of any preferential priviledge of any one riparian state in relation to the others.
    
  
  \item \textsuperscript{74} Guggenheim, \textit{supra} note 72, at 169.
  
  \item \textsuperscript{75} The \textit{Trail Smelter}, 3 R. Int'l Arb. Awards 1911 (1938); \textit{Corfu Channel}, [1949] I.C.J. 4.
  
  For further discussion of the \textit{Trail Smelter}, see text accompanying notes 30-35 \textit{supra}.
  
  \item \textsuperscript{76} Guggenheim, \textit{supra} note 72, at 168.
  
  \item \textsuperscript{77} Tages Anzeiger (Zürich), Sept. 29, 1976, at 5, col. 3.
  
  \item \textsuperscript{78} "The [French] municipalities . . . had . . . complained about landslides, which they said were caused by the blastings and endangered the whole area and its inhabitants." \textit{Id}.
  
  \item \textsuperscript{79} The fact that these blasting activities were impermissible under Swiss law seems irrelevant, since the illegal operations had been going on for years with the apparent knowledge of the Swiss authorities. Only after the French protest was action finally taken against the operators of the quarry.
\end{itemize}
The Canadian government has argued repeatedly that the potential grounding or collision of a supertanker represents "an unacceptable environmental risk." It apparently believes that in view of the potentially disastrous environmental consequences of a major oil spill, Canada could lawfully prohibit United States-bound supertanker traffic through the channel.

It is both impossible and unnecessary to establish here all the legal ramifications of this controversy. Suffice it to say that Canada's position as the territorial sovereign *qua* sovereign of the waters surrounding the two islands seems irrelevant in the situation under examination. Indeed, it is suggested that, apart from the narrowness of its permissible exercise, the initial United States right of navigation through Canadian waters resembles the right which a state may have to the conduct of activities in a border zone of its own territory. For it appears that the 1814 Treaty of Ghent might be construed to give the United States a special right of passage that is not susceptible to unilateral suspension by Canada. Thus, the doctrine of innocent passage, which otherwise confers considerable discretion upon the coastal state insofar as restrictions on or suspension of passage through its territorial waters are concerned, appears inapplicable to the present case. In the alternative, the access route to Eastport would be subject to an international straits regime.

In this event, Canada would be authorized to suspend the right of passage of a foreign vessel only if navigation by this vessel through the strait were non-innocent. While a strait state enjoys a measure of discretion in

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80. N.Y. Times, Mar. 5, 1975, at 12, col. 6. For discussion of the law of the sea as it relates to this controversy, see Feder, A Legal Regime for the Arctic, 6 ECOLOGY L.Q. 785, 805-08 (1978). See also 6 INT'L CANADA 33, 174-75 (1975)


83. The 1958 Convention, supra note 82, art. 16, para. 4, defines straits uniformly as channels "used for international navigation between one part of the high seas and another part of the high seas or the territorial sea of a foreign State." An important refinement of the notion of "international strait" emerged recently from the discussions at the Third-United Nations Law of the Sea Conference (LOS-III), as a result of coastal states' claims to ever-widening zones of maritime jurisdiction. Thus, international straits connecting areas of the high seas or exclusive economic zones with other areas of the high seas or exclusive economic zones are distinguished from straits connecting areas of the high seas or exclusive economic zones with the territorial sea of a foreign state. The concept of innocent passage applies to the latter type of straits, while the former type is subject to a transit passage regime which confers considerably fewer jurisdictional powers upon the strait state with respect to foreign vessels in transit. Informal Composite Negotiating Text, Third Conference on Law of the Sea, U.N. Doc. A/CONF.62/ WP. 10, arts. 38-39, 45 (1977) [hereinafter cited as Informal Composite Negotiating Text]. The access channel to Eastport falls squarely into the latter category of international straits.

84. 1958 Convention, supra note 82, art. 16, para. 4; Informal Composite Negotiating Text, supra note 83, art. 43, para. 2.
determining the innocent nature of passage, it would appear that a suspension of the right of passage of an oil tanker involving a mere risk of environmental pollution would be subject to a most rigorous test of reasonableness. Recent developments at the Law of Sea Conference confirm this conclusion. In other words, if a Canadian claim to the lawfulness of restricting the United States right of access is subject to well-established legal requirements of proving the reasonableness of this claim, the analogy of the Eastport situation to the previously analyzed cases must be evident. The Canadian government argues from the basis of an "effects"

85. While innocent passage cannot be suspended, "passage" is still subject to the requirement that it be "innocent." The 1958 Convention, supra note 82, art. 14, para. 4, defines passage of vessels as innocent "as long as it is not prejudicial to the peace, good order or security of the coastal State. Such passage shall take place in conformity with these articles and other rules of international law." McDougal and Burke note that "no effort was made at the [1958 Law of the Sea] Conference to give operational indices of these terms." M. McDougal & W. Burke, The Public Order of the Oceans 252 (1962). Upon review of the preparatory materials and the Conference discussions they conclude nevertheless that for a violation of strait state prescriptions relating to interests exceeding the narrow notion of "security," the strait state would be competent to prohibit passage as non-innocent. Id. at 190, 254. See also Commentary by the ILC on its draft articles on the law of the sea, [1956] 2 Y.B. INT'L L. COMM'N 273; Pharand, Oil Pollution Control in the Canadian Arctic, 7 TEX. INT'L L.J. 45, 66 (1971).

For the corresponding provisions of the Informal Composite Negotiating Text, supra note 83, see note 88 infra.

86. It would appear obvious that strait states' interests, such as national security and preservation of the marine environment, which bear on the passage of foreign ships, must be accommodated to the equally important interests of shipping nations in smooth and unimpeded transit through the international navigational channels that are part of a foreign state's territorial waters. The legitimacy of a strait state's claim with regard to suspending or restricting transit thus depends on its reasonableness, which must be determined in the light of, inter alia, whether vital national interests of the strait state are at stake, the impact of this action on the flag state's interests, and the precedential implications for world maritime commercial traffic. As to the applicability of the test for reasonableness, see generally M. McDougal & W. Burke, supra note 85, at 231. The official United States view of the law concerning the Head Harbor Passage (the access channel to Eastport) is that "vessels proceeding to or departing from United States ports through the waters of Head Harbour Passage enjoy the right of innocent passage under international law. This right is not subject to unreasonable or arbitrary interference or suspension." Dep't of State aide-memoire of March 12, 1975, in E. McDowell, [1975] Digest of United States Practice in International Law 432.

87. For a comprehensive overview, see Burke, Contemporary Law of the Sea: Transport, Communication and Flight, 2 YALE STUD. WORLD PUB. ORD. 183, 244-52 (1976).

88. The basic stipulation of art. 45, para. 2 of the Informal Composite Negotiating Text, supra note 83, is that "there shall be no suspension of innocent passage through such straits." But despite a detailed listing of grounds for possible denial in art. 19, para. 2(a)(1), "innocent passage" itself is not defined in terms of the absence of significant environmental risks associated with a given passage. Indeed, the only pollution-related basis for denial mentioned in the text is an "act of willful and serious pollution." Id. art. 19, para. 2(h). Besides, any rules and regulations which the strait state may adopt shall not, according to art. 24, para. 1(a), "impose requirements on foreign ships which have the practical effect of denying or prejudicing the right of innocent passage." Canada has, inter alia, claimed the right to "promulgate regulations limiting the amount of oil and/or oil products that may be carried through the waters of Head Harbour Passage." Canadian aide-memoire of March 12, 1975, paraphrased in E. McDowell, supra note 86, at 432. Under an earlier United States-proposed definition of an international strait, the Head Harbour Passage would be subject to a free-transit regime which
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Doctrine, according to which an activity whose conduct would normally be a matter of discretion of one state becomes a matter of international concern if the activity affects significantly another state's interests.

This philosophy underlies, of course, claims of risk-exposed states to the "internationalization" of the decision-making process with respect to the siting of abnormally dangerous agencies in the border area of the neighboring state. In a similar vein, Canada adduces the mere creation of a significant risk to its environment as a ground for contesting not only specific characteristics, but the legality of the very conduct of an activity. The fact that the risk creation takes place within the Canadian territorial boundaries is irrelevant because the navigational channel is not subject to "original" Canadian jurisdiction. The Eastport case therefore constitutes a proper piece of evidence in our inquiry.

3. Creation of Transnational Flood Danger

A further instance of state practice relevant to our discussion again involved the United States, this time in a dispute with its southern neighbor. At issue was the construction of a highway in Baja California (Mexico), parallel to the United States border. The manner in which certain northward draining canyons were to be bridged entailed, in the opinion of United States authorities, a potentially serious flood danger to United States territory and its residents. In a letter from the United States Commissioner on the joint International Boundary and Water Commission to his Mexican counterpart, Mexico was exhorted "to take such remedial measures as required to eliminate this threat to the interests of [the United States]." Although the letter referred to the occurrence of damage only as a possibility, apparently contingent on excessive precipitation in the area and failure of the planned


89. As to the requirement of a qualification of these effects and the concomitant balancing of interests approach, see M. McDougal & W. Burke, supra note 85, at 231. In the environmental context, see Handl, Balancing of Interests and International Liability for the Pollution of International Watercourses: Customary Principles of Law Revisited, 13 CANADIAN Y.B. INT'L L. 156, 175-77 (1975); Utton, The Arctic Waters Pollution Prevention Act and the Right of Self-Protection, 7 U. BRIT. COLUMBIA L. REV. 221, 227 (1977). For an analogous case, see McDougal, Extraterritorial Application of Restrictive Trade Legislation, in INTERNATIONAL LAW ASSOCIATION (ILA), REPORT OF THE FIFTY-FIRST CONFERENCE, TOKYO 304, 330-31 (1964); Jaenicke, in id. at 320. See also United States v. First National City Bank, 396 F.2d 897, 901 (2d Cir. 1968).

90. Because of, e.g., the extraterritoriality of the location of the activity concerned.

91. It is true that Canada has given notice of its intention to regulate the amount of oil shipped at a time through the strait. See note 87 supra. But Canada's purpose clearly is to render supertanker traffic impossible and thus to prevent the conduct of the activity itself.


93. Id. (emphasis added).
earth dams, it nevertheless asserted a Mexican duty to eliminate this risk. The United States Commissioner asserted this duty in terms which went beyond the boundary provisions within the existing United States-Mexico treaty relationship.

In response to the United States letter, Mexico modified its construction plans. The United States felt these changes were inadequate and lodged a formal protest with the Mexican Minister of Foreign Relations. While urging the Mexican government to suspend construction of the highway pending satisfactory implementation of safety devices, the United States note "reserved all the rights that the United States [might] have under international law in the event [of] damage [resulting] from the construction." The letter did not allege specifically that international law prohibited the creation of a considerable transnational hazard. Hence, the basis of any United States claim for reparation in the event of damage remains open to speculation. Obviously, the basis could have been Mexican "responsibility-for-risk," i.e., that in the given circumstances the manner of bridging the canyons rendered the highway a particularly hazardous construction which should result in liability for damage intrinsically connected with this activity, whether or not Mexico in so building the highway was already in default of an international obligation. Or, as with the above Swiss claim vis-à-vis Italy, the basis could have been the alleged violation by Mexico of an international legal obligation requiring states to abstain from abnormally dangerous border activities involving a risk of transnational harm.

Since neither party elaborated on the basis of the alleged duty, the United States letter can be characterized only as a demand for the elimination of a major transnational risk based on some international obligation not derived from a specific bilateral treaty.

94. Id. As to the moderate frequency of excessive rainfall in this area, see Hearings on H.R. 7573 and S. 2540 Before the Subcomm. on Inter-American Affairs of the Comm. on House Foreign Affairs, 98th Cong., 2nd Sess. (1966).


96. Note from the U.S. Ambassador to the Mexican Minister of Foreign Relations (July 29, 1959), cited in M. WHITEMAN, supra note 92, at 262.


98. See text accompanying notes 74-76 supra.

99. In other words, the conduct of an abnormally dangerous activity in a frontier area could be considered negligence per se. See Comment on Draft Art. 7 on Flood Control, INTERNATIONAL LAW ASSOCIATION (ILA), REPORT OF THE FIFTY-FIFTH CONFERENCE, NEW YORK 43 (1972), where Berber, in his capacity as rapporteur on flood control, gives as an example of negligence resulting in international liability "a granting of a State concession for the construction of a work by a private agency which might be contrary to the object of flood control, when such concession has been granted without due consideration of the possible harmful effects of such a work." Id. at 89 (emphasis added).
4. Underground Nuclear Testing

Another risk-creating activity involved the United States in a controversy with some of the Pacific states. Although a 1969 nuclear underground test on Amchitka, one of the Aleutian islands, had drawn strong criticism particularly from the Canadian government, the United States government in 1971 planned an even stronger test on Amchitka, code-named "Cannikin." In response to these plans, the Canadian government "protested" its concern about the proposed nuclear test to the United States government. The reason for making special representations to the United States, and not to the Soviet Union, the Peoples' Republic of China, or France, which at that time were all involved in underground nuclear testing, was, as the Canadian Secretary of State for External Affairs later put it, in the fact that such a test as was proposed could have a direct effect on people living on the Pacific coast in both Canada and the United States. Indeed, such a nuclear explosion [was] to be condemned on two counts: First, it [was] a continuation of the testing and, second, because it happen[ed] to be in an area of difficult terrain where there might be untoward effects.

Specifically, Canada feared that the tests might produce a major earthquake, a tidal wave, or leakage of radioactive materials into the environment, or a combination of these results. The Japanese government shared some of the Canadian fears and expressed its "regrets" over the proposed Cannikin test, together with its concern, inter alia, over the possibility of a tidal wave. Japan, like Canada, reserved its rights to compensation in the event of damage.

In response to the Canadian note, the United States government "assured the Canadian government that the interests of Canada would be taken into full account and careful consideration given to the possible impact of the physical environment on and around Amchitka Island." However, the United States made no further commitment despite extreme pressure, both at home and abroad, that aimed at cancellation of the test.

100. See Note of Sept. 19, 1969, from the Canadian Embassy to the United States State Department, cited in Stein, Cannikin, in INTERNATIONAL RESPONSIBILITY FOR ENVIRONMENTAL INJURY (Stein ed. forthcoming).


102. 2 INT'L CANADA 68.

103. Id. at 185.

104. Id. at 200.


107. 2 INT'L CANADA 199; Stein, supra note 101. For further references, see Schneider, STATE RESPONSIBILITY FOR ENVIRONMENTAL PROTECTION AND PRESERVATION: ECOLOGICAL UNITIES AND A FRAGMENTED WORLD PUBLIC ORDER, 2 YALE STUD. WORLD PUB. ORD. 32, 54, n. 57 (1975).
In the event of damage brought about by the Cannikin test, the United States could have been held liable under the responsibility-for-risk doctrine, which does not imply illegality of the damage-causing conduct. Thus, in contrast to the ambiguous United States claim for reparation in the Baja highway example, the Cannikin claims clearly did not involve an allegation of illegality:

The State Department’s views on both the Canadian and Japanese notes are that they do not constitute “protests” but that they were carefully couched in terms of “expressions of regret.” Any use of the term “protest” the State Department felt was not made in the diplomatic sense, but was a response to domestic pressures.¹⁰⁸

A statement made by the Canadian Secretary of State for External Affairs to Parliament corroborates the State Department’s reading of at least the Canadian note: “The hard fact, Mr. Speaker, is that in the end the American Government has the legal right to carry out this test. It presumably is doing so in accordance with what it perceives to be the national interest of the U.S.A.”¹¹⁰

The Cannikin example differs from previous examples of state practice since neither Canada nor Japan alleged international illegality. This apparent inconsistency is reduced when the pre-existing political relationships between the states are examined. While the preceding case studies concerned primarily economic activities, Cannikin involved the national security interests of several parties to the controversy. The United States decision to go ahead with the test despite growing national and international protests was defended on the grounds of national security.¹¹⁰ The United States stated that Cannikin was an indispensable test of the Spartan warhead and thus necessary for implementation of the American anti-ballistic missile system.

Given the close security relationship between the United States and the objecting countries, and the well-established fact that both Canada and Japan benefit from United States strategic forces and the retention of a credible retaliatory capability which Cannikin was designed to preserve, neither Canada nor Japan was in a position to argue forcefully against the United States test.¹¹¹ In addition, it is probably true that in view of the otherwise extremely good relations among the countries concerned, it would

¹⁰⁸. Stein, supra note 100.
¹⁰⁹. Stein, supra note 100; Speech by the Canadian Secretary of State for External Affairs in the House of Commons on Oct. 27, 1971, in 2 Int’l Canada 201 (1971).
¹¹⁰. For the related statement by James Schlesinger, then Chairman of the United States Atomic Energy Commission, see 2 Int’l Canada 201 (1971).
¹¹¹. This line of argument was also taken by the solitary member of Parliament who opposed a House of Commons resolution of Oct. 15, calling for the cancellation of Cannikin. Id. at 200-01. Of course, acceptance by a state of unidirectional transfrontier pollution is often the result of a “package deal,” with the polluting state yielding on other than environmental issues, such as defense, trade concessions, and cultural agreements. See Smets, Alternative Economic Policies of Unidirectional Transfrontier Pollution, in Organization for Economic Cooperation and Development, Problems in Transfrontier Pollution 75, 81 (1974).
have been bad diplomacy for either country to press a claim which, given the interests involved, was likely to be rejected by the United States. However, had the nations enjoyed less favorable relations, and had the national security aspect been missing, the protests might well have included an allegation of the per se illegality of the test based on the transnational risks involved.

5. Hazardous Border Installations

An interesting comparison to Cannikin is provided by a case in which national security was at least implicitly claimed to be at stake and to constitute the reason for the preservation by a state of transnationally hazardous conditions in border areas. However, in obvious disregard of the motives underlying the claim by the risk-creating state to the lawfulness of its conduct, this assertion of sovereignty was rejected by the risk-exposed state as impermissible under international law.

In 1949, Austria protested formally the existence of mine fields in Hungarian territory close to the border with Austria. Hungarian authorities had laid land mines for the apparent purpose of preventing the clandestine passage of persons across the frontier. The Austrian authorities feared that during a flood mines might be washed into Austrian territory and endanger Austrian citizens living near the border.

Austria's fears were confirmed when a Hungarian contact mine crossed the border and exploded, causing extensive damage. The Austrian ambassador lodged a strong formal protest with the Hungarian foreign ministry. The note accused the Hungarian authorities of violating the "uncontested international legal principle according to which measures taken in the territory of one state must not endanger the lives, the health and the property of citizens of another state." Another accident occurred shortly after the first, and Austria sent a second note arguing that, absent a public commitment by the Hungarian government to take all measures to prevent such accidents in the future, the Hungarian authorities' conduct was "totally inconsistent with the principles of good neighbourliness."

112. The author does not concur, however, with McWhinney's argument that it was inappropriate to bring the French nuclear tests before the ICJ. See McWhinney, International Law-Making and the Judicial Process: The World Court and the French Nuclear Tests Cases, 3 SYRACUSE J. INT'L L. & COM. 9, 45 (1975). In that case, the activity itself, quite apart from its possible consequences, was already shrouded in legal controversy. It also was characterized by an actual or inevitable future deposit of radioactivity on the territory of the plaintiffs, Australia and New Zealand. These circumstances, in conjunction with the absence of plaintiffs' national defense dependency on the risk-creating state, radically distinguish the claims of New Zealand and Australia from those of Canada and Japan arising in the context of Cannikin.

113. Guggenheim, supra note 72, at 169.


The significance of this state practice example is that the Austrian protests at all times focused on the elimination of the risk of transnational damage. The protests were not based on Hungary’s legal obligation to refrain from causing extraterritorial damage. Rather, the notes emphasized the element of risk, characterizing the creation of a danger of severe transnational harm as impermissible under international law. Subsequently, Hungary did remove or relocate all minefields away from the frontier.  

6. Weather Modification Activities

Another area of interest for this inquiry is planned weather modification. On a national level, weather control experiments and operational programs have been occurring for some time. While the problem of transnational effects of nonhostile weather modification activities is not new, state practice in this field has remained fairly limited.

One particularly interesting statement was made in connection with 1966 hearings before the United States Senate on pending legislation concerning a program to increase usable precipitation in the United States. In a letter to Senator Magnuson, the United States Department of State made the following observation:

The Department of State’s only concern would be in case the experimental areas selected would be close to national boundaries which might create problems with the adjoining countries of Canada and Mexico. In the event of such possibilities the Department would like to insure that provision is made for advance agreement with any affected countries before experimentation took place.  

“Advance agreement” with a potentially affected country means nothing less than consent by that country. In other words, the statement suggests, as official policy, abstention from those modifications (such as cloud seeding) which have notoriously unpredictable effects and therefore carry a potential but uncertain transnational risk when conducted in border areas.


120. See, e.g., NATIONAL ACADEMY OF SCIENCES, WEATHER AND CLIMATE MODIFICATION
The scope of this policy statement might be questioned in the light of the 1975 United States-Canadian Agreement on the Exchange of Information of Weather Modification Activities, an example of an alternative approach dispensing with the prior consent requirement. However, this agreement was the product of unique circumstances which reduce its relevance here. Since weather modification activities are being conducted on both sides of the United States-Canadian boundary, the risk creation is reciprocal and therefore amounts to accepted practice between the countries. Irrespective of the 1975 agreement, either country would thus find itself in an awkwardly inconsistent position if it were to object to a particular modification activity in the neighboring country. More relevant to the present discussion are instances of state practice where a specific transnational risk creation does not constitute a common reciprocal practice along the international border.

Absent such qualified state practice, the resolutions and recommendations of competent international organizations acquire special significance. These documents either reflect the expectations of the international community with regard to a given activity of international concern, or represent a key element in the evolution of these very community expectations. Thus, it is worth noting that "[a]s early as 1963 the World Meteorological Organization called for careful evaluation of proposed experiments in large-scale modification and satisfactory international agreement before undertaking the experiments." Recently, a panel of experts of the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) considered the legal aspects of weather modification activities. The dis-


122. The agreement establishes an obligation concerning exchange of information on and notification—prior to commencement—of modification activities within 200 miles of the international boundary. Arts. I, II, and IV, id. at 590-92. These provisions are supplemented by an additional obligation to enter into consultations at the request of either party. Art. V, id. at 593. However, the requirements of prior notification, and possibly of consultation, are waived in cases of emergencies such as forest fires. Art. VI, id.


124. For example, a country could invoke the principle of good neighborliness as rendering such activities (in general) unlawful under international law. Indeed, the very rationale underlying this principle, namely the need to preserve the give-and-take necessitated by the physical coexistence of states, would be conspicuously absent in the above situation. For a description of the estoppel argument, see note 21 supra.


Discussion then turned to the possibility of prohibiting certain weather modification activities which offered the risk of significant harm, unless the consent of all interested States is obtained. It was pointed out that an analogous limitation could be inferred from recommendation 70 of the Stockholm Declaration and from the United Nations General Assembly resolution 2995 (XXVII). Concern was expressed that such a legal principle was unnecessary given the state of the art today and that expressed application of the general limitations found in the Stockholm Declaration, etc. to the field of weather modification was unwarranted. The meeting decided that such a principle should be deferred for further consideration.\footnote{Id. at 7, para. 4.9.}

Although the panel found a general duty to consult with potentially affected states in all cases of weather modifications unwarranted, it agreed on the following:

It is desirable that a State, in whose territory major weather modification activities are to be undertaken, should engage in meaningful and timely consultation with interested States at their request, with a view to working out \textit{mutually acceptable arrangements} regarding the conduct of those activities.\footnote{Id. at 8, para. 4.14 (emphasis added).}

These passages emphasize risk as the crucial factor in determining whether weather modification activities ought to be considered permissible without consent of the potentially affected states. This much can be inferred already from the proposed duty of states to enter into consultations to establish "mutually acceptable arrangements" prior to their engagement in "major modification activities." Activities on a minor scale apparently do not entail a duty to consult. Given the clear relationship between the scope of the proposed activities and the magnitude of the transnational risk, the permissibility of the activity, itself dependent on its acceptability to the potentially affected state or states.\footnote{"Mutually acceptable" does not imply a simple veto power on the part of the risk-exposed state. Rather, it indicates the procedure for dispute settlement, namely by negotiations in which, as the ICJ put it, the conflicting interests of the parties are reconciled, "in as equitable a manner as possible." Fisheries Jurisdiction Case (United Kingdom of Great Britain and Northern Ireland v. Iceland), [1974] I.C.J. 3, 30, para. 70.} was considered to be a function of the transnational risk. This conclusion is consistent with the approach to large-scale modification activities suggested by other commentators.\footnote{See, e.g., Samuels, \textit{International Control of Weather Modification Activities: Peril or Policy?}, 13 NAT. RESOURCES J. 327, 337 (1973): "Perhaps in the short run, total prohibition of weather modification activities with potential significant international consequences would be advisable."}

The first passage quoted above, which is addressed more directly to the
relationship between risk and permissibility, does not mandate a legal duty. However, the panel did not reject the principle of prior consent; it merely deferred consideration. The reason for this attitude is not difficult to grasp. As the wording of the first quotation indicates, the panel was extremely careful not to adopt strongly worded texts, presumably due to possible repercussions on other areas of international environmental law. Some members questioned the propriety of the panel’s undertaking, as intruding into the jurisdiction of the International Law Commission. Others stressed that they viewed the work of the group, useful as it was, as leading “to the preparation of a set of draft principles which would have the value of simple recommendations, not of binding legal norms.”

The panel’s view of the principle of prior consent, however, surfaces most tellingly in the reference to principles of international law incorporated in the Final Documents of the United Nations Conference on the Human Environment as already governing the question before it. The recognition that a limitation, analogous to the principle of prior consent to major weather modification activities, was inferable from recommendation 70 of the Stockholm Final Documents and General Assembly resolution 2995 (XXVII) suggests a strategy of indirect promotion rather than of express adoption. Thus, the panel’s conclusion, while unquestionably weak as a formal expression of an international legal norm, does lend support to the applicability of the “prior consent” principle to proposals for major weather modification activities.

7. Nuclear Plant Siting

Finally, to complete the overview of international disputes concerning border area activities that carry a risk of transnational harm, we shall consider nuclear power plant siting in border areas. Section IV examines the legality of such siting in light of the theoretical framework presented in section III. In this section, only the limited body of precedent on the question is considered.

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132. Id. at 99, para. 388.
134. G.A. Res. 2995 (XXVII) (Cooperation Between States in the Field of the Environment), 27 U.N. GAOR, Supp. (No. 30) 42, U.N. Doc. A/8730, refers only to an obligation to avoid significant harm; it does not refer to the avoidance of risk of significant harm. Paragraph (b) of Recommendation 70, in contrast, refers to a “risk” but only in the context of a duty to “consult fully other interested states when activities carrying a risk of [appreciable effects on climate] are being contemplated or implemented.” Stockholm Final Documents, supra note 133, at 1449. “Full consultation” still would not seem to require obtaining “prior consent.” Cf., e.g., the decision by the Lake Lanoux tribunal, which denied that an “obligation to give notice” included an obligation to obtain the agreement of the state notified. 12 R. Int’l Arb. Awards 285, 309 (1957). For further discussion, see The Avoidance and Adjustment of Environ-
Not surprisingly, the location of nuclear power plants in areas close to international borders has repeatedly been the subject of international diplomatic activity. Dukovany and Rüth are two proposed nuclear power plant sites that have given rise to transnational concern in Central Europe. Another nuclear power plant site near Greifwald (East Germany), apparently at issue between Scandinavian countries and the German Democratic Republic, was the object of an inquiry with the Commission of the European Communities. In many other situations the transnational concern simply did not reach the same explicit official level.

A highly interesting dispute in which the international legal implications of the siting decision apparently were raised in a pertinent way, involved Switzerland and Austria. Swiss plans to construct a 900 MW(e) nuclear power plant in Dukovany, Czechoslovakia, is approximately 35 kilometers from the Austrian border. Two Soviet-designed 440 megawatt electrical power reactors are scheduled to be operating there by 1980. The site's proximity to the Austrian border led to a demand by the Austrian Ministry of Foreign Affairs for, and eventual agreement by the Czech government to, joint talks about the safety aspects of the facility. Die Presse, July 30, 1975, at 2; 15 ÖSTERREICHISCHE ZEITSCHRIFT FÜR AUẞENPOLITIK 290 (1975).

For a detailed discussion, see text accompanying notes 140-150 infra.

An example in point is the Bärsöback power plant near Malmö, Sweden, just opposite Copenhagen. In other cases, the protests by citizen action groups against power plants in border areas, along the Rhine for example, were less over the siting per se than over the hazards of nuclear power in general. See N. Y. Times, Apr. 9, 1975, at 14, col. 3; Peele & Bauman, Review of ANS TOPICAL MEETING ON NUCLEAR POWER PLANT SITING, 16 NUCLEAR SAFETY 273, 280 (1975). The projected power plant also became a matter of controversy between Switzerland and Austria.
nuclear power plant near Rüthi in the Upper Rhine Valley close to the Austrian border caused serious concern in the neighboring Austrian state of Vorarlberg over the project’s transnational environmental implications. Although the Austrian concern may have been partially aesthetic, the safety aspect played an equally significant role in Vorarlberg opposition to the Swiss project.

These objections were brought to the attention of the Swiss authorities, who entered into consultations with the Austrian federal government and the Vorarlberg state government. The talks centered on the international legal principle of good neighborliness as applied to the projected nuclear power plant near Rüthi. The Swiss authorities re-evaluated the entire project as a result of the international controversy aroused. Shortly before the study was completed, the Austrian foreign minister stated that, should the Vorarlberg government still believe the final Swiss decision was in conflict with the principle of good neighborliness and hence violative of international law, the Austrian government was committed to assert formally the illegality of the project to the Swiss government. This position, the minister asserted, had been explicitly communicated to the Swiss government.

In the fall of 1975, the Swiss Minister of Transportation and Energy, speaking before a private forum, revealed that the Rüthi project had been shelved temporarily. This statement in itself does not indicate the legal position taken by Switzerland vis-à-vis the prospects of an official Austrian note charging a violation of international law. The Swiss authorities’ and Liechtenstein. See Neue Zürcher Zeitung, Morgenausgabe Nr. 346, July 27, 1972, at 14, and Nr. 369, Aug. 10, 1972, at 14. However, Liechtenstein was primarily concerned about the possible synergistic effects of water vapor from the plant’s cooling towers and the waste sulfur dioxide from a projected Swiss oil refinery nearby. Its concern over the Rüthi plant apparently did not extend to the radiological safety of the proposed nuclear installation.

141. Thus, local Swiss opposition to that project was based on the fact that the plant complex, with its huge cooling towers, would have been located close to a land area designated a national reserve. Neue Zürcher Zeitung, Fernausgabe Nr. 118, May 1, 1974, at 27. For a similar Austrian concern, see Randelzhofer & Simma, supra note 21, at 412-13.

142. The chief Austrian delegate to the UN characterized the Rüthi project as a “nuclear reactor on [Austria’s] front doorstep, frightening residents of Vorarlberg with prospects of radiation emissions from across the border,” N. Y. Times, May 17, 1976, at 8, col. 3. This statement was made during a weekend gathering of nuclear scientists and UN diplomats to discuss ethical considerations of nuclear issues.

143. See 12 ÖSTERREICHISCHE ZEITSCHRIFT FÜR AUSSENPOLITIK 349 (1972); 14 ÖSTERREICHISCHE ZEITSCHRIFT FÜR AUSSENPOLITIK 224 (1974).

144. See the news release by the Austrian authorities of May 28, 1973, on the occasion of a state visit to Austria of the Swiss foreign minister, paraphrased in 13 ÖSTERREICHISCHE ZEITSCHRIFT FÜR AUSSENPOLITIK 162 (1973).


147. This step by Austria would most likely be taken because of a fundamental Vorarlberg objection to the Swiss project. See text accompanying note 143 supra.

148. Even if the statement referred to unconditional cancellation, it appears doubtful that under the recent ICJ holding in the Nuclear Tests cases this statement could have been of
"mothballing" of the Rüthi project could be interpreted as the consequence of adjusting planned energy production capacity to forecasts of a significant reduction in the growth of domestic electricity consumption. Evidence has recently appeared, however, which suggests that the scope of the Swiss decision was broader, and the reasons for the decision more complex, than the public statement would indicate. Indeed, Austrian opposition to the proposed nuclear power station aired within the consultative framework of the Lake Constance Convention must be considered a crucial factor. It now appears that the Rüthi project has in fact been cancelled, and that this decision came at least in part as a response to Austria's opposition.

This case is thus undoubtedly instructive, even though the apparently elegant settlement of the dispute through indefinite shelving of the project is seemingly devoid of any internationally relevant precedential effect. The existence of an international controversy engulfing the projected site for a nuclear power plant in the vicinity of an international border remains a fact, as does Swiss inaction on the implementation of the project.

III
PARAMETERS FOR AN EVALUATION OF THE PERMISSIBILITY OF THE CONDUCT OF ABNORMALLY DANGEROUS ACTIVITIES IN FRONTIER AREAS

In view of the virtual absence of bilateral or multilateral international treaties bearing directly on transnational risk creation, the preceding case

international legal significance. This holding imposed the requirement of publicity—quite apart from the requirement of an "intention to be bound"—for such a statement to have the effect of creating an international legal obligation. (Australia v. France), [1974] I.C.J. 267, para. 43.

149. Decelerated economic growth and reduced electricity consumption in Switzerland during the years 1974 and 1975 necessitated revision of the Swiss nuclear plant construction program. EIDGENÖSSISCHE KOMMISSION FÜR DIE GESAMTENERGIEKONZEPTION, ZWISCHENBERICHT 87, 94 (1976).

150. Art. 1, para. 3 of the Convention on the Protection of Lake Constance from Pollution stipulates: "Specifically, the riparian States will mutually notify each other in advance of projects for water use which, if carried out, could interfere with the interests of another riparian State as regards maintaining the wholesomeness of the waters of Lake Constance. Such projects shall not be carried out until they have been jointly discussed by the riparian States." Verträge der Bundesrepublik Deutschland, Serie A, vol. 33, at 374 (English text from OECD Doc. AEU/TFP/ENV/75.11, at 16).

Although the provision does not require the parties to abstain from a proposed activity (e.g., the use of water for cooling purposes in the Rüthi case) in the face of an objection by a riparian state, in these formal discussions Switzerland could not easily dismiss Austrian opposition to the project.

151. For example, the West German government gave careful consideration to the implications of a proposal to site a high level radioactive waste repository at Gorleben (Lower Saxony), right at the border with East Germany. In view of similar waste management plans of East Germany, also envisioning location in the immediate vicinity of the border, the West German government apparently expects no serious objections from its neighbor. The fact that environmental monitoring around the site may have to be extended into East Germany is considered to be no intrinsic bar to the West German project. NUCLEAR NEWS, Aug., 1977, at 95-96.

152. As to international agreements concerning the exchange of information and the duty of consultation among risk-creating and risk-exposed countries, see notes 4-5 supra and note infra.
studies gain special relevance as evidence of state practice. Because they reveal a consistent pattern of responses to the initial claims by states to the conduct of transnationally hazardous frontier activities, these cases are even more significant.

The following discussion examines the nature of these reactions and develops a framework for evaluating the permissibility of a hazardous frontier activity. The objections of risk-exposed states generally take the form of diplomatic protests against the hazardous nature of the activity and its proximity to the territory of the complaining state. The complaining states seek either the elimination of a recognizable risk of transnational harm or compensation for damages sustained from the realization of such a risk. In both situations, the risk-exposed state implies that, since the hazardous conduct is incompatible with the principle of good neighborliness, it is impermissible under international law.\textsuperscript{153}

The permissibility of a hazardous frontier activity is viewed to depend upon the resulting degree of risk of transnational harm. Risk-exposed states characteristically claim major risks, such as “an unacceptable threat to the environment”\textsuperscript{154} and “a danger to the lives, the health and property of citizens” of the threatened state.\textsuperscript{155} Such expressions of perceived major risk constitute an essential element of the argument that the challenged activity is impermissible. Since there must be “substantial,” “significant,” or a similarly qualified degree of extraterritorial damage before a state is liable for pollution damages,\textsuperscript{156} international law will probably protect against a transnational risk only if that risk exceeds an analogous threshold. If such a threshold is required, the permissibility of a hazardous frontier activity depends upon the magnitude of risk.

Because of the legal insignificance of minor damages, the state practice examples emphasize the potentially serious consequences of a major accident rather than the high probability that a lesser accident may occur. Similarly, in those examples in which international claims were put forward \textit{ex post facto}, the foreseeability of the severity of the damage, rather than the high probability that the damage would occur, was used to support such claims. These cases therefore suggest strongly that the greater the harm threatened, the smaller the probability of its occurrence needed to create a duty to prevent the infliction of transnational harm by abstaining from risk-creating frontier activity.

\textsuperscript{153} This is, of course, not exactly true for the Cannikin and Rüthi cases. But for the reasons elaborated at text accompanying notes 100-112 and 140-150, respectively, it is assumed that these disputes can be put into the same category as the others.

\textsuperscript{154} See text accompanying note 80 \textit{supra}.

\textsuperscript{155} See text accompanying note 114 \textit{supra}.

\textsuperscript{156} For a comprehensive review of this qualified liability for extraterritorial damage in international jurisprudence, state practice, and international literature, see Handl, \textit{supra} note 89, at 173-74 (1974). \textit{See also} Gaja, \textit{Oral Intervention—Obligations and Responsibility of the States . . . Air, Sea, Rivers and Lakes: Questions of State Responsibility}, in \textit{The Protection
Risk is a product of magnitude, the amount of damage resulting from a given event, and probability, the likelihood that the event will occur.\textsuperscript{157} Evaluation of risks associated with hazardous frontier activities thus requires separate consideration of the magnitude and probability components.\textsuperscript{158} Assuming a constant level of "significant risk," we can conclude that the greater the harm threatened, the smaller need be the component element of probability to attain a constant notion of legally significant risk. The international legal significance of the function operated in this way finds support in writings and evidence discussed below, beyond the present survey of state practice. The function does not, however, work both ways. There exists a threshold below which extraterritorial effects of a state's activity are insignificant from an international legal viewpoint no matter how large the probability of their occurrence.\textsuperscript{159}

This approach to transnational risk creation has already been encountered above.\textsuperscript{160} In reviewing the strict standard of proof of actual transnational damage (including also probable, as against merely possible, damage\textsuperscript{161}) under the \textit{Trail Smelter} formula, Kirgis asks "whether a disinterested decision-maker thirty years after \textit{Trail Smelter}, in a world awakened to the existence of environmental deterioration, would find the clear and convincing standard literally applicable when there are plausible consequences magnified far beyond those considered in that case."\textsuperscript{162}

Other writers have also supported a modified standard of proof approach, apparently as a result of a greater environmental consciousness and increased attention towards environmental preservation.\textsuperscript{163} They appear to

\textsuperscript{157} Risk is a function of frequency (events per unit of time) and magnitude (consequences per event). U.S. NUC. REG. COMM'N, REACTOR SAFETY STUDY: AN ASSESSMENT OF ACCIDENT RISKS IN U.S. COMMERCIAL NUCLEAR POWER PLANTS, WASH-1400 (NUREG 75/014), at 9 (1975) [hereinafter cited as FINAL RSS].

\textsuperscript{158} As to the relevance of such a distinction, see, \textit{e.g.}, the dissenting opinion of Judge Wright in Ethyl Corp. v. EPA, 7 ERC 1353, 1386-87 (D.C. Cir. 1976); and his majority opinion in Ethyl Corp. v. EPA, 541 F.2d 1, 18, 8 ERC 1785 (D.C.Cir. 1976). \textit{Cf.} Green, \textit{The Risk-Benefit Calculus in Safety Determination}, 43 GEO. WASH. L. REV. 791 (1974-75), who suggests that since "quantified benefits will almost always outweigh the quantified risks," the decision-making process would "be better 'informed' if the risks are described qualitatively rather than quantitatively." \textit{id.} at 804. This is certainly the more appropriate approach to risk assessment than is Dr. Handler's, which seems to over-emphasize quantitative at the expense of qualitative analysis. \textit{See} Handler, \textit{A Rebuttal: The Need for a Sufficient Scientific Base for Government Regulation}, 43 GEO. WASH. L. REV. 808 (1974-75). \textit{See also} Yellin, \textit{Judicial Review and Nuclear Power: Assessing the Risks of Environmental Catastrophe}, 45 GEO. WASH. L. REV. 969, 992-93 (1977).

\textsuperscript{159} In other words, some insignificant transnational environmental effects of a proposed state activity are an accepted fact of the physical co-existence of political entities and their interdependence in a world of shared natural resources.

\textsuperscript{160} See text accompanying note 29 supra.

\textsuperscript{161} "The \textit{Trail Smelter} standard would extend comfortably to cases in which the likelihood is established by clear and convincing evidence." Kirgis, supra note 29, at 294. \textit{See also} Handl, supra note 19, at 74-75.

\textsuperscript{162} Kirgis, supra note 29, at 294.

\textsuperscript{163} For such an emphasis, see, \textit{e.g.}, Observations by the Executive Director on the
agree that, even though this approach is not directly derived from the Trail Smelter decision, the approach is not inconsistent with it. However, opinions differ over the legal relevance of this method of establishing a duty of abstention. Kirgis intimates that a modified standard is part and parcel of community expectations for the international decision-making process relating to transnationally hazardous activities. Kiss, on the other hand, denies the present existence of an ascertainable international duty of prevention based on the modified approach. However, he recognizes the need for the law to develop towards this end. Wildhaber recently commented on Kirgis’s standard of proof arguments, admitting that “[g]iven the present state of international and national law and the threat to the environment, the existence of a duty of prevention cannot in fact be denied.” The strongest support for the modified approach to transnationally hazardous activities comes from Randelzhofer and Simma. They paraphrase Kirgis’ modified standard-of-proof approach, restating it as the unequivocal international legal principle for determining the legal relationship between risk-creating and risk-exposed states.

The same approach was implied in some of the Australian arguments in the Nuclear Tests cases. It also emerged indirectly from discussions on weather modification activities held during the 1974 American Society of International Law Conference on the avoidance and adjustment of environmental disputes. Compliance with the duty to obtain prior consent by the risk-exposed state or states was considered crucial to the lawfulness of a proposed activity. Such a duty was found to arise in the cases of large-scale experiments and of the mitigation of severe storms over ocean areas. By contrast, small-scale activities were not considered to entail such an obligation. Support for a standard of proof proportional to the potential harm can also be found in United States domestic litigation.

Relationship between General Assembly Resolutions 3129 (XXVIII), Principles 21, 22 and 24 of the Stockholm Declaration and General Assembly Resolutions 2995 (XXVII) and 2996 (XXVII), U.N. Doc. UNEP/GC/44, at 36, 37-38, para. 79 (1975) [hereinafter cited as Observations of UNEP Director].

164. See Kirgis, supra note 29, at 317-20.

165. Kiss, Un Cas de Pollution Internationale: L’affaire des Boues Rouges, 102 J. DU DROIT INTERNATIONALE 207, 235 (1975); Kiss, Efforts to Control Air Pollution at International Level, in Council of Europe, Legal Aspects of Air Pollution Control, Doc. EXP/Air (72) 11, at 14, 45.

166. Wildhaber, supra note 30, at 119 (translation provided).

167. Randelzhofer & Simma, supra note 21, at 416-17.


169. The Avoidance and Adjustment of Environmental Disputes, supra note 134.

170. The views expressed are those for which only the chairman and the rapporteurs of the working groups concerned are responsible. Id. at 1.

171. Id. at 21-22.

172. Id. at 22.

173. This theme underlies the classic negligence definitions of Judge L. Hand in United
The reasonableness and present applicability of a duty to prevent damage to a neighboring state by abstaining from conduct creating transnational environmental hazards can be inferred from the international obligation of states not to inflict or permit the infliction of significant harm to the environment of other states.\textsuperscript{174} The rejection of the idea that, as a general principle of international law, states might be entitled to buy transnational pollution easements by way of compensation for the extraterritorial environmental damage inflicted, entails a corollary, the duty to abstain from conduct that would or most likely would result in such damage. In controversies where there is not virtually assured transnational injury, but

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\textsuperscript{174} See text accompanying note 30 \textit{supra} for the classic statement in the \textit{Trail Smelter} decision. The tribunal there held unequivocally that Canada—apart from the undertakings in the Convention—was under a duty to bring the smelter operations in line with the international legal principles concerning transnational air pollution established by the arbitrators. 3 R. Int'l Arb. Awards, 1911, 1965-66 (1938). \textit{See also} Principle 21 of the Stockholm Final Documents, \textit{supra} note 133, at 1420; Art. 30 of the Charter of Economic Rights and Duties of States, \textit{supra}
there is some potential for extremely severe transnational environmental consequences, further analysis requires reconsideration of the fundamental purpose of the international proscription of activities causing significant transnational pollution damage.

On both a national and an international level, the basic philosophy underlying environmental regulation is to preserve the environment in a wholesome state and safeguard it against disastrous and irreversible degradation. 175 International environmental concern, at least in the last resort, aims at the prevention of transnational inflictions of such degradations. Hence, potentially catastrophic consequences dwarf the legal relevance of a low probability of such consequences and may alone warrant prevention of the hazardous activity.

After a disastrous accident, restoration of the affected transnational environment may prove either impossible or achievable only over a long period of time and may entail great social and economic hardship. Whatever financial payments might be made as compensation for the extraterritorial damage caused, they are more likely than not to represent mere token amends for the ecological damage inflicted. 176

From an international legal point of view, it is thus not difficult to see why assertion by a state of a sovereign right to conduct an activity may be unacceptable if the activity, though neither unlawful per se nor "more likely than not" 177 to cause significant extraterritorial damage, carries a risk of catastrophic transnational effects. Such an assertion is expressive of an extreme form of national self-interest tantamount to a potential denial of other states' territorial sovereignty. 178 It constitutes pursuit of a policy with implications incompatible with the basic structure of today's international society; it violates what remains an avowed cornerstone of the international legal system, the sovereign equality of, and the independence among, states. Therefore, barring a special relationship between risk-creating and risk-exposed states, such as reciprocity of risk creation or a sharing in the
benefits to be derived from the proposed activity, such an activity should be considered impermissible.

In practice, few cases will ever arise where the proposed activity will create an undisputed risk of transnational catastrophe. Danger often lies in the eye of the beholder, particularly in an era in which accelerating scientific and technological developments outpace society's ability to understand and evaluate the social and environmental implications of such developments. The assessment of the effects of technological change is a complex and demanding endeavor, which frequently produces controversial findings. As a result, where new technologies are involved in a frontier activity, evidence concerning the probabilities and potential consequences of accidents is likely to be quite ambiguous. Hence, the modified standard of proof approach alone may prove a largely ineffective tool for establishing the permissibility of a proposed controversial frontier activity.

Given the inherent uncertainty surrounding transnational risk, determination of the permissibility of the hazardous frontier activity requires recourse to other criteria of "reasonableness," suggesting a balancing of interests approach. A balancing test follows from the fundamental nature of the dispute, a clash of correlative and interdependent claims grounded on the notion of territorial sovereignty, which implies exclusive jurisdiction and control over national territory. This evaluation of the conflicting claims, including those explicitly formulated by the directly involved parties, as well as the ones which must be deemed implicitly asserted in the social and environmental context of the international community at large, appears overwhelmingly sanctioned by international legal practice. It is also almost uniformly advocated by international lawyers.

Hence, although a potential for catastrophic transnational environmental impact would theoretically outweigh other considerations and render the hazardous activity an unreasonable assertion of sovereignty, in practice the reasonableness of a given activity may have to be ascertained on the basis of a multiple factor analysis. This analysis would include consideration of the probability and the magnitude of the harm threatened. In addition, it would include consideration of the whole range of parameters which in national legal systems explicitly or implicitly form the framework for determining


180. Cf. the related issue of the safety assessment of consumer goods and the recent outcry over the proposed banning of saccharin by the Food and Drug Administration. N. Y. Times, Mar. 10, 1977, at 1, col. 2.


182. For a review of both international legal practice and literature see Handl, supra note 89, at 177-86.

183. The United States Restatement of Torts lists parameters for such a classification. See
the ultrahazardous nature of an activity\textsuperscript{184} for the purpose of reallocating the social costs associated with the activity.\textsuperscript{185} 

For purposes of the present discussion, reference to the exemplary listing of relevant criteria in the Restatement of Torts is both instructive and valid from an international legal point of view. Such criteria constitute parameters in any balancing process involving a hazardous activity whether in a national or transnational legal context. These criteria include: (1) the probability of harm; (2) the magnitude of the harm threatened; (3) the interrelationship of risk elimination and exercise of reasonable care; (4) common usage; (5) locality; and (6) the value to the community.\textsuperscript{186} Other criteria of reasonableness, such as those listed in the so-called Helsinki rules,\textsuperscript{187} serve at least a supplementary function where appropriate.\textsuperscript{188} 

Applied to the present inquiry, "common usage" might be exemplified by reciprocal risk creation along a common border. Such reciprocity could constitute an effective bar to an allegation by one state that the hazardous frontier activity of a neighboring state is unlawful \textit{per se}.\textsuperscript{189} A finding of "common usage" would immediately terminate the inquiry.

\textsuperscript{184} However, in some countries, such as Germany, liability without fault for certain hazardous activities is provided for only in specific statutes and the extension by courts of such liability to activities not specifically covered by statute is avoided. One problem with a dogmatic approach to cases of liability without fault is the observed absence of clear general parameters for the imposition of liability. See, e.g., J. Esser, \textit{Grundlagen und Entwicklung der Gefährdungshaftung} 7-8 (2nd ed. 1969). An excellent general survey is also presented by Kötz, \textit{Haftung für besondere Gefahr}, 170 ARCHIV FÜR DIE CIVILISTISCHE PRAXIS 1 (1970).

\textsuperscript{185} For a review of the more flexible approach of Austrian courts to extensions \textit{per analogium} of liability without fault for hazardous activities, see Posch, \textit{Zum Stand der Reform der Gefährdungshaftung}, in \textit{WERTUNG UND INTERESSENAUSGLEICH IM RECHT} 165 (W. Posch ed. 1975).


\textsuperscript{187} The relevance of parameters for determining the allocation of social costs of a given hazardous activity to the process of determining its permissibility is obvious. This process can, of course, result in opposite outcomes; in one case the benefits may be held to outweigh the costs, making the carrying on of the activity lawful under certain conditions, e.g., acceptance of liability by the actor irrespective of fault, while in another case the overall cost/benefit balance may tip towards the cost side, causing the activity to be held impermissible.

\textsuperscript{188} Although the Helsinki criteria relate to "reasonableness" in the context of the direct use of shared natural resources, and no such use is involved in the present inquiry, the pollution transfer media, air and water, nevertheless do qualify as a "shared natural resource." For the definition of shared resources adopted in the present Article, see note 15 \textit{supra}.

\textsuperscript{189} \textit{Cf.} Fletcher, \textit{Fairness and Utility in Tort Theory}, 85 HARV. L. REV. 537 (1972), who
The "value to the community" factor is also of little interest here, for it refers to the relationship between risk-creating and risk-exposed states. Yet, no direct benefits are assumed to accrue to the risk-exposed state and indirect benefits are assumed to be rejected as being unsolicited and outweighed by the associated risks.

Similar considerations apply to factor (3), "reasonable care and risk elimination." Its relevance is limited because it is assumed that the manner in which the activity is conducted is reasonable in the sense that all relevant physical features of the frontier site, (e.g., the topography, ecology, seismology, hydrology, population density, etc.) have been taken into account in the siting, design, construction, and operation of the plant. In other words, as "the relation of the activity to its surroundings is the controlling factor,"190 a frontier activity is reasonable only to the extent that its modalities reflect the findings of transnational safety analyses that consider the possible transnational environmental consequences of national action.191 Factor (3) thus does not refer to the political feature, as it were, of the site, its location near an international boundary, and that factor's implication for the reasonableness of the conduct of the hazardous activity concerned.

Since the risk of transnational harm associated with a given hazardous activity is a function of the "locality" factor, that factor itself becomes the crucial element in the determination of the reasonableness of the conduct of the activity concerned.192 Identification of a frontier location as a major contributor to a significant transnational risk in terms of catastrophic consequences should demonstrate that the conduct of the activity in that location is contrary to principles of international law.193 However, availability of

makes reciprocity of risk-creation the decisive criterion for the denial of liability for harm due to the risk-bearing activity. For criticism of this paradigm of liability, in terms of its availability as a method for implementing distributional goals compatible with prevailing social values, see especially Calabresi & Hirschoff, Toward a Test of Strict Liability in Torts, 81 Yale L.J. 1055, 1078-82 (1972).

191. Note the emerging international standard of nondiscrimination between national and transnational environmental effects in national environmental decision-making processes. See, e.g., Council of Europe Res. (71) 5 on Air Pollution in Frontier Areas, in 19 EUR. Y.B. 263 (1971); Organization for Economic Cooperation and Development (OECD) Council Recommendations on Principles Concerning Transfrontier Pollution, OECD Doc. C (74) 224, reprinted in 14 Int'l Legal Materials 242, 244-45 (1975); Titles A and C of OECD Council Recommendation on the Implementation of a Regime of Equal Right of Access and Non-Discrimination in Relation to Transfrontier Pollution, OECD Doc. C (77) 28 (Final). See also Council of Europe Res. (68) 4 on the joint assessment of air pollution in frontier areas, 16 EUR. Y.B. 381, 385 (1968); Recommendation of the Council on Principles Concerning Coastal Management, OECD Doc. C (76) 161 (Final), Annex. See generally Wildhaber, Procedures nationales et internationales de consultation préalable à l'installation d'établissements polluants dans les régions frontaliers, Council of Europe Doc. EXP/Air (73) 2. As to international agreements requiring transnational safety analyses with respect to the siting of nuclear power facilities, see note 135 supra.
192. See text accompanying note 190 supra.
193. See text accompanying notes 175-178 supra.
alternative sites and cost effectiveness of upgrading safety systems at the frontier location may nevertheless need to be considered in determining the reasonableness of the siting decision.\footnote{For a list of relevant factors, see the analogously applicable criteria (g)-(k) of art. V, para. 2 of the Helsinki Rules, \textit{supra} note 18, at 488.}

\section*{IV
\textbf{THE INTERNATIONAL LEGALITY OF SITING NUCLEAR POWER PLANTS IN FRONTIER AREAS}}

There can be little doubt that the element of "location" plays the crucial role in the characterization as unlawful of the transnational risk creation in the above reviewed instances of state practice. Indeed, the international law concept of liability-for-risk testifies to the lawfulness of activities\footnote{See Report of the International Law Commission on the Work of its Twenty-Seventh Session, 30 U.N. GAOR, Supp. (No. 7-13) 1415, U.N. Doc A/10010, 14-15 (1975).} that carry a risk which is "substantial either in probability or magnitude of harm, and is transnational in character."\footnote{Kelson, \textit{State Responsibility and the Abnormally Dangerous Activity}, 13 \textit{Harv. Int'l L. J.} 197, 229 (1972).} Therefore, if these characteristics of a given activity alone do not compromise its lawfulness,\footnote{Examples are nuclear and outer space activities. For a discussion of nuclear liability regimes, see sources cited in notes 213-214 \textit{infra}. As to outer space activities, see art. II of the Convention of International Liability for Damage Caused by Space Objects, \textit{reprinted in} 10 \textit{Int'l Legal Materials} 965, 966 (1971).} a claim of illegality must be based on other grounds, such as improper siting.

That location is the key factor is not surprising. For most hazards, the magnitude of risk is a function of the proximity of the dangerous activity to the potential target. The relation of proximity and magnitude of risk is similarly direct for accidents associated with nuclear power facilities. In a majority of cases, particularly in Europe, the choice of a non-frontier reactor site may not altogether eliminate the risk of transnational radioactive pollution.\footnote{For what appears to be an overly pessimistic assessment of the relevance of site choice as a strategy for reducing accident consequences, see Hake, \textit{A Comparison of Canadian and U.S. Siting Policies}, 10 \textit{Nuclear Safety} 365 (1969).} However, siting remains a critical transnational risk-reduction factor.\footnote{This emerges clearly from a review of the likely transnational impact consequential to a major accident at a power plant and its mitigation through the banning of power reactors from frontier areas, given a constant level of engineered plant safety as described in \textit{Final RSS, \textit{supra}} note 157, at app. IX.}

The transnational effects of a very large aerial release of radioactive material\footnote{Reference is made here to so-called "accidents beyond the design-basis" or "class 9 accidents beyond the design-basis."} from a nuclear power plant within twenty kilometers of a bor-
de201 could include hundreds of immediate fatalities, thousands of cases of acute sickness, and a similar number of latent somatic and genetic defects.202 Billions of dollars worth of property might be damaged and signifi-

by the U.S. Nuclear Regulatory Commission's classification. These accidents feature a massive release of radioactivity into the environment as a consequence either of a failure of engineered safety devices or of the emergence of a sequence of events that either had been dismissed as totally lacking in probability or had been completely overlooked in the initial safety analysis.

201. This distance value approximately reflects a general national practice of prohibiting the siting of nuclear plants in the vicinity of major population centers. Thus, in the United States, current and past practices by the NRC have precluded reactors from being sited within 20 miles of a major metropolitan area. Final RSS, supra note 157, at app. VI, 11-6. See 10 C.F.R. § 100.11(a)(2),(3) (1977). An earlier British "remote siting policy," now somewhat relaxed, stipulated that plants had to be at least ten miles from any population center of 100,000 or more. European Parliament Working Document, supra note 135, at 30. Similarly, the 1967 Dutch-Belgian, Dutch-German agreements (discussed in note 135 supra) require consultation and cooperation between neighboring countries in the event of proposed sittings of nuclear plants within 20 kilometers of the border. Id. at 68-69.

It must be evident from text accompanying notes 152-194 supra that this distance value is somewhat arbitrary, since it cannot take into account specific site characteristics. Given engineered plant safety features as a constant, the potential effect of reactor locations on the risk of transnational radioactive pollution is a probability function dependent on such factors as topography, local weather, etc., and not solely on distance from the reactor. See Smith, Locating Nuclear Power Plants with Reference to Environmental Safety, in INTERNATIONAL ATOMIC ENERGY AGENCY, SITING OF REACTORS AND NUCLEAR RESEARCH CENTRES, PROCEEDINGS SER. STI/PUB/72, at 133, 136 (1963). For the purposes of the present discussion, however, it is assumed that the distance value characterizes reasonably well the interdependence of site distance from the frontier and transnational effects in case of a major accident. For further details see text accompanying notes 204-209 infra.

Obviously, both a reduction in the probability of major transnational environmental and health effects and a mitigation of these effects requires a commitment of resources to the improvement of nuclear power plant safety. Frontier locations have not so far resulted in adoption of stricter safety standards and additional engineered safety devices. The fundamental question of this inquiry is thus whether, in view of the nature and extent of the potential transnational radioactive pollution costs, a larger share of the burden of pollution prevention costs, in terms of either enhanced safety measures or alternative siting concepts, must not be shouldered by the risk-creating state.

202. Thus, the parameters of the worst accident considered in the RSS are: 3,300 prompt fatalities, 45,000 cases of acute radiation sickness, 1,500 cases of lethal cancer per year over a period of 10-40 years after the accident and 8,000 cases of thyroid nodules per year over a period of 10-40 years after the accident, as well as 170 cases of genetic defects per year over the same time span, property damage of up to $14 billion, evacuation requirements for an area of up to 290 square miles, and certain restrictions on the use of the affected environment within a maximum of 14,500 square miles. Final RSS, supra note 157, tables 5-4, 5-5, figure 5-9; id., Executive Summary 9-11. However, these figures may not represent the true picture of an accident with an RSS-estimated probability of one in a billion, as RSS consequence computations in general have been criticized by various reviewers. See, e.g., U.S. ENVIRONMENTAL PROTECTION AGENCY, REACTOR SAFETY STUDY (WASH-1400): A REVIEW OF THE FINAL REPORT, EPA-520/3-76-009, at 1-3 (1976); Statement by Dr. Rowe (U.S. EPA) before the Working Group on Reactor Safety Study, Advisory Committee on Reactor Safeguards, United States Nuclear Regulatory Comm'n, Jan. 4, 1977.

In this context, consider Pattison, The Transnational Control of Atomic Energy: A Nuclear Ecology, 11 INT'L LAW. 501, 503: "Environmental risks, notably from reactor meltdown, carry the most popular concern . . . In the world of 2000 reactors projected by the end of the century [as in WASH-1400] such statistics indicate a terrifying possibility unless further steps are taken for transnational control of nuclear safety." It should be noted,
Transnational environmental risk
cant portions of productive national territory might be lost for some time due to heavy radioactive contamination of the environment.\textsuperscript{203}

Although the local effects of such an aerial release are difficult to calculate accurately,\textsuperscript{204} prohibition of nuclear power plants within eight kilometers of the border would probably eliminate the radiological risk to the population of an upwind neighboring nation.\textsuperscript{205} For downwind neighbors, banning plants from the twenty kilometer frontier zone would significantly reduce immediate fatalities and cases of acute radiation sickness.\textsuperscript{206} The extra distance between the power station and the international border might provide time to implement emergency evacuation plans, thereby mitigating health impacts. In certain weather conditions\textsuperscript{207} a heavier local concentration of radiological effects could be expected, so that the reactor site in relation to the international border would be of even greater relevance. The siting of nuclear power plants outside the frontier buffer would also substantially reduce the likelihood of transnational groundwater contamination in the event of a discharge of radioactive materials into ground or surface water,\textsuperscript{208} by providing more time to stop the migration of radionuclides through aquifers before they reached a neighboring country.\textsuperscript{209}

The relationship between transnational radiological effects and distance of the reactor site from the border is subject to a number of variables, which include plume rise, meteorological conditions, topography, and population density near the border.\textsuperscript{210} Nevertheless, the siting factor is of overwhelm-
Indeed, the distance of a nuclear power plant from an international border may be a matter of life or death for many citizens of the neighboring state.

In conclusion, the transnational radioactive pollution risk, whose consequences would unquestionably be severe, is to a significant degree a function of the distance at which a nuclear power plant is sited from the international boundary. In view of the nature and extent of transnational harm threatened, and its relationship to the choice of the plant location, a frontier site has all the appearance of an unreasonable assertion of sovereignty. For it seems that unilateral imposition of such a major risk on a neighboring state constitutes an implicit abrogation of that other state's territorial sovereignty.

In addition, unilateral siting of nuclear power plants in frontier areas results in an inefficient and inequitable allocation of resources between neighboring states which appears contrary to principles of international policy. If the neighboring state does not share in the benefits derived from the plant, frontier siting entails an unwarranted externalization of potential costs associated with a national nuclear power program. This externalization occurs despite a channeling of liability to the operator of the nuclear installation in case of transnational damage due to a nuclear accident.

Although a comprehensive scheme of reallocation of costs could in theory ensure complete indemnification of the victims of transnational radiological effects under the nuclear liability conventions and general principles of state responsibility, in practice it is highly unlikely that complete recovery

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211. For a clear recognition of the eminence of this siting factor, see, e.g., EEC Draft Study, supra note 5, at 16, 20.

212. In the analogous case of existing pollution of an international watercourse which threatens human life in another state, the duty of pollution abatement is not subject to the principle of reasonableness, but is absolute. Comment (e) to Art. X of the Helsinki Rules, supra note 18, at 501. In other words, such a pollution generating activity would probably be per se unreasonable without further consideration of criteria relating to the otherwise decisive notion of equitable utilization.


215. Although the operator of a nuclear installation would be primarily liable in the case of transnational damage, the state in whose jurisdiction or control the accident-struck facility is located would be at least secondarily liable. See Vienna Convention, supra note 213, art. XVIII, at 742; Paris Convention, supra note 213, annex II, at 1094. As to the general principles of state responsibility for extra-territorial injuries, see text accompanying note 30 supra; note 9 supra; Principle 21 of the Stockholm Final Documents, supra note 133; text accompanying note 218 infra.
of actual damage sustained is feasible.\textsuperscript{216} In other words, potential noncompensated transnational damage constitutes a cost of nuclear power development not reflected as a liability in facility siting decisions. More cynically, the potential transnational effects pose severe external costs which may encourage location of power plants at the periphery of national territory.

Of course, transnational externalization of environmental costs associated with the conduct of a hazardous activity runs counter to established international environmental legal principles.\textsuperscript{217} These principles stress states’ "responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction."\textsuperscript{218} This fundamental tenet has found further concretization in the so-called "Polluter-Pays Principle," expressly adopted by the Organization for Economic Cooperation and Development (OECD)\textsuperscript{219} and the European Economic Community,\textsuperscript{220} which places the burden of pollution prevention and control on the actor or polluter.\textsuperscript{221}

The Polluter-Pays Principle emphasizes efficient use of shared resources\textsuperscript{222} as the goal of regulatory regimes for transnational pollution.\textsuperscript{223}

\textsuperscript{216} See Observations of UNEP Director, \textit{supra} note 163. Indeed, the difficulty lies in the monetary assessment of environmental damage in general. For a recent review of possible methods for monetary evaluation of environmental damage, see \textit{ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT, ECONOMIC MEASUREMENT OF ENVIRONMENTAL DAMAGE—A TECHNICAL HANDBOOK} (1976). Specifically, the difficulties of assessing the health effects of a given radiation exposure are well-known.

\textsuperscript{217} This is true even though conditions of underdevelopment in a given country may present special development needs and hence give rise to some conflict with the principle of non-externalization. However, as principles 9 and 12 of the Stockholm Final Documents, \textit{supra} note 133, at 1418-19, point out, the resolution of this conflict lies not in the acceptance of exemptions from the principle of non-externalization but in the provision of additional international financial and technological assistance to offset environmental protection-oriented restraints on the demands of development. For a view that exceptional development needs might prevail over the non-externalization principle, see Note on the Implementation of the Polluter-Pays Principle, OECD Doc. ENV (73) 32 (Final), \textit{reprinted in} 14 \textit{INT’L LEGAL MATERIALS} 238, 241 (1975).

\textsuperscript{218} Principle 21 of the Stockholm Final Documents, \textit{supra} note 133, at 1420.


\textsuperscript{220} \textit{Id.} at 138.

\textsuperscript{221} As to the applicability of this principle not only within each member country, but also between them, see Smets, \textit{supra} note 111, at 85.

\textsuperscript{222} See Note on the Implementation of the Polluter-Pays Principle, \textit{supra} note 217, at 239.

\textsuperscript{223} This goal, however, is subject to the additional requirement that the given internationally efficient resource allocation, \textit{i.e.}, one that minimizes the costs of transnational pollution, is compatible with the basic organizational concepts of present-day international society. See text accompanying notes 176-179 \textit{supra}. Although incompatibility with these concepts might conceivably be defined in terms of the social "costs" of the activity under examination, in another context it has been argued persuasively that an analogous extension of the notion of "costs" would "involve stretching the term costs to the point of rendering it useless." G. \textit{CALABRESI}, \textit{supra} note 16, at 31.
"This principle means that the polluter should bear the expenses of carrying out . . . measures . . . to ensure that the environment is in an acceptable state." 224 "Acceptable state," the crucial element in this formulation, is a level of environmental pollution at which "the advantage of a further reduction in the residual social damage involved is considered as being smaller than the social costs of further prevention and control." 225 Under this test the efficiency of resource allocation is a persuasive criterion of the reasonableness of a state's utilization of internationally shared natural resources. 226 Using this criterion, the siting of nuclear power plants in frontier areas, because of the concomitant major risk of externalized transnational harm, is an inefficient and hence unreasonable allocation of shared resources. Since banning nuclear power plants in frontier areas would effectively control transnational pollution effects, 227 it would also lead to more efficient resource use and allocation.

A major reason for siting nuclear power plants in frontier areas is availability of plant cooling water from rivers and lakes which often form national boundaries. Nuclear power stations operate at an energy conversion efficiency which releases two-thirds of the total energy produced as thermal pollution, unless it can be used for direct heating purposes. Alternative cooling techniques which effectively eliminate the requirement of siting nuclear power plants near large bodies of water may eventually become practicable. 228 An already feasible option is the siting of power stations near population centers with significantly upgraded reactor safety systems. 229 The decreased distance between the reactor site and the population center


226. "Economic efficiency" is also essential to the "reasonable use" criterion found in both the ILA's Helsinky Rules, supra note 18, and in the propositions of the Asian-African Legal Consultative Committee concerning the utilization of waters of an international water course. See Draft Propositions of a Subcommittee of the Asian-African Legal Consultative Committee in 1973, cited in U. N. Doc. A/CONF. 4/274 (vol. II) 226, 228 (1974). Interesting criteria include comparative costs of alternative means of satisfying the economic and social needs of the affected countries, availability of other resources, avoidance of unnecessary waste, and practicability of compensation as a means of adjusting conflict among uses. See also note 18 supra.

227. For other transnational radioactive pollution risk-reduction strategies, see notes 228-241 infra.

228. German experiments with reducing the temperature of the power plant's cooling water by circulating it through underground pipes to stimulate agricultural growth are not presently conclusive. In contrast to direct cooling, i.e., the discharge of hot water into rivers and lakes, both wet and dry cooling methods are based on evaporation of water in huge cooling towers, but still depend on the availability of replacement water.

229. See, e.g., Närörläggning av Kärnkraftverk 308, SUO 1974:56 (1974), and the recommendation by the Urban Siting Committee—based on what by RSS standards are admittedly only crude probability and consequence computations for reactor accidents—"that district heat production in the metropolitan areas of Sweden should utilize nuclear heat and power plants, but that pronounced urban sites should be avoided until further experience has been acquired with plants whose locations have been selected according to current standards." Id. at 310.
would be compensated for by improved safety devices,\(^{230}\) while waste heat could be used for residential heating or cooling purposes.\(^{231}\)

Such a siting policy would produce a major gain in the overall energy efficiency of the nuclear power system involved and eliminate thermal pollution of international watercourses.\(^{232}\) Even from a perspective that focuses exclusively on domestic economic and environmental impacts, such a solution might be more desirable. In any event, nuclear plants not dependent on large bodies of water for heat sinks could be located more frequently in interior areas, significantly reducing the transnational effects of a power plant accident. This internalization of potential harm would result in more efficient and equitable allocation of internationally shared resources and act as an incentive to ensure the plant’s safety.

The actual costs of foregoing selection of border areas as sites for nuclear plants are slight if similarly qualified locations are available inland. Siting nuclear power plants outside the frontier zone would not noticeably

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Note in particular the approval by the Reactor Safety Commission (RSK) of the siting of the BASF dual purpose plant in the high population density area of Ludwigshafen/Mannheim (Germany). The plant’s significantly enhanced safety systems and deeper foundation have been characterized as coming “close to the ultimate in engineered reactor safety features.” Nuclear News, Aug., 1976, at 83.

Upon review, the additional safety-related costs ($378 million more than for a standard nuclear power plant) have apparently been found to render that site economically less attractive than one further from the population center, despite the added costs associated with a longer steam line to the BASF chemical plant, itself located in the highly populated area. See Nuclear News, Jan., 1977, at 17-18. However, the case of the BASF plant does not appear to be a representative example of the economics involved in the urban siting of nuclear plants which are equipped with improved safety systems. In large part, the additional costs are due not to the addition of safety equipment but to long delays in the licensing process of a novel siting solution. For a breakdown of the total plant costs, see Nuclear News, Aug., 1976, at 83, 85.


\(^{231}\) This would be similar to the way solar energy could be used for both heating and cooling purposes.

Dual purpose power stations have been operating in Sweden (Ågesta) and in the Soviet Union (Shevchenko and Bilbino); projects involving such stations are well advanced in Finland and West Germany. For further discussion, see Mühlhäuser & Helbling, Heating from Nuclear Power Stations, 57 Sulzer Technical Rev. 157 (1975); International Atomic Energy Agency, Urban District Heating Using Nuclear Heat (1977) (Proceedings of an Advisory Group Meeting, Vienna, March 15-19, 1976). For a discussion of the BASF plant, which produces both electricity and process heat, see note 229 supra. Note also the findings of a recent study for the Ministry of Economics and Transport of the State of Baden-Württemberg (Germany) that nuclear district heating for the Stuttgart area offered considerable environmental and economic advantages. Nuclear News, Jan., 1977, at 84. A study of the Basle area of Switzerland concludes that the average total cost per nuclear-supplied heat unit would equal 70 percent of the cost of local heating by light fuel oil or gas. Kirvel & Gruneko AG, Possibilities of Nuclear District Heating for the Swiss Canton of Basle, in Urban District Heating Using Nuclear Heat, supra, 197, 202-03.

\(^{232}\) Thermal pollution is a major problem along many international rivers. For a review of this issue, see Proctor, Transfrontier Thermal Pollution, OECD Doc. ENV/TFP/76.6 (1976).
affect the price of electricity in border areas. However, transportation of hot water for residential heating may be uneconomical over distances in excess of ten kilometers. While pollution prevention costs are presently incurred, most pollution costs are only potential liabilities. However, consistent with the modified standard of proof approach, a distinction between actual and potential costs makes no sense if the latter are exceedingly high.

Finally, alternatives to eliminating frontier locations include underground siting or considerably improved reactor safety systems for aboveground plants similar to those now used at urban sites. Both alternatives promise significant reductions in the transnational risks associated with border siting. Underground siting substantially improves overall safety in cases where severe accidents are involved. It may also constitute an economically viable alternative to surface siting. Even though some experts have recently suggested as much as 20-40 percent additional capital cost, underground siting might allow placing the power station close


234. The difference between thermal and electric output of a plant, the “waste heat,” which otherwise would be released into the environment, could be harnessed for heating water to be used for residential heating. For further details, see note 231 supra.

235. Marchetti, supra note 233, at 14. For the advantages, in this respect, of underground siting in the frontier zone, see text accompanying notes 238-239 infra.

236. There are, of course, costs arising from psychological impact on the neighboring state’s population and from the necessity of emergency planning by the authorities of the risk-exposed state, etc. For the international legal relevance of the psychological transfrontier effects, see Handl, supra note 19, at 75. See also note 142 supra.

237. See the discussion of the proposed BASF plant in note 229 supra. For further technical details on the BASF design, see Birkhofer, supra note 230.

238. Crowley, Doan & McCreath, Underground Nuclear Power Plant Siting: A Technical and Safety Assessment, 15 NUCLEAR SAFETY 519, 532 (1974); Karpenko & Walter, Underground Siting of Nuclear Power Reactors, in SITING OF NUCLEAR FACILITIES, supra note 206, at 581, 591. The latter authors’ conclusion relates to an underground site in an excavated pit, with the reactor covered by backfill materials upon completion of plant construction. For a reaffirmation of the extra level of safety provided by underground siting in accidents beyond the design basis, see comments by Crowley, Doan and McCreath to critical observations by J.C. Buclin, in 16 NUCLEAR SAFETY 434, 435 (1975). See further APS, supra note 204, at S43. See most recently J.A. Allensworth, et al., Sandia Laboratories, Underground Siting of Nuclear Power Plants: Potential Benefits and Penalties, SAND76-0412, NUREG-0255, at 12 (1977).

239. "Although it is intuitive that an underground plant would be more expensive to build than a surface one, there are nevertheless many important factors that could offset the extra cost of rock excavation . . . It is apparent from this study that the underground concept is a viable alternative to surface siting.” Crowley, Doan & McCreath, supra note 238, at 532. See also Karpenko & Walter, supra note 238, at 592.

240. J.A. Allensworth, et al., supra note 238, at 16. In contrast, Crowley, Doan and McCreath conclude that “most European and United States feasibility studies estimate an
enough to population centers for the benefits of district heating to compensate for the extra capital cost in the long run.\textsuperscript{241}

Thus, various economically viable strategies exist for the reduction of transnational radioactive pollution risk from border area nuclear power plants. Adoption of any one of them would be consistent with the basic policy of maximizing competing utilizations of the internationally shared environment by members of the international community. The choice of such a strategy would also reflect due recognition of the political factor of the international boundary, the fact that beyond that line the risk exposure is both involuntary and uncompensated for by the benefits linked to the risk incurrence. Finally, it is a choice that the nuclear risk-creating state is committed to make under international law.

V
CONCLUSION AND OUTLOOK

Although the few pertinent international arbitral and judicial decisions do not provide a basis for unambiguous inferences, state practice, analogous national legal decisions, and international legal literature represent fairly consistent pieces of evidence pointing to the following conclusions:

(1) Assuming that no special authorizing circumstances prevail,\textsuperscript{242} conduct of an activity in frontier areas is incompatible with established principles of international law if: (a) the activity concerned involves a major risk of transnational harm; (b) this risk is a function, at least to a significant degree, of the location in which the activity takes place; and (c) the activity in that frontier location amounts to an inefficient use between the risk-creating and risk-exposed states of the internationally shared natural resources concerned,\textsuperscript{243} provided the risk is not already of such an obvious nature or magnitude as to render the activity incompatible \textit{per se} with fundamental principles of the sovereign equality and independence of states.

(2) The parameters of “major risk” are determined through the use of a modified standard of proof: if “risk” is defined as the probability of occurrence of a harmful event multiplied by the consequences of the event, the required showing of probability is inversely proportional to the showing of potentially harmful consequences. In other words, the greater the harm threatened, the smaller is the required probability of occurrence in order to make transnational risk creation a matter of lawful international concern.

\textsuperscript{241} In the case of a 1000 Mw(e) nuclear plant, the increase in direct cost is between 5 and 10 percent. Crowley, Doan & McCree, \textit{ supra} note 238, at 531.

\textsuperscript{242} \textit{ Siting of Nuclear Facilities, supra} note 206, at 595. As to the “incidental” benefit of mitigating the thermal pollution problem, see notes 231-232 \textit{ supra}.

\textsuperscript{243} See text accompanying notes 21-22 \textit{ supra}.

\textit{E.g.}, air and water as transnational pollution-transfer media.
(3) For the purpose of assessing the legal relationship between risk-creating and risk-exposed states, any distinction between actual and potential transnational harm that limits the operation of international law to the former, is accordingly unwarranted, where the hazardous activity concerned involves a risk of transnational harm which is severe in the sense of posing a substantial threat to the lives and health of persons or of large-scale or long-term transnational environmental degradation.

The finding under the above principle of inverse proportionality that the conduct of an activity may be unlawful even though the transnational harm has a very low probability is of major importance. It highlights the relativity of a state's right to engage in hazardous activities in its border areas. The relative nature of a right to risk creation along national borders may further be subject to a review concerning its compatibility with the overriding principle of the maximization of the aggregate benefit to be derived from the use of the internationally shared natural resource. Since risk assessment is essential to the determination of the lawfulness of the activity, states are under an international duty to submit any on-going or planned hazardous activity in their border areas to review by the risk-exposed states if the risk involved is recognizably major in terms of the threatened transnational consequences even if the realization of those consequences is only a remote possibility.

This requirement seems a fundamental tenet of present-day international environmental law. Specific instances of international practice are sufficiently numerous and consistent to confirm the existence of a general duty of information and consultation on the part of states whose planned activities are likely to entail transnationally harmful effects, a duty inferable from the principle of good neighborliness. As such, it extends comfortably to


planned activities which carry a risk of merely remote probability, provided the consequences associated therewith are major or their nature or extent is at least a matter of controversy between risk-creating and risk-exposed states.\textsuperscript{246}

Risk-exposed states are, however, entitled to more than mere receipt of information and a hearing in the bilateral forum of interstate consultations. Given the interdependence among states, the principles of good neighborliness and international solidarity require certain substantive limitations on states' rights to transnational risk creation.\textsuperscript{247} Generally, this does not imply a right to veto a hazardous activity in the border area.\textsuperscript{248} Rather, these principles suggest that, given the nature of the threat, namely its uncertainty coupled with predictably severe consequences in case of its occurrence, the exposed state should be entitled to an equitable solution. Indeed, in the absence of an authoritative third-party determination and balancing of the interests at stake, mutually acceptable agreements regarding the conduct of risk-creating activities\textsuperscript{249} at issue among the potentially affected states should be the end product of existing procedures for resolving or anticipating conflicts over the use of internationally shared natural resources.\textsuperscript{250}

The difficulties that may be expected to arise in the substantive solution of conflicts have already been discussed elsewhere.\textsuperscript{251}

To the extent that the complex task of overall risk assessment and the

\textit{Law: A Survey of Capabilities, Trends and Limits}, in 1973 \textit{Hague Colloquium}, supra note 156, at 25, 68-69: "While remaining a general directive, [the principle's] operation becomes dependent upon those modalities which are developed in the vernacular of each international ecological system."

\textsuperscript{246} See Utton, \textit{International Water Quality Law}, 13 \textit{Nat. Resources} J. 282, 306 (1973). It is true, however, that the principle of notification and consultation (upon request) prior to engagement in an activity that carries a risk of significantly affecting the environment of another state or states did not find unqualified support at a recent UNEP meeting. Consideration of Draft Principle of Conduct in the Utilization of Shared Natural Resources, U. N. Doc. UNEP/IG.2/4, at 7 (1976).

\textsuperscript{247} See text accompanying note 127. supra. This was subsequently modified. See text accompanying note 128 supra. \textit{Cf.}, e.g., art. 1, para. 3, of the Resolution adopted by the Tenth Conference on the Inter-American Bar Association at Buenos Aires in 1957, in Rios y Lagos, Internacionales (Utilizacion para Fines Agricolas e Industriales) OEA/Documentos Oficiales, OEA Ser. I/VI, CIJ-75 Rev. 2, at 621 (1971).


\textsuperscript{249} See text accompanying note 128 supra.

\textsuperscript{250} This conclusion goes beyond Wildhaber's assessment of the parties' rights and duties in such a case. See Wildhaber, supra note 30, at 112-13. However, the view taken here seems borne out by decisions of the ICJ in factual situations analogous to the present one, in which the Court instructed the parties to find an equitable solution to the respective disputes. See North Sea Continental Shelf Cases, [1969] I.C.J. 3, at 48-55, paras. 87-101; Fisheries Jurisdiction Cases (United Kingdom of Great Britain and Northern Ireland v. Iceland), [1974] I.C.J. 3. The crucial common factor underlying these three cases is the applicability of a balancing-of-interests approach as a prerequisite for establishing the rights and duties of the respective parties.

\textsuperscript{251} Handl, supra note 89, at 187-92. As to the additional drawback of what Utton calls the "uncertainties of equitable utilization," see Utton, supra note 246, at 297-99.
contextual evaluation of the claims which bear on the risk-creating activity require third-party intervention, the problems inherent in the application of the preferred solution are obvious. States are notoriously reluctant to submit to external fora disputes over direct utilizations of transnational natural resources, such as international watercourses, which entail actual transnational effects.\textsuperscript{252} This must a fortiori be true for indirect utilizations which pose only a remote danger.

Be that as it may, by clarifying the fundamental legal relationship between risk-creating and risk-exposed states, the findings of this Article cast light on the respective initial bargaining positions in bilateral negotiations, the most likely forum for the settlement of a conflict over the conduct of an abnormally dangerous activity in frontier areas.

By indicating the availability of alternative strategies for a dispute settlement, including avoidance of the frontier site, or \textit{in situ} reductions of the risk potential, the above approach to the question of legality should allow an accommodation of conflicting interests which ought to be satisfactory to both sides.

Finally, the management endeavors with respect to the international environment should evolve toward anticipation of international conflicts over resource utilization at the earliest possible stage. If national land use plans, particularly with regard to border areas, are internationalized only after they have been drafted and accepted by the risk-creating state, a \textit{fait accompli} is forced upon the notified neighboring and affected states. Joint regional planning commissions are necessary to develop blueprints for long-term management, before national plans become firm. Fortunately, development in this direction is encouraging.\textsuperscript{253} Such a policy makes economic sense as it reduces costs to the parties when a possible dispute is resolved by joint planning \textit{ab initio} rather than by cancellation or redesign of mature national projects. Joint planning, moreover, would tend to yield substantial environmental benefits through early and more thorough identification and elimination of potential hazards to the internationally shared environment.

\textsuperscript{252} \textit{But see} arts. 17, 21, 22 and 87 of the Treaty of La Plata River and its Maritime Limits, Nov. 19, 1973, Argentina—Uruguay, \textit{reprinted in} 13 INT'\textsc{L} LEGAL MATERIALS 251 (1974). They provide for the submission to the ICJ of disputes over projected waterworks.