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Toxic Substance Contamination: The Risk-Benefit Approach to Causation Analysis

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TOXIC SUBSTANCE CONTAMINATION: THE RISK-BENEFIT APPROACH TO CAUSATION ANALYSIS

The dangers posed by chemical wastes have been slowly seeping into the public and political consciousness over the past decade.[1] The health effects of chemical waste contamination are beginning to surface, and incidents such as the Love Canal disaster in Niagra Falls, New York, are receiving widespread attention.[2] In some toxic waste situations, the causal link between contamination of the environment and injury to health is relatively clear.[3] In cases involving areas of scientific controversy and uncertainty, however, plaintiffs may be unable to prove causation, an essential element of any action to recover damages.[4] Scientific uncertainty, consequently, may often preclude these victims of toxic waste contamination from obtaining relief under existing law.

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[1] The scope of the problem is indicated by a recent estimate by the Environmental Protection Agency (EPA) that 32,254 sites may exist which contain potentially dangerous amounts of hazardous wastes. The EPA states that 638 of these sites may contain quantities of hazardous wastes which could cause imminent hazards to public health. [1978] 9 ENVIR. REP. (BNA) 1342. The Second Annual Resource Conservation and Recovery Act (RCRA) Report says that the most significant effect of disposal of hazardous wastes is the contamination of groundwater, with over half of the disposal facilities projected to be leaking contaminants into the groundwater. [1979] 9 ENVIR. REP. (BNA) 2303. *See also* Koch, *Cleaning Up Chemical Dumps Posing Dilemma for Congress*, CONG. Q., March 22, 1980, at 795; and [1980] 11 ENVIR. REP. (BNA) 709.

[2] *See generally* M. BROWN, LAYING WASTE: THE POISONING OF AMERICA BY TOXIC CHEMICALS (1979). Medical experts believe the Love Canal contamination to have caused higher incidences of cancer, miscarriages, birth defects, respiratory and pulmonary diseases, heart problems, and nervous disorders in residents of the area. *See also* American Trial Lawyers Association (ATLA), TOXIC TORTS (1972).

[3] For example, the Love Canal situation presents no questions as to the source of the contaminants, or whether they affect health. *See, e.g.* M. BROWN, *supra* note 2, at 5, 18-20, 23, 25, 44-45.

[4] For an overview of how scientific uncertainties may affect the drawing of causal relationships, *see* Gelpe & Tarlock, *The Uses of Scientific Information in Environmental Decisionmaking*, 48 S. CAL. L. REV. 371, 404-407 (1974). *See generally* H. HART & A. HONORE, CAUSATION IN THE LAW (1959); W. PROSSER, HANDBOOK OF THE LAW OF TORTS §§ 41-45 (4th ed. 1971); A. BECHT & F. MILLER, THE TEST OF FACTUAL CAUSATION IN NEGLIGENCE AND STRICT LIABILITY CASES (1961).

A tragedy involving residents living near Hemlock, Michigan, presents a current illustration of this dilemma.[5] Hemlock area residents allege that reinjection wells used for disposal of by-products of chemical manufacture have caused contamination of their well-water.[6] The people in the area have suffered considerable health effects, including miscarriages, tumors, and nervous system disorders.[7] State authorities have concluded, however, that insufficient evidence exists to establish a causal link between the complaints and private well water,[8] notwithstanding official statements that the high incidence of health disorders in the Hemlock area is hard to explain.[9] The Hemlock victims face virtually insurmountable barriers to relief, due to problems in proving the existence of toxic substances in their well water,[10] in determining the movement of groundwaters,[11] and the need for extensive and possibly unobtainable medical studies.[12]

This article argues that the dilemma described above requires change and proposes a new standard for causation in this type of toxic contamination case. Part I examines the difficulties posed by conventional common law relief mechanisms, and the inade-

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[5] *See generally* M. BROWN, *supra* note 2, at 185-203.

[6] Reinjection wells are used for subsurface disposal of industrial wastes. The United States Geological Survey finds reinjection wells acceptable, but some states have banned their use. State geologists investigating the Hemlock situation considered it unlikely that the wastes could migrate upward to taint drinking wells. However, it is not clear whether old oil wells in the area were properly capped, raising the possibility that the wastes had risen up through them to the surface. *See* M. BROWN, *supra* note 2, at 194-97. *See also* Tripp and Jaffe, *Preventing Groundwater Pollution: Towards a Coordinated Strategy to Protect Critical Recharge Zones*, 3 HARV. ENVT'L L. REV. 1, 6 n. 38 (1979).

[7] *See* M. BROWN, *supra* note 2, at 187-90.

[8] *Id.* at 95, 97, 100. A study by the Michigan Department of Health has found insufficient evidence "to establish a link betweeen the complaints and private well water." Chemicals and Health Center, Michigan Department of Public Health, The Hemlock Area Study 14 (March, 1979) [hereinafter Hemlock Area Study].

[9] The extent of the health problems, when compared to a control area, have prompted the state health director to conclude that the differences are difficult to explain. *See* M. BROWN, *supra* note 2, at 188.

[10] A sampling of wells in the Hemlock area by the Michigan Department of Natural Resources (DNR) has not found evidence of organic chemical contaminants. GROUNDWATER COMPLIANCE AND SPECIAL STUDIES SECTION, WATER QUALITY DIVISION, MICHIGAN DEPARTMENT OF NATURAL RESOURCES, INVESTIGATION OF GROUNDWATER QUALITY IN THE HEMLOCK AREA OF SAGINAW COUNTY 1 (April, 1979). Tests by an independent laboratory, however, found low amounts of chemicals theoretically capable of causing many of the reported ailments. *See* M. BROWN, *supra* note 2, at 191-92.

[11] *See generally* D. TODD, GROUNDWATER HYDROLOGY 44-77 (1959). *See also* M. BROWN, *supra* note 2, at 194-97.

[12] Determining which substances caused which health effects would require in-depth scientific studies which may take a number of years to perform. *See, e.g.*, E. BAKER, P. LANDRIGAN AND J. HARRINGTON, PERSPECTIVES ON ENVIRONMENTAL HEALTH: VIGNETTES FROM RECENT EPIDEMIOLOGICAL INVESTIGATIONS (1977), *reprinted in* ATLA, *supra* note 2, at 127-39.

quacies of existing statutory relief mechanisms. Part II scrutinizes a more lenient burden of proof standard, the risk-benefit approach, which some courts have applied when faced with situations involving scientific uncertainties. The risk-benefit approach will be applied to causation analysis in the context of damage recoveries, using the Hemlock, Michigan, situation as a case study. Part III discusses present congressional proposals, and compares the economic efficiencies of such legislative action with those of a judicially implemented relaxation of causation requirements. This article concludes that relaxation of causation requirements through the adoption of the risk-benefit approach is a response the judicial system can and should make in cases involving scientific uncertainty.

I. REMEDIES CURRENTLY AVAILABLE

A. The Inadequacies of Common Law Relief

Traditional elements of tort law causes of action place a number of obstacles in the path of plaintiffs in any chemical contamination case.[13] The most formidable requirement in cases involving scientific uncertainty is the proof of causation. Proving a legally cognizable link between the defendant's conduct and the plaintiff's harm is traditionally required to establish that the defendant's activities constitute negligence, nuisance, or that the defendant be held strictly liable.[14] Proof of causation, however,

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[13] The persistent backlog of cases on court dockets, for example, can be a potent weapon for the defense. A long wait for relief can be especially difficult for victims with very limited financial means. Second, the trial itself can be long and costly. Finally, discovery proceedings such as intensive physical examinations may also become burdensome to plaintiffs. *See* Sibbach v. Wilson & Co., 312 U.S. 1, *modified*, 312 U.S. 655 (1940); Cardinal v. University of Rochester, 187 Misc. 519, 63 N.Y.S.2d 868 (1946). *See also* J. O'CONNELL, ENDING INSULT TO INJURY: NO-FAULT INSURANCE FOR PRODUCTS AND SERVICES (1975).

[14] Causation is an essential element of a cause of action based on negligence. *See* PROSSER, *supra* note 4, § 41; *and* RESTATEMENT (SECOND) OF TORTS §§ 281, 431 (1965). Courts will deny relief if the causation element is not adequately proven. *See, e.g.*, Sheptur v. Procter & Gamble Distrib. Co., 261 F.2d 221 (6th Cir. 1958) (plaintiff failed to show sufficient evidence that defendant's dish detergent caused her dermatitis); Heck v. Beryllium Corp., 424 Pa. 140, 226 A.2d 87 (1966) (new trial granted because evidence did not show to what extent certain portions of defendant's emissions could have been harmful). The causation requirement also applies to causes of action based on a nuisance theory. *See* RESTATEMENT (SECOND) OF TORTS §§ 822, 431 (1979). *See, e.g.*, Joldersma v. Muskegon, 286 Mich. 520, 282 N.W. 229 (1938) (plaintiff did not meet burden of proof by showing that defendant permitted salt water to seep into the ground and that salt appeared at a distance several feet to the south). *But see* Watson v. Great Lakes Pipeline

like proof of any essential element of the plaintiff's case, must rise to or exceed the "preponderance of the evidence" standard.[15] Clearly, in a situation involving unavailability of information due to scientific uncertainty, it may be impossible to meet the burden of proof usually imposed. Plaintiffs are thus foreclosed from relief simply because science has not sufficiently advanced to enable them to prove an essential element of their case.

Unavailability of scientific information in situations such as groundwater contamination by toxic substances can occur in two ways. First, the information may be unobtainable by *any* means given the state of current science and technology, and thus be "unknowable" in some sense. Second, the information may be theoretically "knowable," but only if a massive commitment of resources is made to acquire it (*e.g.*, enormous expenditures of funds, manpower, and/or time).[16] The result of either type of unavailability is the same in practice: plaintiffs are unable to meet what is essentially an unprovable burden of proof.[17]

Tort law does provide for one doctrine which allows relief in some situations marked by the absence of a clearly proven causal link: *res ipsa loquitur*. For application of *res ipsa loqui-*

Co., 85 S.D. 310, 182 N.W.2d 314 (1979) (the court considered such circumstantial evidence as defendant's adjacent business being involved in handling and storing petroleum products sufficient to show causation of damages). The causation problems present in other tort remedies are also inherent in strict liability doctrine. *See, e.g.*, Shell Oil Co. v. Ainsworth, 247 So. 2d 815, 816-17 (Miss. 1971) (plaintiff's failure to identify substance that caused the harm, and to show that defendant was responsible for its presence was insufficient proof of causation); 35 Estates Inc. v. Central Park Garden Inc., 35 App. Div. 2d 915, 316 N.Y.S.2d 3 (1970) (imposition of strict liability does not dispense with need to prove causation).

[15] *See generally* E. CLEARY, MCCORMICK ON EVIDENCE § 338 (2d ed. 1972) [hereinafter cited as MCCORMICK ON EVIDENCE].

[16] The expenditures required to perform adequate scientific studies must be extremely high before the facts at issue are rendered "unknowable." The mere inability to spend the amount of money required to obtain evidence in normal evidentiary situations does not render the facts "unknowable." For example, to study what effect long term exposure to a new chemical substance would have on human reproductive potential, several years would be needed to gather the necessary data, along with extensive scientific testing. *See* note 12, *supra*. *See also* GELPE & TARLOCK, *supra* note 4, at 393-94.

[17] A third possibility is that the information is unavailable to the plaintiff but available to the defendant. In this situation, traditional theories of reallocation of the burden of proof may be available to place the burden on the defendant. Such reallocation theories require generally that when certain facts in question are more readily accessible to one party, that party has the burden of proving those facts. MCCORMICK ON EVIDENCE § 337. A notion that courts sometimes find to be significant in determining the proper allocation of the burden of proof, however, is the judicial estimate of probabilities of the situation. The risk of failure of proof may thereby be placed upon the party which alleges the more unusual event. *Id.* at 787. Thus, a plaintiff alleging the more unlikely factual situation may still carry the burden of proof. *Id.* § 339.

tur, the event must be a kind which ordinarily does not occur in the absence of negligence, must be caused by an instrumentality within the exclusive control of the defendant, and must not result from any voluntary action by the plaintiff.[18]

An illustrative case in the toxic contamination context is *Reynolds Metal Co. v. Yturbide*,[19] where the doctrine of *res ipsa loquitur* was applied to the escape of noxious gases from an aluminum reduction plant. The *Reynolds* court acknowledged an absence of proof as to what amounts of the noxious gases actually passed over the plaintiff's land.[20] The court nonetheless concluded that the quantities of fluorides known to be present on plaintiff's property would not have been emitted into the air, and would not have settled on plaintiff's property in the absence of defendant's negligence. By imposing *res ipsa loquitur* the court assessed liability without requiring the plaintiff to meet the usual standard of proof of cause-in-fact, and allowed damage relief.

However, application of *res ipsa loquitur* in a groundwater pollution situation such as Hemlock, Michigan, would be more difficult. First, the groundwater situation requires drawing a more tenuous causal link that the defendant was the source of the pollutant, because movements of substances through groundwaters are harder to trace than the movement of substances through the air.[21] Second, a difficult proof problem may arise in establishing that the charged defendant was the only possible source of the groundwater contaminants. This was not a problem in *Reynolds* because the defendant's plant was the only possible source of flouride contaminants in the area.[22] Groundwaters, however, may travel large distances, raising the possibility that the contaminants came from a source further away. Third, the accident could have occurred without *anyone* being involved. Some toxic substances occur in groundwaters naturally (albeit rarely), a possibility which might make a court reluctant to invoke *res ipsa loquitur*.

Consequently, because the only tort doctrine designed to handle uncertain cause-in-fact situations is likely to be unusable, scientific uncertainty may make it impossible to meet the traditional burden of proof. People suffering the often serious conse-

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[18] *See* W. PROSSER, *supra* note 4, § 39.

[19] 258 F.2d 321 (9th Cir. 1958), *cert. denied*, 358 U.S. 840 (1958).

[20] *Id.* at 326.

[21] Tracing groundwater movement involves technical and difficult scientific analyses. *See* note 11 *supra*.

[22] 258 F.2d 321 (9th Cir. 1958).

quences of groundwater pollution must therefore search elsewhere for adequate compensation schemes.

B. Existing Statutory Schemes

Hazardous substances have been enacted in a piecemeal fashion. Provisions of several statutes, however, are potentially available to plaintiffs faced with toxic waste groundwater pollution. The most noteworthy are the "imminent hazard" provisions contained in several federal statutes,[23] which generally apply when a pollution source presents "an imminent and substantial endangerment to the health of persons."[24]

The most promising statutes for victims of groundwater pollution are the Clean Water Act (CWA),[25] Safe Drinking Water Act (SDWA),[26] and Resource Conservation and Recovery Act (RCRA).[27] A close examination of the relevant language, however, calls into question the applicability of these provisions to the Hemlock-type situation. For example, the Clean Water Act gives the Administrator of the EPA the power to set effluent standards pertaining to toxic substances.[28] However, the courts have been reluctant to apply the CWA to groundwater pollution.[29] The Safe Drinking Water Act protects public drinking water supplies from contaminants which are dangerous to health, and is a promising source of relief. The SDWA applies, however, to public water supplies and not to private wells.[30]

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[23] *See, e.g.,* Resource Conservation and Recovery Act, 42 U.S.C. § 6973 (Supp. II 1976); Clean Water Act, 33 U.S.C. § 1321(e) (1976); Clean Water Act, 33 U.S.C. § 1364(a) (1976); Clean Air Act, 42 U.S.C. § 7603(a) (Supp. II 1976); Safe Drinking Water Act, 42 U.S.C. § 300(i) (1976); Toxic Substances Control Act, 15 U.S.C.A. § 2606 (Supp. 1979); Marine Protection, Research, and Sanctuaries Act, 33 U.S.C. § 1415(d) (1976); Consumer Product Safety Act, 15 U.S.C. § 2601 (1976); Hazardous Materials Transportation Act, 49 U.S.C. § 1810(b) (1976); Occupational Safety and Health Act, 29 U.S.C. § 662 (1976); Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S.C. § 136d(c) (1976); Deepwater Ports Act, 33 U.S.C. § 1511(b) (1976); Food, Drug, and Cosmetic Act, 21 U.S.C. § 355(e) (1976). *See generally* Tripp and Jaffe, *supra* note 6.

[24] Clean Water Act, 33 U.S.C. § 1364(a) (1976).

[25] 33 U.S.C. § 1251-§ 1376 (1976).

[26] 42 U.S.C. §§ 300f-300j (1976 & Supp. II 1978).

[27] 42 U.S.C. §§ 6901-6987 (1976 & Supp. II 1978).

[28] 33 U.S.C. § 1317 (1976 & Supp. II 1978).

[29] The dispute over the applicability of the Clean Water Act concerns whether "navigable waters" includes groundwater. Two courts have denied EPA jurisdiction over well injection of waste: Exxon Corp. v. Train, 554 F.2d 1310 (5th Cir. 1977); United States v. GAF Corp., 389 F. Supp. 1379 (S.D. Tex. 1975). *See generally* Tripp & Jaffe, *supra* note 6, at 10-14.

[30] A "public water system" must have at least fifteen service connections or serve at least twenty-five people. 42 U.S.C. § 300f(4) (1976).

A further problem inherent in the present statutory maze is that only injunctive relief is explicitly made available. Most of the imminent hazard provisions limit available relief to immediate injunctions.[31] One possible exception may be provided by those imminent hazard provisions which state that the Administrator of the EPA may bring suit to immediately restrain disposal or take other such action as may be necessary.[32] However, the meaning of the phrase, "take other such action as may be necessary", is unclear. No answer has developed as to whether the Administrator may bring suit to collect damages for the victims of an "imminent hazard," or whether he is restricted to seeking only injunctive relief.

"Citizen suit" mechanisms found in many statutes containing imminent hazard provisions[33] present another set of obstacles to the toxic waste victim seeking statutory relief. When the government fails to take action, private citizens may bring suit under these provisions.[34] Although jurisdictional and standing requirements have been substantially relaxed for citizen suits,[35] a number of procedural barriers still remain. For example, most imminent hazard provisions contain notice requirements,[36] and litigation costs may be awarded to any party.[37] The spectre of

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[31] *See, e.g.*, Toxic Substance Control Act, 15 U.S.C.A. § 2606 (Supp. 1979).

[32] *See, e.g.*, Clean Water Act's imminent hazard provision, 33 U.S.C. § 1364 (Supp. II 1978); or the Resource Conservation and Recovery Act, 42 U.S.C. § 6973 (Supp. II 1978).

[33] *See, e.g.*, Clean Water Act, 33 U.S.C. § 1365 (1976); Toxic Substances Control Act, 15 U.S.C. § 2619 (Supp. 1979); Safe Drinking Water Act, 42 U.S.C. § 300j-8 (1976 & Supp. II 1978); Clean Air Act, 42 U.S.C. § 1857h-2 (1977) (current version at 42 U.S.C. § 7604 Supp. II 1978); Resource Conservation and Recovery Act, 42 U.S.C. § 6972 (Supp. II 1978).

[34] For example, read along with RCRA's citizen suit provision, *Id.* § 6972, the "other action as may be necessary" language raises the question whether a citizen, in the absence of any action by the Administrator, may independantly bring suit for damages even though such a cause of action is not explicitly granted within the RCRA.

[35] Jurisdictional requirements have been relaxed by allowing "any citizen" to bring such a suit, without regard to diversity of citizenship or jurisdictional amounts. *See, e.g.*, Clean Water Act, 33 U.S.C. § 1365 (1976). Also, the normal "injury in fact" requirements for standing have been read to have been eliminated. *See, e.g.*, Metropolitan Washington Coalitition for Clean Air v. District of Columbia, 511 F.2d 809, 814 n.26 (D.C. Cir. 1975). *See generally* W. RODGERS, HANDBOOK ON ENVIRONMENTAL LAW § 1.13 (1977).

[36] Most citizen suit provisions forbid commencement of an action "prior to sixty days after the plaintiff has been given notice of the alleged violation (i) to the Administrator, (ii) to the State in which the violation occurs, and (iii) to any alleged violator of the standard, limitation, or order. . . ." Clean Air Act, 33 U.S.C. § 1365(b)(1)(A) (1976). The courts have interpreted such language not to impose strict procedural requirements, but to allow flexible and realistic requirements to be placed on citizens. *See, e.g.*, Friends of the Earth v. Carey, 535 F.2d 165, 175 (2d Cir. 1976). *But cf.* Massachusetts v. U.S. Veterans Administration, 541 F.2d 119, 121 (1st Cir. 1976). *See generally* W. RODGERS, *supra* note 35, § 1.13.

[37] *See, e.g.*, Clean Water Act, 33 U.S.C. § 1365(d) (1976), giving the courts the power

liability for the opposing counsel's litigation costs may chill plaintiffs from pursuing even meritorious claims. The citizen suit option may well be foreclosed because of these procedural demands. If the government fails to bring suit, victims of toxic substance poisoning could be left without a procedural avenue for seeking the relief provided by the remedial sections of the statutes.[38]

Another potential source of statutory relief for groundwater pollution victims are statutes imposing strict liability for activities dealing with particular subjects.[39] Some states have enacted statutes invoking strict liability for damage caused by oil pollution,[40] and Congress has passed strict liability provisions for injuries inflicted by certain pesticides.[41] Congress has also provided compensation for nuclear catastrophes on a strict liability basis.[42] All of these statutory schemes, however, still require the plaintiff to prove causation with complete certainty.[43] Seriously injured parties may still remain uncompensated if scientific uncertainty undermines the causation element of their case.

II. THE RISK-BENEFIT APPROACH TO CAUSATION ANALYSIS

A. Reserve Mining *and the Risk-Benefit Approach*

One response to scientific uncertainty on causation questions in environmental lawsuits has been termed the "risk-benefit" approach.[44] This approach was applied in the landmark case *Reserve Mining Co. v. Environmental Protection Agency*[45] in

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to award litigation costs to any party.

[38] This would be particularly true in those instances when the government agency given enforcement powers under the applicable statute, is unresponsive for political or other reasons, or, due to its limited resources, is simply unable to respond.

[39] *See generally* Note, *The Rylands v. Fletcher Doctrine in America: Abnormally Dangerous, Ultra-Hazardous, or Absolute Nuisance?*, 1978 ARIZ. ST. L.J. 99 (1978).

[40] *See, e.g.*, Alaska Stat. § 46.03.822-.824 (1977); Fla. Stat. Ann. § 1376.12 (1975); Me. Rev. Stat. Tit. 38, §§ 541, 552 (1964 & Supp. 1980); Md. Nat. Res. Code Ann. § 8-1409 (1974).

[41] *See, e.g.*, 7 U.S.C. § 1444a(d) (1976).

[42] *See, e.g.*, Price-Anderson Act, 42 U.S.C. § 2210 (1976).

[43] *See, e.g.*, Wheatland Irrig. Distrib. v. McGuire, 537 P.2d 1128, 1133 (Wyo. 1975); Me. Rev. Stat. Tit. 38 §§ 541, 552 (1964 & Supp. 1980); Md. Nat. Res. Code Ann. § 8-1409 (1974).

[44] *See generally* Gelpe & Tarlock, *The Uses of Scientific Information in Environmental Decisionmaking*, 48 S. CAL. L. REV. 371 (1974).

[45] 514 F.2d 492 (8th Cir. 1975). *See generally* R. BARTLETT, THE RESERVE MINING CONTROVERSY (1980); Note, *Reserve Mining—The Standard of Proof Required to Enjoin an*

the context of injunctive relief. In *Reserve Mining,* asbestos fibers were discharged from defendant's processing plant into Lake Superior, which supplies drinking water for local communities. The plant also discharged asbestos fibers into the air. Injunctive relief hinged on the applicability of the imminent hazard provision of the Federal Water Pollution Control Act (FWPCA),[46] but scientific evidence was inconclusive on the key question as to whether the asbestos fibers would cause increased rates of cancer among the people ingesting them.[47] The court directly addressed the problem of scientific uncertainty, discussing in detail the complex testimony presented at trial.[48] When proof with certainty is impossible, the court stated, "concepts of potential harm, whether they be assessed as 'probabilities and consequences' or 'risk and harm,' necessarily must apply. . . ."[49] The court then assessed the gravity of potential harm and the degree of certainty that the harm could occur,[50] weighing this against the benefits gained by allowing the allegedly harmful activity to occur.[51] After careful consideration of the benefits, economic and otherwise, provided by the company's presence in the area,[52] the court ordered injunctive relief.[53]

Reserve Mining, of course, cannot be read as a carte blanche endorsement of risk-benefit analysis for all damage litigation in toxic contamination situations. The risk-benefit analysis in *Reserve Mining* involved a statutory imminent hazard provision, not a common law action for damages.[54] Secondly, attention in

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Environmental Hazard to Health, 59 MINN. L. REV. 893 (1975).

[46] 33 U.S.C. § 1160 (1970), *amended* Pub. L. No. 92-500, § 2, 86 Stat. 816 (1972) (now 33 U.S.C. § 1354). The case was tried under the statute as it existed before the 1972 amendments.

[47] 514 F.2d 492, 538 (8th Cir. 1975). *See also* R. BARTLETT, *supra* note 45, at 154-57. The Eighth Circuit Court of Appeals concluded that the two types of discharges posed different degrees of potential harm. Reserve was allowed to continue for a reasonable time its disposal of taconite tailings in Lake Superior—until an on-land disposal system could be implemented. However, the Court ordered Reserve to take reasonable immediate steps to reduce the air emissions. *Id.* at 500.

[48] *Id.* at 506-20.

[49] *Id.* at 520.

[50] *Id.* at 535-37.

[51] *Id.*

[52] The court noted that Reserve employed over 3,000 people in the area and had a payroll of approximately $31,000,000 per year.

[53] *Id.* at 537-40.

[54] The applicability of risk-benefit analysis to a common law public nuisance action was left unanswered, because no evidence of an interstate hazard was found. *Id.* at 520-21. The court did find that Reserve's air emissions were in violation of various provisions of Minnesota's pollution control laws, and could therefore be enjoined as a public nuisance. *Id.* at 522-27. The court stated, however: "In light of this statute, [providing that violations of statutory air pollution standards constitute a public nuisance] we deem it

Reserve Mining focused on injunctive rather than compensatory relief, involving consideration of factors traditionally associated with precautionary relief.[55] The underlying rationale of *Reserve Mining*, however, does have application beyond the procedural context addressed explicitly in the decision. At the very least, the success of the court in handling detailed information in an area of scientific controversy rebuts the argument that such analyses cannot be required of or performed adequately by courts. More fundamentally, the *Reserve Mining* decision also points out a possible direction for courts to pursue in other areas involving scientific uncertainty, especially the damage-award context.

B. Applying the Risk-Benefit Approach to Compensatory Rather than Injunctive Relief

As discussed in Part I above, common law doctrines are essentially unavailable to plaintiffs who are unable to show a cause-in-fact relationship between injury and the defendant's activity. The present statutory framework seems similarly unlikely to provide relief. This results in the anomalous situation that courts may order relief when a toxic waste hazard is "imminent," but refuse to do so when the hazard becomes actual. Citizens are thus protected from potential injury, while victims are left unprotected from actual effects.

This anomalous situation raises two competing equities. On one hand, the victim of the toxic substance contamination will be stranded without relief if the burden of proof of causation is not lowered, simply because necessary information is unobtainable. On the other hand, causation requirements ensure that the correct party is held responsible for a plaintiff's injuries. Relaxing this element of plaintiff's prima facie case raises the spectre

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unnecessary to discuss whether Reserve's air emissions could constitute a public nuisance independently of violations of the state's air pollution control regulations." *Id.* at 524.

[55] In the nuisance area, for example, courts will often weigh hardship to the defendant in deciding whether to grant an injunction. Thus courts may deny injunctive relief when the balance of equities is resolved in favor of the defendant even though a nuisance has been proven to exist. *See, e.g.*, Boomer v. Atlantic Cement Co., 26 N.Y.2d 219, 309 N.Y.S.2d 312, 257 N.E.2d 870 (1970). In terms of compensatory relief, however, the comparative hardship on the parties is usually immaterial in assessing damages. W. PROSSER, *supra* note 4, § 90. *See also* W. RODGERS, *supra* note 35, § 2.5. The relevance of balancing of equities in determining the existence of a nuisance, however, appears to be unsettled. *Cf.* RESTATEMENT (SECOND) OF TORTS §§ 822, 826 (1979) (the weighing of hardship *is* incorporated into the determination of a nuisance).

of holding a factually innocent defendant liable for damages.[56]

One way to address these competing questions would be to extend the use of risk-benefit analysis implemented in *Reserve Mining* to cases involving damage awards. Rather than requiring the plaintiff to meet the usual burden of proof or shifting it to the defendant once the plaintiff has proven a prima facie case,[57] a sliding scale approach could be implemented to determine the degree of certainty of cause-in-fact which the plaintiff must prove, on a case-by-case basis. The burden of proof, consequently, would not be a set standard or formulation such as "preponderance of the evidence," applicable to every case. Instead, the burden of proof on the causation issue would "float," varying according to the nature of the case.

In implementing a risk-benefit approach to causation analysis, a court would first make a threshold determination concerning the applicability of risk-benefit analysis to the case before it. In making this threshold determination, the court would examine the nature of the scientific controversy, evaluating the degree of uncertainty presented. Where the uncertainty is unresolvable and touches on essential areas of plaintiff's case, a strong case for lowering the burden on the causation issue would be made out, and risk-benefit analysis would be deemed appropriate.[58] The court would then proceed with a three-step analysis to assess the proper burden of proof. First, the seriousness of the plaintiffs' injury would be weighed. Second, the court would examine the benefits to the community of the defendant's activi-

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[56] These concerns could, in some situations, pose problems with due process implications. Burdens of proof, however, are fixed at the pleading stage in civil trials "not for constitutional reasons, but for reasons of probability, social policy and convenience." MCCORMICK ON EVIDENCE § 344. Although constitutional limits exist on the creation of *presumptions* in civil cases, the adjustment to burden of proof proposed here falls well within these bounds. *See, e.g.*, Western & Atlantic R.R. v. Henderson, 279 U.S. 639, 643 (1929) (statute creating an inference of negligence in railroad accident cases declared invalid, because the mere fact than an accident occurred furnished no basis for an inference of negligence).

[57] *See* note 15 and accompanying text *supra*. The shifting of the burden of proof to the defendant once the plaintiff has proven a prima facie case has been suggested as a more equitable approach to the proof problem in nuisance actions involving environmental degradation. It is argued that doing so would give nuisance actions modern vitality by incorporating new public policies mandating environmental protection. *See* Note, *The Burden of Proof in California Environmental Nuisance Cases*, 9 U. CALIF. D. L. REV. 679 (1976). Also, a number of state environmental protection acts have implemented such an approach. *E.g.*, the Michigan Environmental Protection Act, MICH. COMP. LAWS ANNOT. § 6901.1203 (1970).

[58] Some scientific controversies are narrowly focused, esoteric, and do not go to the heart of plaintiffs' causation analyses. Others, like the dispute in *Reserve Mining* (whether ingesting asbestos fibers causes gastrointestinal cancer), involve substantial scientific disagreement on questions essential to plaintiffs' cases.

ties, and the effects on those activities of imposing a damage award on the company. In the third and final step, the court would balance the result of the "injury" and "benefit" inquiries against the degree of uncertainty presented by the scientific information introduced into evidence. As the seriousness of the harms to plaintiffs increases, and the benefits of defendant's activity become less, the less certain need be proof of causation. On the basis of this balancing, the court would decide whether the evidence presented adequately shows a causal connection between defendant's actions and plaintiff's harms to enable plaintiff to meet the burden of proving causation.

The first step, examining the seriousness of the injuries to health, addresses a central concern of tort law: not to leave innocent victims of another's conduct uncompensated.[59] This concern magnifies with the seriousness of the injury, and should be considered by examining both the *type* of injuries and their *extent*. For example, a small number of plaintiffs with potentially terminal cancer would be considered as serious as a large number of victims suffering from reproductive system disorders.[60]

The second step, examining the benefits of defendant's activity, addresses the second competing equity, by requiring that as more societal benefits are sacrificed by imposing liability, the causal link should become more certain. Economic benefits —such as jobs and other contributions to the local economy—must therefore be considered. These economic benefits, however, should be considered only to the extent that they will be lost by imposition of liability.[61] In the injunction context, the spectre of closing a plant down requires considering the *total* benefits provided by the plant, because all benefits are indeed lost by a shutdown. A damage award, however, need not result in total loss of economic benefits; the costs of liability to a large company may in fact have no effect whatsoever on employment, and only a negligible effect on other benefits. Only that portion of economic benefit actually affected by the potential damage award would be considered.

The third "balancing" step injects, to a certain extent, policy determinations into the causation analysis. Such policy considerations are, however, manifest in courts' proximate cause deter-

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[59] W. PROSSER, *supra* note 4, § 1 at 6.

[60] The Love Canal situation is an example where both the type of harms and their extent are serious. *See* note 2 and accompanying text *supra*.

[61] This would primarily involve an assessment of the economic effects of damage relief, *i.e.*, whether the defendant's plant would be shut down, how many jobs would be lost, how much income to the community would be lost, etc.

minations generally. As Judge Edgerton has aptly noted in his classic work on causation,[62] the proximate cause decision involves "a balancing of conflicting interests, individual and social," aimed at determining whether legal cause is "justly attachable" cause.[63] In a sense, then, the causation analysis proposed here is simply an extension of proximate cause principles to the cause-in-fact determination under appropriate circumstances.[64]

Obviously, the appropriate balancing of these factors cannot be performed in the abstract. It may be helpful, then, to look at how risk-benefit causation analysis might be applied to the Hemlock, Michigan, situation. First, the court would examine the nature of the scientific uncertainty presented. Given the scientific and technical difficulties involved in mapping ground water,[65] and the controversy surrounding the link between the well-water contaminants and plaintiffs' injuries,[66] risk-benefit causation analysis would be clearly appropriate. The court would then examine the seriousness of plaintiffs' health injuries, *i.e.*, miscarriages, tumors, serious nervous system disorders.[67] These are clearly serious harms, and would support reduction of the burden on the causation issue. The court would next examine the economic benefits provided by Dow Chemical's presence in the area, and the impact that a damage claim would have on provision of those benefits. Because such a damage award, unless very high, would not seriously harm Dow's economic position, this factor would only slightly raise the burden of proving causation. Finally, the court would examine the evidence offered in proof of causation, and determine whether it showed a sufficient causal link in light of the above considerations.

Extending the *Reserve Mining* approach to situations involving compensatory rather than injunctive relief is warranted for a variety of reasons. For one, the competing interests in both contexts are similar. In both the *Reserve Mining* and Hemlock, Michigan, situations, for example, the health interests of residents are in conflict with the economic interests of the defendant and the community at large. In addition, the effects of granting relief are not so dissimilar as to justify different treat-

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[62] Edgerton, *Legal Cause* (pts. 1-2), 72 U. PA. L. REV. 211, 343 (1924).

[63] *Id.* at 211.

[64] For discussion of the role policy plays in proximate cause analysis, *see* W. PROSSER, *supra* note 4, § 42.

[65] *See* note 11 and accompanying text *supra*.

[66] *See* note 12 and accompanying text *supra*.

[67] *See* notes 4-10 and accompanying text *supra*.

ment. Indeed, an injunction, in practice, may be a *more* burdensome remedy than a damage award,[68] which would seem to call for a *higher* burden of proof for injunctions. More importantly, the rationale for a flexible standard of proof stems more from the scientific uncertainties involved—a characteristic shared by both the *Reserve Mining* and Hemlock situations—than from the nature of the remedy at issue. Continued disparity of causation treatment between toxic waste cases calling for injunctions, and toxic waste cases calling for damage awards, thus seems unjustified on many levels. Finally, the kind of burden-of-proof adaptation urged here is not unprecedented. Courts have historically altered burdens of proof to reflect changing conditions or values,[69] and the risk-benefit approach has been implemented in areas other than tort causation.[70]

A number of possible objections to risk-benefit analysis need to be addressed. The first is the concern, possibly reaching due process dimensions,[71] that innocent defendants may be held liable under this approach. It should be observed that the *Reserve Mining* situation involved a lone, isolated industrial facility.[72] If *anyone* is liable for toxic waste pollution in this kind of situation, it is most likely to be the defendants. Certainly, at some level of low probability, the chances that even a lone defendant was the factual cause of plaintiffs' injury is so low that it would be arbitrary, unfair, and perhaps unconstitutional to hold that

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[68] *See, e.g.*, Boomer v. Atlantic Cement Co., 26 N.Y.2d 219, 309 N.Y.S.2d 312, 257 N.E.2d 870 (1970) (Injunctive relief denied while damage relief imposed due to less serious effects of latter on economic benefits provided by defendant's activities).

[69] For example, our procedural laws, in their early development, tended to favor industrial and economic growth at the expense of other values. "The common law embodied a general preference for the initiator of economically productive action, by casting the burden of persuasion on an aggrieved person to show cause why law should intervene to shift a loss from where it fell as a consequence of the initiative taken." J. HURST, LAW AND ECONOMIC GROWTH 224 (1964). *See generally* Krier, *Environmental Litigation and the Burden of Proof*, in LAW AND THE ENVIRONMENT, 105 (M. Murdoch & J. Page, Jr. ed. 1970). A specific example is provided by workmen's compensation law. Early in the development of the law of injured employees the employee-plaintiff had to prove he was not injured by a co-worker. *See, e.g.*, Chicago City Ry. Co. v. Leach, 208 Ill. 198, 200-201, 70 N.E. 222, 223 (1904). The new attitude in burden of proof rules may allow the injured employee to reach a jury on a scintilla of evidence. *See, e.g.*, Note, *FELA, Negligence, and Jury Trials—Speculation Upon a Scintilla*, 11 W. RES. L. REV. 123 (1959).

[70] A number of court decisions have upheld the use of risk-benefit principles by agencies involved in promulgating regulations where the types of harm the agency is authorized to prevent are difficult to prove by ordinary judicial standards. *See, e.g.*, South Terminal Corp. v. EPA, 504 F.2d 646, 655 n. 6 (1st Cir. 1974); Industrial Union Dep't AFL-CIO v. Hodgson, 499 F.2d 467, 474 (D.C. Cir. 1974); *See also* Gelpe & Tarlock, *supra* note 4, at 417-19.

[71] *See* note 56 *supra*.

[72] *See* R. BARTLETT, *supra* note 45, at 3.

defendant liable.[73] This potential problem should be addressed during the courts' threshold determination of applicability of the analysis in light of the probabilities presented by the scientific uncertainties. Courts, of course, will also have to adjust the appropriate level of proof arrived at in the balancing of the third step to ensure that imposition of liability is not arbitrary. A more difficult problem arises when there is more than one potential source of the pollutant. In such a case, *i.e.*, if the plaintiffs lived in a large industrial city where any number of potential defendants could have emitted the toxic substances that caused the harm, then courts will have to adjust their notions of appropriate level of proof to reflect a concern that the proper defendant is held liable. Of course, if all possible firms are joined as defendants, the plaintiffs may be able to show to a sufficient degree that *all* defendants, considered together, caused the harm. At this point traditional joint and several liability analysis, or emerging theories of "enterprise liability," would apportion liability among the defendants.[74]

III. RISK-BENEFIT CAUSATION OR "SUPERFUND"?

Recent legislative efforts present an alternative to the judicial solution suggested above. Congress has recently considered reforms on two fronts. Recent legislation, often referred to as the "superfund," will create a government-controlled fund to provide monies for emergency clean-up of toxic substance pollution posing serious risks.[75] All producers and handlers of hazardous substances will be required to contribute to the fund. A second approach which failed to pass would have required that owners or operators of facilities disposing of hazardous substances be held strictly liable for damages caused by their activities, including costs of emergency clean-up, and damages for economic loss and personal injury.[76]

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[73] *See* note 56 *supra*. *See also* Newman, *The Process of Prescribing "Due Process,"* 49 CALIF. L. REV. 215, 221 (1961).

[74] *See, e.g.*, Oakwood Homeowners Assoc. v. Ford Motor Co., 77 Mich. App. 197, 258 N.W.2d 475 (1977). *See generally*, W. PROSSER, *supra* note 4, § 52.

[75] *See* Comprehensive Environmental Responses, Compensation, and Liability Act of 1980, Pub. L. No. 96-510, 94 Stat. 2767 (1980).

[76] Most importantly, one of the proposed bills, S. 1480, 96th Cong., 1st Sess. (1979), would have imposed a more relaxed causation requirement on the party seeking such relief. Under this bill's original language the injured party would satisfy the requisite burden of proof if he showed that there is a "reasonable likelihood that [the exposure] was sufficient to cause or significantly contribute to injury or disease . . . ." *Id.* §

Congress has therefore addressed only half of the problem. While providing funds for the clean-up of pollution, the legislation fails to provide compensation for injuries. Although adding an administrative compensation scheme[77] to the present superfund would certainly improve the current state of the law, relief through the judicial system would provide better compensation for individual victims, lead to a more economically efficient outcome, and more effectively stimulate implementation of safer waste disposal methods.

To the extent economic costs are more precisely assigned to those members of the industry that actually caused those costs economic efficiencies are increased.[78] Because tort liability is the most direct and accurate means of assigning damage costs to the responsible firm or firms, this method will lead to a more economically efficient outcome[79] than the loss-spreading mechanism of the superfund. Under one type of superfund compensation approach, where contribution is based on production volume,[80] an individual firm's contribution is not related to the societal costs attributable to the firm's particular disposal method.[81] Accordingly, if a firm maintains a disposal method more dangerous than the industry norm, it will be charged less than the actual cost its activities impose on society; a firm that utilizes a method of disposal *safer* than the industry norm may end up being

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4(c)(3)(A). In addition, the bill allowed statistical probabilities to be considered by the court in addressing the causation issue. *Id.* § 4(a). This proposed legislation therefore addressed many of those problems discussed above which are inherent in the present judicial "fault system" approach to groundwater pollution damage relief.

[77] *See, e.g.*, Soble, *A Proposal for the Administrative Compensation of Victims of Toxic Substance Pollution: A Model Act*, 14 HARV. J. LEGIS. 683 (1977).

[78] For a general overview of the economic perspective of tort liability *see* R. RABIN, PERSPECTIVES ON TORT LAW 139-210 (1976).

[79] Tort liability allows victims of toxic waste pollution to collect the costs of the damages they have suffered *directly* from the individual firm that has caused those costs. To the extent that a tort liability mechanism holds liable firms responsible for injuries caused by their toxic waste, the cost borne by disposers will approach total societal cost. Therefore, societal cost is absorbed largely by the responsible parties, a more efficient outcome.

[80] The important characteristic of one type of proposed superfund scheme (*see, e.g.*, S. 1480, 96th Cong., 1st Sess. (1979)) is that the cost placed on each individual firm will be based solely on the amount of product that firm creates.

[81] Thus, no direct correlation exists between the potential damages an individual firm's disposal methods may incur, and the actual cost that firm pays. In actual practice, the agency implementing a superfund which would pay for all the costs of damages imposed by the industry as a whole, would need to determine the amount of those costs. The amount of the fee placed on each firm per unit produced would be the total costs to society of toxic-waste-caused-damages divided by the number of units produced by the entire industry. The amount each firm pays would equal the number of units it produces times the charge per unit.

charged *higher* costs. The end result will often be an over- or under-assessment of costs to the individual disposer.

A second type of superfund compensation scheme would base contributions more directly upon the dangers posed by the individual firm's method of disposal,[82] and better handle this problem. The administrator of such a superfund, however, would have to determine the degree of danger and the resulting costs in advance and in the abstract. The accuracy of such a fund in assigning costs would hinge on how good the administrator's guesses proved to be.

Another important element of any method of pollution control is its ability to stimulate the search for and the use of safer disposal methods. Imposing tort liability provides a kind of deterrence which stimulates positive and constructive consideration of alternatives.[83] Because firms in the marketplace will minimize the costs of production, including, *e.g.*, damage liability, whenever possible, they will have an incentive to develop and use safer production methods. In contrast, paying a superfund charge results in elimination of individual firm liability. Therefore, virtually no incentive is provided to reduce costs of liability by use of safer methods. Indeed, the result may be to create the incentive to dispose of wastes in the *cheapest* manner possible, without regard to the dangers posed, or the subsequent costs to society. This effect is minimized by superfund contribution mechanisms geared to the perceived danger of the disposal method, but again, such a mechanism depends heavily on guesswork.

Finally, the transaction costs of an elaborate superfund compensation scheme far exceed those of the judicial solution presented here. The superfund scheme would require the creation of a bureaucracy to assess and collect charges, and to administer the distribution of compensation.[84] The judicial approach obviously avoids this by using the existing judicial system. To be sure, the risk-benefit approach would create additional costs within the judicial system, but the costs would be less than those from creation of an entirely new agency.

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[82] *See, e.g.*, S. 1046, 96th Cong., 1st Sess. (1979).

[83] Katz, *The Function of Tort Liability in Technology Assessment*, 38 U. CIN. L. REV. 587, 607 (1969).

[84] The Environmental Protection Agency has estimated that from 1,000 to 1,500 employees will be needed to administer the superfund program. *See, e.g.*, [1980] 11 ENVIR. REP. (BNA) 705.

CONCLUSION

Toxic waste pollution poses widespread problems with serious implications for human health. Scientific uncertainty, however, often enshrouds the facts needed to satisfy current judicial standards for proof of cause-in-fact, leaving the victims of toxic substance injury without relief in some instances. Since judicial standards of causation are clearly inadequate to deal with cases at the frontiers of scientific knowledge, change is needed.

A relaxed burden of proof, within carefully determined limitations, represents such a change. The risk-benefit approach would alleviate hardship in situations where relief is denied simply because essential information is unobtainable. Moreover, it provides a solution more economically efficient than the superfund. As control of environmental degradation becomes more costly, the adoption of the solution that allows the most efficient allocation of economic costs and resources becomes even more crucial.

This article has focused upon toxic chemical waste disposal and the possibility of associated groundwater pollution as a prime example which begs for judicial attention. Courts may discover other areas which demand similar consideration. The path is clear. Courts have the ability to institute these vital reforms, and it is to be hoped they will soon take the first steps towards a better view of causation.

—Bradford W. Kuster