only with the question of the father's eligibility and right to assert this claim.

[5] Finally, Klara and Abraham argue that the trial court erred in instructing the jury that it could return a verdict in favor of the defendant on the issue of plaintiffs' pain and suffering. Assuming arguendo that this was error, it is harmless; the jury did return an award of damages for pain and suffering for both Klara and Abraham.

V.

That portion of the judgment of the district court in favor of plaintiff Abraham Leizerowski against the appellees will be affirmed; the judgment in favor of the appellees against plaintiff Boruch Leizerowski will be reversed and a new trial granted in accordance with the foregoing. The judgment in favor of Klara will be vacated and a new trial granted as to damages only. Costs taxed against appellees.

RESERVE MINING COMPANY, a Minnesota Corporation, Petitioner,

v.

ENVIRONMENTAL PROTECTION AGENCY and William D. Ruckelshaus, Individually and as Administrator of the Environmental Protection Agency, Respondents.

RESERVE MINING COMPANY et al., Appellants,

v.

UNITED STATES of America et al., Appellees.

UNITED STATES of America, Appellant,

v.

RESERVE MINING COMPANY et al., Appellees.

RESERVE MINING COMPANY et al., Appellants,

v.

UNITED STATES of America et al., Appellees.

The STATE OF WISCONSIN, Appellant,

v.

RESERVE MINING COMPANY et al., Appellees.

MINNESOTA ENVIRONMENTAL LAW INSTITUTE, INC., et al., Appellants,

v.

UNITED STATES of America et al., Appellees.

The STATE OF MICHIGAN, Appellant,

v.

RESERVE MINING COMPANY et al., Appellees.

Nos. 73-1239, 74-1291, 74-1466, 74-1816, 74-1977, 75-1003 and 75-1005.

United States Court of Appeals, Eighth Circuit.

Submitted Dec. 9, 1974.

Decided March 14, 1975.

As Modified on Rehearing and Order on Remand April 8, 1975.

The United States and the State of Minnesota brought an action against taconite processing company to prevent the company from continuing the discharge of taconite tailings into the water of Lake Superior. The United States District Court for the District of Minnesota, 380 F.Supp. 11, Miles W. Lord, J., issued an injunction and appeals were taken. The Court of Appeals, en banc, Bright, Circuit Judge, held, inter alia, that it was established that the taconite company's discharges into the air and water of Lake Superior gave rise to potential threat to the public health which was of sufficient gravity to be legally cognizable and to call for an abatement order

on reasonable terms; that the discharges violated federal and state laws and state pollution control regulations, also justifying injunctive relief on equitable terms; that no harm to the public health had been shown to have occurred, that the danger to health was not imminent but that it did call for preventive and cautionary steps; that no reason existed which required that the company terminate its operations at once; that the company, with its parent companies, was entitled to reasonable opportunity and reasonable time period to convert its Minnesota taconite operations to on-land disposal of taconite "tailings" and to restrict air emissions at its plant, or to close its existing taconite-pelletizing operations; that the evidence suggested that the threat to public health from the air emissions was more significant than that from water discharge and that consequently the company must take reasonable immediate steps to reduce its air emissions.

Modified in part and remanded with directions.

1. Federal Civil Procedure ⇐2285

Where a number of disputes in environmental case involve conflicting theories and experimental results, about which it would be judicially presumptive to offer conclusive findings, the finder of fact must accept certain areas of uncertainty, and the findings themselves cannot extend further than attempting to assess or characterize the strength and weaknesses of the opposing arguments.

2. Health and Environment ⇐28
Navigable Waters ⇐35

Evidence concerning taconite processing company's discharges into the ambient air and water of Lake Superior was not sufficient to support the kind of demonstrable danger to the public health that would justify the immediate closing of the company's operations. Rivers and Harbors Appropriation Act of 1899, §§ 9 et seq., 13, 33 U.S.C.A. §§ 401 et seq., 407; Federal Water Pollution Control Act, §§ 1 et seq., 10, 33 U.S.C.A. §§ 1151 et seq., 1160; Federal Water Pollution Control Act Amendments of 1972, § 101 et seq., 33 U.S.C.A. § 1251 et seq.; Clean Air Act, § 211(c)(1)(A) as amended 42 U.S.C.A. § 1857f–6c(c)(1)(A).

3. Health and Environment ⇐28

Evidence supported district court's finding that taconite processing company's discharges into the ambient air gave rise to potential threat to the public health which was a risk of sufficient gravity to be legally cognizable although the exposure to asbestos fibers could not be equated with the factory exposures which have been clearly linked to excess cancers and asbestosis. Clean Air Act, § 211(c)(1)(A) as amended 42 U.S.C.A. § 1857f–6c(c)(1)(A).

4. Navigable Waters ⇐35

Scientific study which produced negative results concerning carcinogenic effects of asbestos fibers could not be deemed conclusive in exonerating the ingestion of asbestos fibers in Lake Superior water as a hazard but the negative results must be given some weight in assessing the probabilities of harm from taconite processing company's discharges of taconite "tailings" into Lake Superior water. Rivers and Harbors Appropriation Act of 1899, §§ 9 et seq., 13, 33 U.S.C.A. §§ 401 et seq., 407; Federal Water Pollution Control Act, §§ 1 et seq., 10, 33 U.S.C.A. §§ 1151 et seq., 1160; Federal Water Pollution Control Act Amendments of 1972, § 101 et seq., 33 U.S.C.A. § 1251 et seq.

5. Navigable Waters ⇐35

Evidence supported district court's finding that taconite processing company's discharges of taconite "tailings" into the water of Lake Superior gave rise to a potential threat to the public health which was of sufficient gravity to be legally cognizable. Rivers and Harbors Appropriation Act of 1899, §§ 9 et seq., 13, 33 U.S.C.A. §§ 401 et seq., 407; Federal Water Pollution Control Act, §§ 1 et seq., 10, 33 U.S.C.A. §§ 1151 et seq., 1160; Federal Water Pollution Control Act Amendments of 1972, § 101 et seq., 33 U.S.C.A. § 1251 et seq.

6. Courts ⇐360

The federal common law of nuisance did not provide basis for abatement of taconite processing company's air emissions and discharges into the water of Lake Superior where there was no interstate pollution of air or water and such discharges affected only Minnesota.

7. Health and Environment ⇐28

Federal nuisance law contemplates, at a minimum, interstate pollution of air or water.

8. Courts ⇐263(5)

Where claim by State of Minnesota that taconite processing company's discharges into the ambient air and water of Lake Superior violated Minnesota law originated out of a common fact situation which gave rise to violations of federal statutes, the district court properly exercised pendent jurisdiction with respect to Minnesota's claims relating to air emissions. M.S.A. §§ 116.07, 116.081, subd. 1, 609.74(1); Fed.Rules Civ.Proc. rule 19(a)(2), 28 U.S.C.A.

9. Federal Civil Procedure ⇐219

State of Minnesota was a necessary party to suit to enjoin taconite processing company's discharges into Lake Superior and was properly joined as a party plaintiff notwithstanding that there was no independent jurisdictional basis for Minnesota's claims against the taconite processing plant, a resident corporation. Fed.Rules Civ.Proc. rule 19(a)(2), 28 U.S.C.A.; Rivers and Harbors Appropriation Act of 1899, § 13, 33 U.S.C.A. § 407.

10. Health and Environment ⇐28

Evidence supported district court's finding that taconite processing company violated the primary and secondary air quality standards established by the State of Minnesota. M.S.A. §§ 116.07, 609.74(1).

11. Health and Environment ⇐28

Evidence supported district court's finding that taconite processing company violated Minnesota pollution control standard which prohibits the operation of an existing emission source unless it has filtration equipment with a collection efficiency of 99 percent by weight. M.S.A. §§ 116.07, 609.74(1).

12. Health and Environment ⇐28

Evidence supported district court's finding that taconite processing company was in violation of Minnesota pollution control standard which requires that a person operating an existing installation which is a source of air contaminants and air pollution shall apply for operating permit because the plant failed to obtain a permit for its emissions into the air. M.S.A. § 116.081, subd. 1.

13. Health and Environment ⇐28

Stipulation between Minnesota Pollution Control Agency and taconite processing company providing that the plant shall be issued "appropriate installation and operating permits" by the Agency only upon compliance with "applicable laws, regulations and standards of the Agency" did not shield the company from an abatement order based on existence of a hazard to health from air emission and was not itself a permit authorizing the company's air discharges. M.S.A. §§ 116.06, subds. 4, 5, 116.081, subd. 1.

14. Nuisance ⇐80

Where taconite processing company, by its air emissions, violated Minnesota pollution control regulations pertaining to air quality and air emissions, the company's violations could properly be enjoined as a public nuisance under Minnesota law. M.S.A. §§ 115.071, subd. 4, 116.081, subd. 1.

15. Health and Environment ⇐28

Where taconite pellets contained no asbestos and, at the most, asbestos occurred as a contaminant in a component, cummingtonite-grunerite, of the taconite that was processed to produce iron ore pellets, the taconite company was not engaged in the processing of asbestos or the production of any product containing asbestos and the taconite could not be considered "asbestos" for the purposes of

Minnesota pollution control regulation pertaining to asbestos emission.

See publication Words and Phrases for other judicial constructions and definitions.

16. Health and Environment ⇐28

Taconite processing company's emission of amosite asbestos fibers into the ambient air did not violate Minnesota pollution control asbestos emission regulation.

17. Health and Environment ⇐28

Minnesota asbestos emission regulation would not be applied more extensively than the federal regulation after which it was closely patterned in the absence of evidence of an independent background for its adoption.

18. Health and Environment ⇐28

Evidence did not support trial court's finding that taconite processing company was in violation of Minnesota pollution control regulation prohibiting particulate matter from becoming airborne as result of handling, use, transporting, or storage of any material or from construction, maintenance, or use of a road or a driveway.

19. Navigable Waters ⇐35

Evidence supported district court's finding that taconite processing company's discharge of taconite "tailings" into Lake Superior was "potentially harmful" to the public health and in violation of Minnesota water quality standards. M.S.A. §§ 115.01, subd. 5, 115.42; Federal Water Pollution Control Act, § 10(c)(5), 33 U.S.C.A. § 1160(c)(5).

20. Navigable Waters ⇐35

In order to establish cause of action under Federal Water Pollution Control Act, the United States must establish that the water pollution which is violative of state water quality standards is also endangering the health or welfare of persons. Federal Water Pollution Control Act, §§ 1(a), 10(g)(1), 11(d), 33 U.S.C.A. §§ 1151(a), 1160(g)(1), 1161(d); Federal Water Pollution Control Act Amendments of 1972, § 504, 33 U.S.C.A. § 1364.

21. Navigable Waters ⇐3

The provisions of the Federal Water Pollution Control Act are aimed at the prevention as well as the cure of water pollution. Federal Water Pollution Control Act, §§ 1(a), 10(g)(1), 11(d), 33 U.S.C.A. §§ 1151(a), 1160(g)(1), 1161(d); Federal Water Pollution Control Act Amendments of 1972, § 504, 33 U.S.C.A. § 1364.

22. Navigable Waters ⇐3

The term "endangering," as used in the Federal Water Pollution Control Act, connotes a lesser risk of harm than the phrase "imminent and substantial endangerment to the health of persons," as used in the 1972 amendments to the Act. Federal Water Pollution Control Act, §§ 1(a), 10(g)(1), 11(d), 33 U.S.C.A. §§ 1151(a), 1160(g)(1), 1161(d); Federal Water Pollution Control Act Amendments of 1972, § 504, 33 U.S.C.A. § 1364.

See publication Words and Phrases for other judicial constructions and definitions.

23. Navigable Waters ⇐35

The term "endangering," within meaning of the Federal Water Pollution Control Act, was used by Congress in a precautionary or preventive sense and, therefore, evidence of potential harm as well as actual harm comes within the purview of that term. Federal Water Pollution Control Act, §§ 1(a), 10(g)(1), 11(d), 33 U.S.C.A. §§ 1151(a), 1160(g)(1), 1161(d); Federal Water Pollution Control Act Amendments of 1972, § 504, 33 U.S.C.A. § 1364.

24. Navigable Waters ⇐35

Where taconite processing company was discharging a substance into Lake Superior water which under an acceptable but unproved medical theory might be considered as carcinogenic and the discharge gave rise to a reasonable medical concern over the public health, the district court properly determined that the discharge of taconite tailings into Lake Superior constituted pollution of waters "endangering the health or welfare of persons," within the terms of the Federal Water Pollution Control Act and

the discharge was subject to abatement. Federal Water Pollution Control Act, § 10(c)(5), (g)(1), 33 U.S.C.A. § 1160(c)(5), (g)(1).

25. Nuisance ⇐84

In common-law nuisance cases involving alleged harmful health effects, some present harm or at least an immediate threat of harm must be established.

26. Navigable Waters ⇐35

Although the Refuse Act was initially thought to apply to only those discharges which could arguably affect navigation, the term "refuse matter of any kind or description," within meaning of the Act, includes all foreign substance and pollutants apart from those flowing from streets and sewers and passing therefrom in a liquid state into the watercourse. Rivers and Harbors Appropriation Act of 1899, §§ 13, 16, 17, 33 U.S.C.A. §§ 407, 411, 413.

See publication Words and Phrases for other judicial constructions and definitions.

27. Navigable Waters ⇐25, 35

The 67,000 tons of taconite "tailings" which taconite processing company discharged daily into Lake Superior constituted "refuse matter," within meaning of the Refuse Act. Rivers and Harbors Appropriation Act of 1899, §§ 13, 16, 17, 33 U.S.C.A. §§ 407, 411, 413.

See publication Words and Phrases for other judicial constructions and definitions.

28. Navigable Waters ⇐25, 35

The Refuse Act prohibits virtually all deposits of foreign matter into navigable waters except liquids flowing from streets and sewers, absent a valid permit. Rivers and Harbors Appropriation Act of 1899, § 13, 33 U.S.C.A. § 407.

29. Navigable Waters ⇐25, 35

Permit, granted by the Department of the Army in 1948, which authorized taconite processing company to construct a steel sheet pile dock and to deposit tailings from its ore processing mill into Lake Superior, although valid as it related to possible impediments in navigation, does not now sanction the continued dumping of refuse matter into Lake Superior. Federal Water Pollution Control Act Amendments of 1972, §§ 4, 402, 402(a)(5), (k), 33 U.S.C.A. §§ 1251 note, 1342, 1342(a)(5), (k).

30. Navigable Waters ⇐25, 35

The existence of taconite processing company's pending application for a new permit under the Refuse Act permit program, which was converted by statute into an application for a national pollutant discharge elimination system permit, did not preclude a determination that the company was violating the Refuse Act by its discharge of taconite "tailings" into Lake Superior. Federal Water Pollution Control Act Amendments of 1972, §§ 4, 402, 402(a)(5), (k), 33 U.S.C.A. §§ 1251 note, 1342, 1342(a)(5), (k).

31. Navigable Waters ⇐25, 35

A permit which grants government consent to discharge, into waters, which does not impede navigation cannot be construed as consent to continue the discharge upon discovery that the discharged materials may be hazardous to public health. Federal Water Pollution Control Act Amendments of 1972, §§ 4, 402, 402(a)(5), (k), 33 U.S.C.A. §§ 1251 note, 1342, 1342(a)(5), (k).

32. Navigable Waters ⇐35

Where taconite processing company's discharge of taconite "tailings" into Lake Superior might be hazardous to public health, the discharges in the future were subject to abatement under the Refuse Act. Rivers and Harbors Appropriation Act of 1899, §§ 13, 16, 17, 33 U.S.C.A. §§ 407, 411, 413.

33. Courts ⇐405(12.1)

Where State of Minnesota had not requested injunctive relief for taconite processing company's violations of Minnesota statute requiring a permit for the disposal of industrial wastes into surface waters by the dumping of waste from its mine pit into rivers and waste from its pilot plant into Lake Superior, district court's orders which found the company to be in violation of the Minnesota stat-

ute were not appealable interlocutory orders. M.S.A. § 115.07, subd. 1; 28 U.S.C.A. § 1292(a).

34. Courts ⇐405(14.8)

Where the district court specifically reserved for later resolution the assessment of fines and penalties against taconite processing company for its violation of Minnesota statute requiring a permit for the disposal of industrial waste into surface waters, the district court's certification as final orders of its orders finding the company to be in violation of the Minnesota statute was insufficient to give the Court of Appeals jurisdiction over the issues. M.S.A. § 115.07, subd. 1; 28 U.S.C.A. §§ 1291, 1292(a); Fed.Rules Civ.Proc. rule 54(b), 28 U.S.C.A.

35. Courts ⇐405(14.8)

The partial adjudication of a single claim is not appealable even though the district court has issued a certification of the entry of a final judgment. 28 U.S.C.A. §§ 1291, 1292(a); Fed.Rules Civ. Proc. rule 54(b), 28 U.S.C.A.

36. Courts ⇐406.6(16)

Where taconite processing company had not pressed before the Court of Appeals by its briefs or in oral argument its original petition seeking to annul Minnesota state water quality standards as arbitrary and unreasonable and to order the administrator of the environmental protection agency to direct that Minnesota modify one of its water pollution control standards to bring it into conformity with federal standards, the petition would be considered abandoned and the petition would be dismissed. Federal Water Pollution Control Act Amendments of 1972, §§ 303(a), 509(b)(1), 33 U.S.C.A. §§ 1313(a), 1369(b)(1).

37. Federal Civil Procedure ⇐215

Where parent corporations of taconite processing company, as the sole stockholders of the company, had interests substantially identical with the company and the parents were not prejudiced by being joined after evidence relating to public health had been substantially completed, trial court did not abuse its discretion in action to enjoin taconite processing company from making discharges into the air and water of Lake Superior in ruling that complete relief could not be accorded plaintiffs unless the parents were joined as parties defendant. Fed.Rules Civ.Proc. rule 19(a), 28 U.S.C.A.

38. Appeal and Error ⇐781(7)

Where the Corps of Engineers informed the district court that it was complying with the district court's order to provide filtered drinking water to localities along Lake Superior and would continue to do so regardless of the outcome of the appeal, the United States' appeal from the order requiring the corps to provide filtered drinking water would be dismissed as moot. Water Resources Development Act of 1974, § 82, 33 U.S.C.A. § 701n.

39. Judgment ⇐564(1)

The doctrine of res judicata serves to bar an action when the prior proceedings have produced final decision on the merits.

40. Judgment ⇐828(3.16)

Where possible health hazard in taconite processing company's discharges into the air and water of Lake Superior was not before state court and no final decision had been reached in state court action because the state Supreme Court remanded the case to the state pollution control agency for further proceedings, the inconclusive and nonfinal decision in the state courts was not res judicata in federal court action to enjoin taconite processing company from its discharges.

41. Courts ⇐406.5(16)

When the trial court has authorized amendment of a complaint, the standard of review by the Court of Appeals is abuse of discretion. Fed.Rules Civ.Proc. rule 15(a, b), 28 U.S.C.A.

42. Federal Civil Procedure ⇐828

Trial court did not abuse its discretion in action to enjoin taconite processing company from discharging waste into the ambient air and into Lake Superior by permitting state to amend its

complaint in order to allege violations of a number of statutes and regulations relating to air emissions. Fed.Rules Civ. Proc. rule 15(a, b), 28 U.S.C.A.

43. Health and Environment ⇐28
Navigable Waters ⇐35

Where risk of harm to public from taconite processing company's discharges into the ambient air and into the waters of Lake Superior were potential, not imminent, or certain, and the company stated it was seeking a practical way to abate the pollution and the evidence called for preventive and precautionary steps, trial court abused its discretion by immediately closing the taconite processing plant and requiring that the company terminate its operations at once. Rivers and Harbors Appropriation Act of 1899, §§ 9 et seq., 13, 33 U.S.C.A. §§ 401 et seq., 407; Federal Water Pollution Control Act, §§ 1 et seq., 10, 33 U.S.C.A. §§ 1151 et seq., 1160; Federal Water Pollution Control Act Amendments of 1972, § 101 et seq., 33 U.S.C.A. § 1251 et seq.

44. Health and Environment ⇐28

Taconite processing company, with its parent companies, was entitled to reasonable opportunity and reasonable time period in which to convert its Minnesota taconite operations to on-land disposal of taconite "tailings" and to restrict air emissions at its plant, or to close its existing Minnesota taconite-pelletizing operations. Federal Water Pollution Control Act, § 10, 33 U.S.C.A. § 1160; Clean Air Act, §§ 110 to 113 as amended 42 U.S.C.A. §§ 1857c–5 to 1857c–8.

45. Navigable Waters ⇐35

Taconite processing company would be given reasonable time to stop discharging its waste into Lake Superior, including reasonable time necessary for the State of Minnesota to act on the company's application to dispose of its wastes at a particular on-land site and company was entitled to a reasonable turnaround time in which to construct necessary facilities. Federal Water Pollution Control Act, § 10(c)(5), (g)(1), 33 U.S.C.A. § 1160(c)(5), (g)(1).

46. Health and Environment ⇐28

With respect to air emissions, taconite processing company would be required, at minimum, to comply with state pollution control standards and to use such available technology as would reduce the asbestos fiber count in the ambient air in the vicinity of its plant below a medically significant level. M.S.A. §§ 115.071, subd. 4, 116.06, subd. 3, 116.07, subd. 4a.

47. Courts ⇐284(3)

Resolution of controversy between state and taconite processing company concerning the location of on-land disposal site for taconite "tailings" was not within the jurisdiction of the federal courts. M.S.A. §§ 115.05, 116.07, subd. 4a.

48. Mines and Minerals ⇐92.8

In event that taconite processing company could not practicably meet state's requirements for an on-land disposal site for taconite "tailings," the company would be free to close its operation without the fear of substantial fines and penalties being levied against it because of the election.

Order on Remand

49. Courts ⇐405(15.5)

Until the Court of Appeals issues its mandate and remands cases to the district court, the district court lacks jurisdiction of the cases.

50. Courts ⇐406.9(15)

Trial judge and counsel for all parties to litigation must respect the letter and spirit of the Court of Appeals as incorporated in the mandate of the Court of Appeals.

51. Courts ⇐406.9(12)

Until modified by Court of Appeals or reversed or modified by the United States Supreme Court, the opinion of the Court of Appeals governs the rights and obligations of the parties.

52. Courts ⇐406.9(15)

Attorneys for parties to appeal all serve as officers of the court and all are bound to respect and follow the law as laid down by a final appellate judgment.

O. C. Adamson, II, Maclay R. Hyde, Minneapolis, Minn., Edward T. Fride, Duluth, Minn., for Reserve Mining Co.

Edmund B. Clark, Chief, Appellate Section, Dept. of Justice, Thomas F. Bastow, Washington, D. C., for United States and Environmental Protection Agency.

Byron E. Starns, Chief Deputy Atty. Gen., St. Paul, Minn., for State of Minnesota and Minnesota Pollution Control Agency.

Robert M. McConnell, Asst. Atty. Gen., Madison, Wis., for State of Wisconsin.

Frank J. Kelly, Atty. Gen., Clive D. Gemmill, Asst. Atty. Gen., Robert A. Derengoski, Sol. Gen., Lansing, Mich., for State of Michigan.

William T. Egan, Minneapolis, Minn., for Republic Steel Corp.

G. Alan Cunningham, Minneapolis, Minn., for Armco Steel Corp.

Wayne G. Johnson, Johnson & Thomas, Silver Bay, Minn., for Northeastern Minnesota Development Ass'n, and others.

John M. Donovan, Duluth, Minn., for appellee.

Howard J. Vogel, Minneapolis, Minn.. for Minnesota Environmental Law Institute, and others.

Philip J. Mause, Washington, D. C., for Environmental Defense Fund.

John G. Engberg, Minneapolis, Minn., for U. S. Steelworkers of America, AFL–CIO, amicus curiae.

Michael R. Sherwood, San Francisco, Cal., for Sierra Club, amicus curiae.

Before LAY, BRIGHT, ROSS, STEPHENSON and WEBSTER, Circuit Judges, En Banc.

BRIGHT, Circuit Judge.

The United States, the States of Michigan, Wisconsin, and Minnesota, and several environmental groups seek an injunction ordering Reserve Mining Company [1] to cease discharging wastes from its iron ore processing plant in Silver Bay, Minnesota, into the ambient air of Silver Bay and the waters of Lake Superior. On April 20, 1974, the district court granted the requested relief and ordered that the discharges immediately cease, thus effectively closing the plant. United States v. Reserve Mining Co., 380 F.Supp. 11 (D.Minn.1974). Reserve Mining Company appealed that order and we stayed the injunction pending resolution of the merits of the appeal. Reserve Mining Co. v. United States, 498 F.2d 1073 (8th Cir. 1974). We affirm the injunction but direct modification of its terms. As to other issues brought before us by appeals during the course of

1. Reserve Mining Company is a jointly owned subsidiary of Armco Steel Corporation and Republic Steel Corporation. The district court joined these parent corporations as parties to this lawsuit at an advanced state of the litigation. The propriety of this joinder is raised on appeal and discussed in part VI of our opinion. Generally we shall make reference only to Reserve, the original defendant.

The following environmental groups intervened as plaintiffs on June 15, 1972, by order of the district court: The Minnesota Environmental Law Institute, the Northern Environmental Council, the Save Lake Superior Association, and the Michigan Student Environmental Confederation. United States v. Reserve Mining Co., 56 F.R.D. 408 (D.Minn.1972). The Environmental Defense Fund intervened pursuant to the court's order of July 31, 1973, and the Sierra Club has filed an amicus curiae brief on behalf of the plaintiffs.

Numerous parties have intervened as defendants. They include the Northeastern Minnesota Development Association, the Duluth Area Chamber of Commerce, the Towns of Silver Bay, Babbitt, and Beaver Bay, and several other civic and governmental units in the area of the Reserve facility. The United Steelworkers of America has submitted an amicus curiae brief on behalf of the defendants.

this complex litigation, we affirm in part and reverse in part.

SUMMARY OF DECISION

In this lengthy opinion, we undertake a comprehensive analysis of the relevant scientific and medical testimony and evaluate the claims of the plaintiffs that Reserve's conduct violates express provisions of federal law as well as state laws and regulations and is a public nuisance.

We summarize our key rulings as follows:

1) The United States and the other plaintiffs have established that Reserve's discharges into the air and water give rise to a potential threat to the public health. The risk to public health is of sufficient gravity to be legally cognizable and calls for an abatement order on reasonable terms.

2) The United States and Minnesota have shown that Reserve's discharges violate federal and state laws and state pollution control regulations, also justifying injunctive relief on equitable terms.

3) No harm to the public health has been shown to have occurred to this date and the danger to health is not imminent. The evidence calls for preventive and precautionary steps. No reason exists which requires that Reserve terminate its operations at once.

4) Reserve, with its parent companies Armco Steel and Republic Steel, is entitled to a reasonable opportunity and a reasonable time period to convert its Minnesota taconite operations to on-land disposal of taconite tailings and to restrict air emissions at its Silver Bay plant, or to close its existing Minnesota taconite-pelletizing operations. The parties are required to expedite consideration and resolution of these alternatives.

5) The evidence suggests that the threat to public health from the air emissions is more significant than that from the water discharge. Consequently, Reserve must take reasonable immediate steps to reduce its air emissions.

I. INTRODUCTION

A. *Summary of Controversy.*

In 1947, Reserve Mining Company (Reserve), then contemplating a venture in which it would mine low-grade iron ore ("taconite") present in Minnesota's Mesabi Iron Range and process the ore into iron-rich pellets at facilities bordering on Lake Superior, received a permit [2] from the State of Minnesota to discharge the wastes (called "tailings") from its processing operations into the lake.[3]

Reserve commenced the processing of taconite ore in Silver Bay, Minnesota, in 1955, and that operation continues today. Taconite mined near Babbitt, Minnesota, is shipped by rail some 47 miles to the Silver Bay "beneficiating" plant where it is concentrated into pellets containing some 65 percent iron ore. The process involves crushing the taconite into fine granules, separating out the metallic iron with huge magnets, and flushing the residual tailings into Lake Superior. The tailings enter the lake as a slurry of approximately 1.5 percent solids. The slurry acts as a heavy density current bearing the bulk of the suspended particles to the lake bottom. In this manner, approximately 67,000 tons of tailings are discharged daily.[4]

The states and the United States commenced efforts to procure abatement of

2. The permit provides in part:

   [T]ailings shall not be discharged * * * so as to result in any material adverse effects on fish life of public water supplies or in any other material unlawful pollution of the waters of the lake * * *.

3. Minnesota granted the permit based on Reserve's theory that the weight and velocity of the tailings as they are discharged from the plant into the lake would ensure deposit of the tailings in the 900 foot depth of the "great trough" area offshore from the proposed facility.

4. The Silver Bay processing operation employs about 3,000 workers and is central to the economic livelihood of Silver Bay and surrounding communities.

these discharges as early as mid-1969. These efforts, however, produced only an unsuccessful series of administrative conferences and unsuccessful state court proceedings.[5] The instant litigation commenced on February 2, 1972, when the United States—joined eventually by the States of Minnesota, Wisconsin, and Michigan and by various environmental groups—filed a complaint alleging that Reserve's discharge of tailings into Lake Superior violated § 407 of the Rivers and Harbors Act of 1899 [33 U.S.C. § 401 et seq. (1970)],[6] § 1160 of the pre-1972 Federal Water Pollution Control Act (FWPCA) [33 U.S.C. § 1151 et seq. (1970)][7] and the federal common law of public nuisance.

Until June 8, 1973, the case was essentially a water pollution abatement case, but on that date the focus of the controversy shifted to the public health impact of the tailings discharge and Reserve's emissions into the ambient air. Arguing the health issue in the district court, plaintiffs maintained that the taconite ore mined by Reserve contained an asbestiform variety of the amphibole mineral cummingtonite-grunerite,[8] and that the processing of the ore resulted in the discharge into the air and water of mineral fibers substantially identical and in some instances identical to amosite asbestos.[9] This contention raised an immediate health issue, since inhalation of asbestos at occupational levels of exposure is associated with an increased incidence of various forms of cancer.

Although it is undisputed that Reserve discharges significant amounts of waste tailings into Lake Superior and dust into the Silver Bay air, the parties vigorously contest the precise physical properties of the discharges, their biological effects, and, with respect to the water discharge, the issue of whether a significant proportion of the discharge, instead of flowing to the lake bottom with the density current, disperses throughout the lake. Plaintiffs attempted to show that a substantial amount of the fibers discharged by Reserve could be classified as amosite asbestos, and that these fibers could be traced in the ambient air of Silver Bay and surrounding communities and in the drinking water of Duluth and other communities drawing water from the lake. Reserve countered that its cummingtonite-grunerite does not have a fibrous form and is otherwise distinguishable from amosite asbestos. It further maintained that the discharges do not pose any cognizable hazard to health and that, in any event, with respect to the discharge into water, the tailings largely

5. *See* Reserve Mining Co. v. Minnesota Pollution Control Agency, 294 Minn. 300, 200 N.W.2d 142 (1972).

6. Section 407 is also known as the Refuse Act.

7. Unless otherwise noted, all references to the FWPCA are to the statute as it existed prior to the 1972 amendments. The 1972 amendments, Pub.L. No. 92–500, 86 Stat. 816 (Oct. 18, 1972), amended and reorganized the FWPCA. The current FWPCA is now codified at 33 U.S.C. § 1251 et seq. (Supp.1974).

The district court found that "[p]ursuant to § 4(a) of P.L. 92–500, the 1972 amendments have no effect on actions pending prior to the effective date of the amendments." 380 F.Supp. at 23 n. 1. The 1972 amendments were passed on October 18, 1972, some eight months subsequent to the initiation of this suit.

8. Amphibole denotes the mineral family made up by silicates of calcium and magnesium and, usually, one or more other metals (such as iron or manganese). Cummingtonite-grunerite is a general name for a "suite" of amphibole minerals which are essentially identical except for the relative quantities of iron and magnesium in them. The iron-rich members are sometimes referred to as grunerites, although the word cummingtonite is used to refer to the entire suite.

9. The cummingtonite-grunerite in Reserve's mine was formed when molten igneous rock, now known as the Duluth gabbro, intruded upon and heated a portion of the iron formation of the eastern Mesabi Range, thereby chemically altering it. When this gabbro contacted the iron deposits of the eastern district of the Range it caused the creation of several new minerals and produced a coarsening of grain size of pre-existing minerals such as magnetite and quartz. Among the new minerals formed were several amphiboles, including cummingtonite-grunerite.

The intrusion of igneous rock and resulting metamorphism of the iron formation extend in a strip about a mile wide and 15 miles long. [A.4:12–13.]

settle to the bottom of the lake in the "great trough" area as initially planned.[10]

The evidence presented on these points was extensive and complex. Hearings on a motion for a preliminary injunction were consolidated with the trial on the merits and during the nine-month period of 139 days of trial, the trial court heard more than 100 witnesses and received over 1,600 exhibits. The parties introduced testimony comparing the mineralogy of Reserve's cummingtonite-grunerite with amosite asbestos, such testimony based on electron microscope analysis of morphology, x-ray and electron diffraction analysis of crystal structure, laboratory analysis of chemical composition, and other identification techniques. As for the possible dispersion of the tailings throughout Lake Superior, witnesses disputed whether Reserve's discharges provided the sole source of cummingtonite-grunerite in the lake and whether the presence of the mineral could thus be used as a "tracer" for Reserve's discharge. In an effort to assess the health hazard, the parties presented extensive expert scientific and medical testimony, and the court itself appointed certain expert witnesses, who assumed the task of assisting the court in the evaluation of scientific testimony and supervising court-sponsored studies to measure the levels of asbestos fibers in the air near Silver Bay, in Lake Superior water, and in the tissues of deceased Duluth residents.

On April 20, 1974, the district court entered an order closing Reserve's Silver Bay facility. In an abbreviated memorandum opinion,[11] the court held that Reserve's water discharge violated federal water pollution laws and that its air emissions violated state air pollution regulations, and that both the air and water discharges constituted common law nuisances. The court's decision, in part, rested on these core findings:

> The discharge into the air substantially endangers the health of the people of Silver Bay and surrounding communities as far away as the eastern shore in Wisconsin.
>
> The discharge into the water substantially endangers the health of people who procure their drinking water from the western arm of Lake Superior including the communities of Beaver Bay, Two Harbors, Cloquet, Duluth [Minnesota], and Superior, Wisconsin. [380 F.Supp. at 16.]

The district court issued an extensive supplemental memorandum on May 11, 1974,[12] expanding on its earlier findings of fact and conclusions of law. In proceedings detailed in the following section of this opinion, a panel of this court stayed the injunction [13] and subsequently requested the district court to fully dispose of the litigation and enter final judgment. This court, sitting *en banc*, heard the merits of several consolidated appeals at the December 1974 session. We have also taken under consideration other appeals which have been subsequently submitted to us on briefs, but without oral argument. Our disposition follows.

B. *Discussion of Rulings by the District Court and Previous Proceedings in this Court.*

In its memorandum opinions of April 20, and May 11, ordering Reserve to cease immediately its discharges into the air and water, the district court predicated its determinations on several counts. On the discharge into water, the court found a violation of several sections of the Minnesota water quality standards. These standards, promulgated pursuant to § 1160(c)(5) of the FWPCA and subsequently approved by the federal government, are denominated as Minnesota Water Pollution Control Regulation 15 (WPC 15). The district court found the following parts of WPC 15 violated:

10. *See* note 3 *supra*.

11. United States v. Reserve Mining Co., 380 F.Supp. 11, 15 (D.Minn.1974).

12. United States v. Reserve Mining Co., 380 F.Supp. 11, 21 (D.Minn.1974).

13. Reserve Mining Co. v. United States, 498 F.2d 1073 (8th Cir. 1974).

WPC 15(a)(4), providing that waters of naturally high quality shall not be degraded; WPC 15(c)(2), a broad provision prohibiting the discharge of wastes which create nuisance conditions or cause "offensive or harmful effects;" WPC 15(c)(6), limiting the allowable suspended solid content of effluent discharges to 30 milligrams per liter; WPC 15(d)(1), controlling the discharge of substances that make certain waters unfit to drink even after chemical treatment; and WPC 26, a general effluent standard for Lake Superior incorporating the standards of WPC 15. Further, the court found that the discharge into Lake Superior endangered the health and welfare of persons in Minnesota, Wisconsin, and Michigan and therefore was subject to abatement pursuant to §§ 1160(c)(5) and (g)(1) of the FWPCA. Finally, the court found that the endangerment to health also constituted both a federal common law nuisance and a nuisance under the applicable laws of Minnesota, Wisconsin, and Michigan. 380 F.Supp. at 55.

As for the air emissions, the court also found liability under both federal and state common law nuisance. Additionally, the court cited Reserve for the violation of several Minnesota air pollution control regulations: APC 1, setting primary and secondary air standards; APC 5 and 6, controlling particulate emissions; and APC 17, setting an emission standard for asbestos. 380 F.Supp. at 55–56.

The trial court based its closure decision on two independent determinations. First, as noted above, the court had concluded that the discharges "substantially endanger" the exposed populations. Second, the court had concluded that, although a method of abatement providing for an alternate means of disposal of wastes with some turn-around time represented a desirable middle course in this litigation,[14] Reserve had demonstrated such intransigence on the issue of abating its water discharge as to render any such middle course impossible. The court thus believed it had no alternative but to immediately enjoin the discharges:

> Defendants have the economic and engineering capability to carry out an on land disposal system that satisfies the health and environmental considerations raised. For reasons unknown to this Court they have chosen not to implement such a plan. In essence they have decided to continue exposing thousands daily to a substantial health risk in order to maintain the current profitability of the present operation and delay the capital outlay (with its concomitant profit) needed to institute modifications. The Court has no other alternative but to order an immediate halt to the discharge which threatens the lives of thousands. In that defendants have no plan to make the necessary modifications, there is no reason to delay any further the issuance of the injunction. [380 F.Supp. at 20.]

Reserve promptly appealed the injunction order of the district court and we issued a temporary stay of that order on April 22, 1974, and scheduled a hearing on Reserve's application for a stay of injunction pending its appeal. That hearing was held on May 15, 1974, before a panel of this court consisting of Judges Bright, Ross, and Webster, and on June 4, 1974, the court issued an opinion granting Reserve a 70-day stay of the injunction. Reserve Mining Co. v. United States, 498 F.2d 1073 (8th Cir. 1974). The court conditioned the stay upon Reserve taking prompt steps to abate its

14. The court observed that it

> would like to find a middle ground that would satisfy both considerations. If an alternate method of disposal is available that is economically feasible, could be speedily implemented and took into consideration the health questions involved, the Court might be disposed to fashion a remedy that would permit the implementation of such a system. However, if there is no alternative method available, the Court has no other choice but to immediately curtail the discharge and stop the contamination of the water supply of those downstream from the plant. [380 F.Supp. at 17–18.]

air and water discharges, and provided for further proceedings to review whether Reserve had proceeded with the good faith preparation and implementation of an acceptable plan.[15]

The State of Minnesota applied to the Supreme Court to vacate this stay. The Court denied Minnesota this relief in an order entered July 9, 1974. Minnesota v. Reserve Mining Co., 418 U.S. 911, 94 S.Ct. 3203, 41 L.Ed.2d 1156 (1974). Meanwhile, in accordance with the stay order, the district court evaluated compliance with our order that Reserve proceed in good faith to present a plan of abatement. In a memorandum opinion filed August 3, 1974,[16] the district court, taking cognizance of the opposition of the State of Minnesota to Reserve's proffered plan (the so-called Palisades Plan), rejected Reserve's proposal as unreasonable and recommended against any further stay during the pendency of this litigation. Also, pursuant to our earlier request for advice on the status of unresolved claims, the district court indicated that it had "severed for later resolution the issue of the biological effect of Reserve's discharge on the Lake itself" and that several other issues remained under advisement. 380 F.Supp. at 91 n. 6.

Judges Bright and Ross convened a prehearing conference under Fed.R. App.P. 33 to inquire into consolidation, clarification, and simplification of issues pending an appeal and to advise this court of the time necessary to submit unresolved issues pending before the district court. The cause was then remanded with a request that the district court expedite disposition of the unresolved issues, with this court retaining jurisdiction over the pending appeal of the district court injunction.

Additionally, this court, on its own motion, scheduled a hearing before a panel consisting of Judges Bright, Ross, and Webster to consider the recommendations of the district court against continuing the stay order pending appeal. Following hearings, this court entered an order continuing the stay, concluding that:

> 1) The representations of counsel at the hearing on August 27, 1974, satisfy us that significant progress has been achieved by the parties in seeking agreement for an on-land disposal site and method for abatement of Reserve's discharge into Lake Superior. These negotiations are continuing and will not impede the processing of the pending appeal upon the merits, [and]
>
> 2) No substantial reason has been advanced why the stay order should not be continued pending such appeal other than the argument of imminent health hazard, which this court, for purposes of the stay pending appeal, has already determined adversely to

15. We stated:

> Accordingly, our stay of the injunction will be conditioned upon Reserve taking prompt steps to abate its discharges into air and water. We invited Reserve to advise this court concerning plans for the on-land disposal of its tailings and the significant control of its air emissions. Reserve's counsel stated that the company envisioned a three and one-half year to five year "turn-around" time, but added that investigation continues in an effort to reduce further the time for achieving abatement.
>
> Our stay of the injunction rests upon the good faith preparation and implementation of an acceptable plan. Therefore, we grant a 70-day stay upon these conditions:
>
> 1) Reserve's plans shall be promptly submitted to plaintiff-states and to the United States for review and recommendations by appropriate agencies concerned with environmental and health protection. Such plan shall be filed with the district court and submitted to all plaintiffs in no event later than 25 days from the filing of this order.
>
> 2) Plaintiffs shall then have an additional 20 days within which to file their comments on such plan.
>
> 3) The district court shall consider Reserve's plan and any recommendations made by the United States and plaintiff-states and make a recommendation, within 15 days following submission of plaintiffs' comments, whether or not a stay of the injunction should be continued pending the appeal.
>
> 4) Based on these plans, comments, and recommendations, this court will then review the status of its stay order within the time remaining. [498 F.2d at 1085–1086 (footnotes omitted).]

16. United States v. Reserve Mining Co., 380 F.Supp. 11, 71 (D.Minn.1974).

appellees. [Reserve Mining Co. v. United States, No. 74–1291 (8th Cir., Aug. 28, 1974).]

Minnesota and the United States applied to the Supreme Court for relief from this further stay order. The Court denied the applications, with Mr. Justice Douglas dissenting. Minnesota v. Reserve Mining Co., 419 U.S. 802, 95 S.Ct. 287, 42 L.Ed.2d 33 (1974).

On October 18, 1974, the district court issued an unpublished memorandum resolving certain other issues in the case and, noting that there was no just reason for delay, directing the entry of final judgment on all claims decided to date. *See* Fed.R.Civ.P. 54(b).

The district court made the following additional rulings: 1) that Reserve's discharge into the water constitutes a violation of the Refuse Act, 33 U.S.C. § 407; 2) that Reserve's counterclaims, alleging that interference with its present modes of discharge as sanctioned by permits amounts to a deprivation of property and an impairment of contractual rights, should be dismissed; 3) that Reserve's air emissions violate Minnesota air pollution control regulation (APC) 3 and Minn.Stat.Ann. § 116.081(1), which require that permits be obtained for the operation of certain emission facilities; 4) that Reserve's discharge of wastes into the Dunka and Partridge Rivers of Minnesota violates Minn.Stat.Ann. § 115.07(1), which requires a permit for the operation of a disposal system; 5) that Minn.Stat.Ann. § 115.07(1) is also violated by Reserve's discharge of wastes from its pilot plant into Lake Superior without a permit; 6) that the evidence is insufficient to justify liability under Minn.Stat.Ann. § 105.41, which makes unlawful the appropriation of state water without a permit; and 7) that the State of Wisconsin could not assert the state's "public trust doctrine" as an affirmative cause of action against Reserve's discharge into Lake Superior. Finally, the court left certain matters undecided, stating:

> The question of fines and penalties, the question of sanctions for failure to make discovery, and the question of liability of defendants for the water filtration systems that may be installed in Duluth, Minnesota, and Superior, Wisconsin, cannot be decided at this time. [Order of Oct. 18, 1974, at 19.]

This final order has produced several additional appeals. We now have under submission the following:

No. 73–1239: Reserve Mining Co. v. Environmental Protection Agency, in which Reserve urges that WPC 15 is arbitrary and unreasonable and challenges the failure of the Administrator of the EPA to require its revision.

No. 74–1291: Reserve Mining Co. v. United States, in which Reserve seeks to vacate the April 20, 1974, order enjoining its discharges into the air and water.

No. 74–1466: United States v. Reserve Mining Co., in which the United States appeals from the district court's order (April 19, 1974) directing that the Corps of Engineers of the United States provide filtered water at government expense to certain Minnesota communities located on the North Shore of Lake Superior.

No. 74–1816: Reserve Mining Co. v. United States, in which Reserve appeals from the most recent judgment entered October 18, 1974.

No. 74–1977: State of Wisconsin v. Reserve Mining Co., in which appellant-Wisconsin contests the district court's determination that the Wisconsin public trust doctrine does not provide an affirmative cause of action against Reserve's discharge into Lake Superior.[17]

No. 75–1003: Minnesota Environmental Law Institute v. United States, in which various environmental plaintiffs contest the district court's decision to "sever" the issue of whether Reserve's

17. By letter to this court dated December 23, 1974, Wisconsin abandoned this appeal. Accordingly, we dismiss this appeal.

discharge constitutes biological pollution of Lake Superior.

No. 75–1005: State of Michigan v. Reserve Mining Co., in which appellant-Michigan contests the district court's decision to "sever" the issue of whether Reserve's discharge constitutes biological pollution of Lake Superior.

During oral arguments and by written submissions, Reserve has advised us that it no longer asks Minnesota to accept its plan to dispose taconite tailings at the Palisades location, *see* discussion at p. 504 *supra*. Reserve has now submitted a second proposal to Minnesota for an on-land disposal site in which it proposes to spend approximately $243,000,000 in order to end its discharge of tailings into Lake Superior and curtail its emission of contaminants into the air. This proposed site, which Minnesota has under consideration, is located approximately seven miles inland from the Silver Bay facility, and is referred to as Milepost 7, or Lax Lake site.

II. HEALTH ISSUE

The initial, crucial question for our evaluation and resolution focuses upon the alleged hazard to public health attributable to Reserve's discharges into the air and water.

We first considered this issue on Reserve's application for a stay of the district court's injunction pending a determination of the merits of its appeal. We noted the usual formulation of the applicable standards to be met by the party seeking a stay. One of those standards addresses the likelihood of success by the moving party on the merits of the appeal. In applying this standard we made a preliminary assessment of the merits of Reserve's appeal from the trial court's injunction order. We noted that the "rather drastic remedy ordered by the district court * * * was a response to the finding of a substantial danger to the public health," and that our preliminary assessment of whether such a substantial danger was presented "should control our action as to whether to grant or deny a stay." 498 F.2d at 1076–1077.

In this preliminary review, we did not view the evidence as supporting a finding of substantial danger. We noted numerous uncertainties in plaintiffs' theory of harm which controlled our assessment, particularly the uncertainty as to present levels of exposure and the difficulty in attempting to quantify those uncertain levels in terms of a demonstrable health hazard. As we stated then, "* * * it is not known what the level of fiber exposure is, other than that it is relatively low, and it is not known what level of exposure is safe or unsafe." 498 F.2d at 1082. In confirmation of our view, we noted the opinion of Dr. Arnold Brown,[18] the principal court-appointed expert, that no adverse health consequences could be scientifically predicted on the basis of existing medical knowledge. Additionally, we noted the district court's conclusion that there is "'* * insufficient knowledge upon which to base an opinion as to the magnitude of the risks associated with this exposure.'" 498 F.2d at 1083. We thought one proposition evident:

> [A]lthough Reserve's discharges represent a possible medical danger, they have not in this case been proven to amount to a health hazard. The discharges may or may not result in detrimental health effects, but, for the present, that is simply unknown. [*Id.*]

On the basis of the foregoing we forecast that Reserve would likely prevail on the merits of the health issue.[19] We limited this forecast to the single issue before us whether Reserve's plant should

18. Dr. Arnold Brown is Chairman of the Department of Pathology and Anatomy at the Mayo Clinic of Rochester, Minnesota. He served the court both in the capacity of a technical advisor and that of an impartial witness.

19. We also suggested that plaintiffs would prevail in their claim that the discharges, apart from any danger to health, constituted unlawful pollution subject to abatement. In this case we find it necessary to discuss pollution only with respect to its possible adverse health effects.

be closed immediately because of a "substantial danger" to health:

> While not called upon at this stage to reach any final conclusion, our review suggests that this evidence does not support a finding of *substantial danger* and that, indeed, the testimony indicates that such a finding should not be made. *In this regard,* we conclude that Reserve appears likely to succeed on the merits of its appeal on the health issue. 498 F.2d at 1077–1078. (Emphasis added).

We reached no preliminary decision on whether the facts justified a less stringent abatement order.

[1, 2] As will be evident from the discussion that follows, we adhere to our preliminary assessment that the evidence is insufficient to support the kind of demonstrable danger to the public health that would justify the immediate closing of Reserve's operations. We now address the basic question of whether the discharges pose any risk to public health and, if so, whether the risk is one which is legally cognizable. This inquiry demands separate attention to the discharge into the air of Silver Bay and the discharge into Lake Superior.[20]

A. *The Discharge Into Air.*

As we noted in our stay opinion, much of the scientific knowledge regarding asbestos disease pathology derives from epidemiological studies of asbestos workers occupationally exposed to and inhaling high levels of asbestos dust. Studies of workers naturally exposed to asbestos dust have shown "excess" cancer deaths[21] and a significant incidence of asbestosis.[22] The principal excess cancers are cancer of the lung, the pleura (mesothelioma) and gastrointestinal tract ("gi" cancer).

Studies conducted by Dr. Irving Selikoff,[23] plaintiffs' principal medical witness, illustrated these disease effects. Dr. Selikoff investigated the disease experience of asbestos insulation workers in the New York-New Jersey area, asbestos insulation workers nationwide, and workers in a New Jersey plant manufacturing amosite asbestos. Generally, all three groups showed excess cancer deaths among the exposed populations,

20. While we, of course, adhere to the "clearly erroneous" standard in our review of district court findings, we note that many of the issues in this case do not involve "historical" facts subject to the ordinary means of judicial resolution. Indeed, a number of the disputes involve conflicting theories and experimental results, about which it would be judicially presumptuous to offer conclusive findings. In addressing this same type of problem, the District of Columbia Circuit recently observed:

> Where * * * the [EPA] regulations turn on choices of policy, on an assessment of risks, or on predictions dealing with matters on the frontiers of scientific knowledge, we will demand adequate reasons and explanations, but not "findings" of the sort familiar from the world of adjudication. [Amoco Oil Co. v. Environmental Protection Agency, 501 F.2d 722, 741 (D.C.Cir.1974).]

In such circumstances, the finder of fact must accept certain areas of uncertainty, and the findings themselves cannot extend further than attempting to assess or characterize the strengths and weaknesses of the opposing arguments. As Judge Wright observed in dissent in Ethyl Corporation v. Environmental Protection Agency, No. 73-2205 (D.C.Cir. filed Jan. 28, 1975) (dissenting opinion n. 74), "* * the court should [not] view itself as the equivalent of a combined Ph.D. in chemistry, biology, and statistics."

If our review seems unusually detailed, then, it is because we have endeavored to carefully explain the delicate balance of many of the issues in this case. While generally we do not find error in the underlying findings of the district court, we believe that an appreciation of the risk posed by Reserve's discharge demands an understanding of the state of scientific knowledge upon which those findings are based.

21. "Excess" cancer deaths refers to an incidence of *observed* cancer deaths among a segment of the population exposed to a certain agent greater than that *expected* from a general population not similarly exposed. The expected incidence of cancer is usually determined by reference to national cancer statistics.

22. Asbestosis, a respiratory disease, is a diffuse scarring of the lung resulting from the inhalation of asbestos dust.

23. Dr. Irving Selikoff is Director of the Environmental Sciences Laboratory of Mt. Sinai School of Medicine. He is a nationally recognized authority in asbestos-induced disease and occupational diseases generally.

as well as a significant incidence of asbestosis. With respect to cancer generally, three to four times the expected number of deaths occurred; with respect to lung cancer in particular, five to eight times the expected number; and with respect to gastrointestinal cancer, two to three times that expected. Dr. Selikoff described the increase of gastrointestinal cancer as "modest." [A.10:286–287.]

Several principles of asbestos-related disease pathology emerge from these occupational studies. One principle relates to the so-called 20-year rule, meaning that there is a latent period of cancer development of at least 20 years. [A.10:284–285.] Another basic principle is the importance of initial exposure, demonstrated by significant increases in the incidence of cancer even among asbestos manufacturing workers employed for less than three months (although the incidence of disease does increase upon longer exposure). [A.10:279–280.] Finally, these studies indicate that threshold values and dose response relationships,[24] although probably operative with respect to asbestos-induced cancer, are not quantifiable on the basis of existing data.[25] [A.10:280, 317–19.]

Additionally, some studies implicate asbestos as a possible pathogenic agent in circumstances of exposure less severe than occupational levels. For example, several studies indicate that mesothelioma, a rare but particularly lethal cancer frequently associated with asbestos exposure, has been found in persons experiencing a low level of asbestos exposure.[26]

24. A threshold value is that level of exposure below which no adverse health effects occur, while the dose response relationship quantifies the association between disease-producing levels of exposure and the incidence of disease.

25. Reserve presented testimony by several scientists supporting the proposition that the threshold level of asbestos exposure with respect to lung cancer and asbestosis is reasonably well established. Dr. Hans Weill, a Professor of Medicine at Tulane University School of Medicine, testified that his study of asbestos workers exposed for a mean period of 17.3 years indicated that asbestosis does not develop where the concentration of fibers is only five fibers per cc. [A.16:29–30.] Dr. Weill went on to review a series of epidemiological studies also suggesting the existence of a threshold level of exposure for lung cancer. [A.16:33–36.] Moreover, he reasoned that the value of this threshold would not be any lower than that applicable to the development of asbestosis, and thus is at least five fibers per cc. [A.16:43–44.] Dr. Paul Gross, Professor of Pathology at the University of South Carolina Medical School, likewise viewed these epidemiological studies as establishing a threshold level of exposure for lung cancer. [A.15:33–35.]

On cross-examination, plaintiffs challenged the interpretations of Doctors Weill and Gross, noting various deficiencies in the methodologies of the studies. [A.15:41–44; A.16:37–39.] For example, the testimony indicated that one of the studies had not tracked the workers for a sufficient period of time to determine whether cancer might develop, and that in fact a follow-up study indicated excess cancer deaths after 25 years in even low exposure groups. [A.16:38.] Moreover, plaintiffs' witnesses held firm opinions that although threshold levels probably exist, those levels could not be considered as authoritatively established. [A.10:133–35 (Wagoner); A.10:317–318 (Selikoff); A.13:285–89 (Rankin).]

It is significant that the witnesses generally agreed that no known safe level of exposure exists for mesothelioma. The agreement on this point seems a reflection of the weight given to the studies showing an association between mesothelioma and residence in proximity to an asbestos mine or mill or in the household of an asbestos worker. *See* note 26 *infra*.

26. Dr. Selikoff described some of this research. A study of mesothelioma victims in the northwestern portion of Cape Province, South Africa, in an area where there are many crocidolite asbestos mines and mills, found that in approximately one-half the deaths the only asbestos exposure was that resulting from residence in an area where there was a mine or mill. [A.10:244–245.] A study of mesothelioma victims in Hamburg, Germany, showed rates of mesothelioma of nine per ten thousand and one per ten thousand in two districts which had an asbestos factory, and no occurrence of the disease in the one district without such a factory. A study of 76 cases of mesothelioma drawn from the files of a London hospital showed that, of 45 victims who had not worked with asbestos, nine had simply lived in the household of an asbestos worker, 11 had lived within one-half mile of an asbestos plant. Finally, a study of 42 mesothelioma victims drawn from the files of the Pennsylvania Department of Health revealed that, of 22 victims who had not been occupationally exposed, three had lived in the household of an asbestos worker and eight had lived within

Although Dr. Selikoff acknowledged that these studies of lower-level exposure involve certain methodological difficulties and rest "on much less firm ground" than the occupational studies,[27] he expressed the opinion that they should be considered in the assessment of risks posed by an asbestos discharge.

At issue in the present case is the similarity of the circumstances of Reserve's discharge into the air to those circumstances known to result in asbestos-related disease. This inquiry may be divided into two stages: first, circumstances relating to the nature of the discharge and, second, circumstances relating to the level of the discharge (and resulting level of exposure).

1. *The Nature of the Discharge.*

The comparability of the nature of Reserve's discharge to the nature of the discharge in known disease situations raises two principal questions. The first is whether the discharged fibers are identical or substantially identical to fibers known to cause disease; the second is whether the length of the fibers discharged is a relevant factor in assessing pathogenic effect. The district court found that Reserve's discharge includes known pathogenic fibers and that a lower risk to health could not be assigned to this discharge for reasons of fiber length.

On the first question—the issue of the identity of the fibers—the argument focuses on whether the ore mined by Reserve contains (and yields wastes during processing consistent with) amosite asbestos. The inquiry is critical because studies demonstrate that amosite, at least in occupational settings, may serve as a carcinogenic (cancer-producing) agent. A principal dispute concerns the precise composition of the mineral cummingtonite-grunerite found in Reserve's taconite ore: Reserve maintains that the cummingtonite-grunerite present in its Peter Mitchell Mine at Babbitt is not asbestiform and is not chemically consistent with amosite asbestos; plaintiffs argue that much of the cummingtonite-grunerite mined by Reserve is substantially identical to amosite asbestos.

As a general scientific proposition, it is clear that cummingtonite-grunerite embraces a range of chemistries, including the chemistry of amosite asbestos. The mineral also embraces a range of morphologies, from asbestiform, needle-like fibers to block-shaped, crystal aggregates. The crucial factual determination is, thus, whether the particular cummingtonite-grunerite mined by Reserve contains asbestiform fibers consistent with the properties of amosite asbestos.

The trial court heard extensive evidence as to the chemistry, crystallography and morphology of the cummingtonite-grunerite present in the mined ore. This evidence demonstrated that, at the level of the individual fiber, a portion of Reserve's cummingtonite-grunerite cannot be meaningfully distinguished from amosite asbestos. Reserve attempted to rebut this testimony by showing that the gross morphology of the two minerals differed and that characteristics of the two minerals varied when considered in crystal aggregations. Since, according to the opinions of some experts, the indi-

one-half mile of an asbestos plant. [A.10:245–47.]

Additionally, Dr. Selikoff reported on several studies of shipyard workers. These studies indicated excess mesothelioma not only among the shipyard insulation workers dealing directly with asbestos, but also among the occupational groups working in proximity with the insulation workers. [A.10:254–62.]

27. Dr. Selikoff stated:

I would now like to turn to the problem at hand, the question of environmental exposure. And relate what I have just given you from occupational sources to environmental sources. And here we're on much less firm ground.

The cohort studies that were done and are much more readily and easily done among workers, are not readily done in the general population. You cannot identify people who, twenty, thirty, forty years ago breathed asbestos from environmental contamination and compare them with people who you can prove forty years ago didn't breath asbestos from environmental sources. And, therefore, much of the evidence that I will now place before you is a little unusual. [A.10:243.]

vidual fiber probably serves as a carcinogenic agent, the district court viewed the variations in mineralogy as irrelevant and determined that Reserve discharges fibers substantially identical and in some instances identical to fibers of amosite asbestos.

The second question, that of fiber length, reflects a current dispute among scientists as to whether "short" fibers (*i.e.*, fibers less than five microns in length) have any pathogenic effect. Most of the fibers detected in Reserve's discharges may be termed "short."[28] The evidence adduced at trial included conflicting scientific studies and diverse opinions on this question. Several Reserve witnesses testified concerning animal studies which seem to demonstrate that short fibers are nontumorigenic.[29] Plaintiffs offered opposing evidence based on contrary studies.[30] Dr. Brown noted his general criticism of the studies on fiber size, stating that the researchers typically did not use electron microscopy to properly "size" the fibers, and thus it cannot be said that the animals are in fact being exposed to only short or only long fibers. [A.23:338–40.]

Presented with this conflicting and uncertain evidence from animal experimentation, and the fact that there are no human epidemiological studies bearing on the issue, the district court concluded that short fibers could not be assigned a lower relative risk than long fibers.[31] This conclusion comports with the uncertain state of scientific knowledge. Furthermore, Dr. Brown and the National Academy of Sciences reached the same conclusion.[32]

2. *The Level of Exposure.*

The second major step in the inquiry of the health aspects of Reserve's air emissions is an assessment of the amount of the discharge and the resulting level of exposure. Two principal issues are raised: first, what in fact is the level of exposure; second, does that level present a cognizable risk to health? The district court found the level "significant" and

28. Plaintiffs' witness Dr. William Nicholson, Associate Professor of Community Medicine at the Mt. Sinai School of Medicine, testified that 95 percent of the fibers identified, both in the air and in the water, were less than five microns in length. [A.8:257.]

29. Dr. John M. G. Davis, head of the pathology branch of the Institute of Occupational Medicine in Edinburgh, Scotland, described several experiments in which tumor production among laboratory animals was reduced when researchers shortened the fibers to which the animals were exposed. [A.16:141–142.] Dr. George Wright, a former professor at the University of Rochester Medical School, concluded that there was a "cut off" value for fiber length below which mesothelioma could not be induced in experimental animals by intrapleural injection. [A.16:342–343.] Plaintiffs objected to these studies on the ground that generally a "milling process" is used to obtain the needed short fibers, and that through this process the original character of the fibers may be lost. Reserve witness Dr. Davis agreed that the effects of this milling are as yet unresolved. [A.16:207.]

30. For example, Dr. Selikoff testified to a study in which one group of rats was exposed to chrysotile fibers where only one percent of the fibers were longer than three microns, and a second group was exposed to fibers where five percent of the fibers were longer than five microns. In both groups, 40 percent of the animals eventually developed mesothelioma, although tumors took longer to develop in the group exposed to the shorter fibers. [A.11:19–21.] Reserve generally objected to plaintiffs' studies on the ground that the experimental methodology involved did not sufficiently isolate small fibers. [A.15:98–100.]

31. The standard set by the Secretary of Labor for permissible occupational exposure to asbestos is drawn in terms of fibers in excess of five microns in length. A dispute surfaced at the trial whether this standard should be read as endorsing the safety of fibers less than five microns. The district court ruled in the negative. Two participants, in the formulation of the standard, Dr. Selikoff and Dr. Wagoner, testified that the five micron limit reflected primarily a technological consideration since local laboratories do not possess the equipment to count fibers of a lesser length. [A.10:324–26, 104–105, 171.]

32. Dr. Brown testified that, in his view, "fibers less than five microns are just as dangerous as those over five microns * * *." [A.23:153.] A report by the National Academy of Sciences concluded: "There is, however, no body of knowledge that permits the assigning of relative risk factors to fibers in the electron microscope range compared with fibers in the light microscope range." [A.11:10.]

comparable to the levels associated with disease in nonoccupational contexts. 380 F.Supp. at 48.

The first issue was addressed at length in our stay opinion. We noted there the great difficulties in attempted fiber counts and the uncertainties in measurement which necessarily resulted. 498 F.2d at 1079–1080. Commenting on these difficulties, Dr. Brown stated that the fiber counts of the air and water samples could establish only the presence of fibers and not any particular amount, *i. e.*, such a count establishes only a qualitative, and not a quantitative, proposition. The district court recognized these difficulties in counting fibers and observed that "[t]he most that can be gained from the Court [ordered] air study is the very roughest approximation of fiber levels." 380 F.Supp. at 49.

A court-appointed witness, Dr. William F. Taylor,[33] made the most sophisticated attempt to use the fiber counts in a quantitative manner. By taking the average fiber count of five testing sites in Silver Bay, Dr. Taylor concluded that the burden of fibers in the air of Silver Bay exceeded that present in St. Paul, Minnesota, (used as a control) by a margin which could not be attributed to chance.[34] [A.23:117.]

The experts indicated that the counting of fibers represents a scientifically perilous undertaking, and that any particular count can only suggest the actual fiber concentration which may be present. Nevertheless, Dr. Taylor's computation indicating some excess of asbestiform fibers in the air of Silver Bay over that of the control city of St. Paul appears statistically significant and cannot be disregarded. Thus, as we indicated in the stay opinion and as the district court concluded,[35] while the actual level of fibers in the air of Silver Bay is essentially unknown, it may be said that fibers are present at levels significantly higher than levels found in another Minnesota community removed from this air contamination.

Given the presence of excess fibers, we must now assess the effects of this exposure on the public. We note first, as we did in the stay opinion, that the exposure here cannot be equated with the factory exposures which have been clearly linked to excess cancers and asbestosis.[36] Our inquiry, however, does not end there. Asbestos-related disease, as noted earlier, has been associated with exposure levels considerably less than normal occupational exposure. The studies indicating that mesothelioma is associated with the lower levels of exposure typical of resi-

33. Dr. Taylor is head of the Medical Research Statistics Section at the Mayo Clinic. He has been a consulting statistician in medical and biological research and a Professor of Biostatistics.

34. The fiber concentration found was 0.0626 fibers per cc, with a 95 percent confidence interval of from 0.0350 to 0.900 fibers per cc. (Although we indicated in the stay opinion that this count, like the other fiber counts, is subject to a nine-fold margin of error, 498 F.2d at 1078 n. 7, Dr. Taylor's testimony indicates that this particular calculation, embodying as it does the average of several readings, is subject to the lesser margin of error indicated above). It is significant that this concentration, even at its upper range, is far below the legally permissible level for occupational settings, and, thus, obviously below those levels typically associated with occupational exposure to asbestos.

Dr. Taylor warned that his Silver Bay computation, based on only several days of sampling during a particular time of the year, could not be extrapolated to represent the average annual burden of fibers in the air of Silver Bay. [A.23:132–41.]

35. The district court stated:

> * * * It is sufficient if one knows the number ranges between 1,620 fibers per cubic meter and 140,000,000, and that any particular count may be off by a factor of ten. One fact, however, cannot be denied. There is a significant burden of amphibole fibers from Reserve's discharge in the air of Silver Bay. [380 F.Supp. at 49–50.]

36. In commenting on the possibility of extrapolating the disease experience of occupational workers to the situation presented by Reserve's operations, Dr. Selikoff commented:

> Now, does this mean this is going to happen to people who drink or inhale dust from Reserve? Not at all. It doesn't mean this, because this is a *different kind* of exposure. But it does get important, it does show what can happen with amosite in these circumstances. [A.10:279 (emphasis added).]

dence near an asbestos mine or mill or in the household of an asbestos worker are of significance.[37] Although these studies do not possess the methodological strengths of the occupational studies, they must be considered in the medical evaluation of Reserve's discharge into the air.

Of course, it is still not possible to directly equate the exposure in Silver Bay with the exposure patterns in these nonoccupational studies. The studies typically do not attempt to quantify the level of exposure and, as noted above, it is not possible to assess with any precision the exposure level in Silver Bay; thus, exposure levels may be compared only on the most general basis. Furthermore, it is questionable whether Reserve's operations may be equated with those of an asbestos mine or mill; for, while we concur in the trial court's finding that Reserve discharges fibers similar, and in some cases, identical to amosite asbestos, it is also true, as testified by plaintiffs' own witnesses, that only a portion of Reserve's discharge may be so characterized.[38] Additionally, it is also true that at least some of the fiber counts reported to the court reflect *all* amphibole fibers present, thereby including fibers inconsistent with amosite asbestos.[39] Even if all the amphibole fibers inconsistent with amosite could still be attributed to Reserve's discharge, it remains uncertain whether the disease effects attributable to amosite may be extended to these other fibers, or whether the varying forms of asbestos possess differing pathogenic properties.[40]

37. *See* note 26 *supra*.

38. For example, Dr. Arthur Langer, Associate Professor of Mineralogy at the Mt. Sinai School of Medicine, testified that 15 of 30 amphibole particles present in an air sample taken at Reserve's facilities in Silver Bay were cummingtonite-grunerite. Of these 15, 14 were consistent with amosite asbestos, and of these 14 "a good number" were identical with amosite. [A.9:312.]

39. Plaintiffs' witness Dr. Nicholson reported some sample counts to the court which measured the level of all amphibole fibers present. [A.8:31–32, 121–24, 182–90.] The district court evidenced some concern on this point:

> The Court: I am having a little trouble in figuring out why you are counting amphiboles. It could be actinolite, tremolite, anthophyllite or cummingtonite-grunerite, or some other amphibole that I maybe never heard or. Has he [Dr. Nicholson] conducted further tests to prove that they are cummingtonite-grunerite?
>
> Mr. Hills [attorney for the United States]:
>
> * * * * * *
>
> With the electron diffraction pattern you determine the crystalline structure which determines amphibole. With the SEM [scanning electron microscope] you can go further and get the exact chemical composition.
>
> The Court: That is right. Have we done that in this instance?
>
> Mr. Hills: I don't believe so in this instance.
>
> The Witness [Dr. Nicholson]: No. These fibers were not subjected to the analysis of the scanning electron microscope.
>
> * * * * * *
>
> The Court: * * *
>
> My inquiry was directed to the question—up until this point the emphasis of the Government's case has been on the studies on amosite and the similarity of amosite to grunerite. This is the first time, as I recall, that you have said that other amphiboles are carcinogenic. And you may be able to establish that. But I was wondering what was the significance of putting in other amphiboles without designating them as cummingtonite grunerite?
>
> [A.8:124–26.]

40. There is some evidence that the various forms of asbestos differ in pathogenicity. Reserve witness Dr. William Smith, Director of the Health, Research Institute at Fairleigh-Dickinson University, testified that tremolite, although implicated as a carcinogen in studies of talc miners, did not induce tumors in experimental animals. [A.15:247.] Reserve witness Dr. Wright testified that the British view crocidolite asbestos as a particularly hazardous agent and the British standard for crocidolite exposure is one-tenth of that established for chrysotile or amosite. [A.16:322.] Dr. Selikoff noted that there are many amphibole minerals, but that few have been studied for their effects upon health. He expressed doubt about the carcinogenicity of tremolite. [A.10:266–267.]

The report of the National Academy of Sciences concludes that such differences are not clearly understood and that no type of asbestos can be regarded as free from hazard. [A.15:134.] This view was endorsed by Reserve witness Dr. Gross. [*Id.*] We think the district court proceeded correctly in relying on

3. *Conclusion.*

[3] Plaintiffs' hypothesis that Reserve's air emissions represent a significant threat to the public health touches numerous scientific disciplines, and an overall evaluation demands broad scientific understanding. We think it significant that Dr. Brown, an impartial witness whose court-appointed task was to address the health issue in its entirety, joined with plaintiffs' witnesses in viewing as reasonable the hypothesis that Reserve's discharges present a threat to public health. Although, as we noted in our stay opinion, Dr. Brown found the evidence insufficient to make a scientific probability statement as to whether adverse health consequences would in fact ensue, he expressed a public health concern over the continued long-term emission of fibers into the air. We quote his testimony at some length.

> [Dr. Brown]. Based on the scientific evidence, I would be unable to predict that the number of fibers in the air of Silver Bay, as seen on four days in October, that I would be unable to predict that cancer would be found in Silver Bay.
>
> Now, going beyond that, it seems to me that speaking now in general terms, where it has been shown that a known human carcinogen, sir, and I make that distinction and I shall make it again, I suspect, a human carcinogen is in the air of any community, and if it could be lowered I would say, as a physician that, yes, it should be lowered. And if it could be taken out of the air completely, I would be even more happy.
>
> But the presence of a known, human carcinogen, sir, is in my view cause for concern, and if there are means of removing that human carcinogen from the environment, that should then be done. [A.23:207–08.]

He explained further:

> As a physician, I take the view that I cannot consider, with equanimity, the fact that a known human carcinogen is in the environment. If I knew more about that human carcinogen, if I knew what a safe level was in the air, if I knew what a safe level was in the water, then I could draw some firm conclusions and advise you in precise terms. That information is not available to me and I submit, sir, it's not available to anyone else. And that until that information is developed in a scientific way, using techniques that would be acceptable to the medical community, until that time has arrived, then I take only the view that I have expressed. [A.23:211.]
>
> But with asbestos, * * * we're dealing with a different situation, we're dealing with a material which is known to cause cancer not only in animals but in humans. [A.23:212.]

Finally, in a post-trial deposition taken December 6, 1974, which the parties have stipulated may be considered by this court, Dr. Brown further testified:

> Q [Mr. Bastow, attorney for the United States]. [I]s there any question in your mind that the people living on the North Shore are being exposed to a human carcinogen in the air and water?
>
> * * * * * *
>
> A [Dr. Brown]. Court studies demonstrated to my satisfaction that similar [asbestiform] fibers are present in the air of Silver Bay and since I am convinced that asbestiform fibers are carcinogenic for humans, my answer to your question would be yes.

He added:

> I took some pains to also say that it was my medical opinion that the presence of a human carcinogen in the air and water was not to be taken lightly * * *.
>
> Until I know what the safe level is I therefore could not, as a physician, consider with equanimity the fact that

the National Academy report and concluding that no type of asbestos could be deemed safe. However, we note, too, that the discharge of fibers dissimilar from amosite adds further uncertainty to equating the likely health consequences from Reserve's discharge with that found in certain other occupational situations.

they are being exposed to a human carcinogen. [Brown dep. at 8–12.]

B. *The Discharge Into Water.*

The claim that Reserve's discharge of tailings into Lake Superior causes a hazard to public health raises many of the same uncertainties present with respect to the discharge into air. Thus, the previous discussion of fiber identity and fiber size is also applicable to the water discharge. In two respects, however, the discharge into water raises added uncertainties: first, whether the ingestion of fibers, as compared with their inhalation, poses any danger whatsoever; and second, should ingestion pose a danger, whether the exposure resulting from Reserve's discharge may be said to present a legally cognizable risk to health.

1. *Ingestion of Fibers as a Danger to Health.*

All epidemiological studies which associate asbestos fibers with harm to health are based upon inhalation of these fibers by humans. Thus, although medical opinion agrees that fibers entering the respiratory tract can interact with body tissues and produce disease, it is unknown whether the same can be said of fibers entering the digestive tract. If asbestos fibers do not interact with digestive tissue, they are presumably eliminated as waste without harmful effect upon the body.

The evidence bearing upon possible harm from ingestion of fibers falls into three areas: first, the court-sponsored tissue study, designed to measure whether asbestos fibers are present in the tissues of long-time Duluth residents; second, animal experiments designed to measure whether, as a biological phenomenon, fibers can penetrate the gastrointestinal mucosa and thus interact with body tissues; third, the increased incidence of gastrointestinal cancer among workers occupationally exposed to asbestos, and the hypothesis that this increase may be due to the ingestion of fibers initially inhaled.

a. The Tissue Study.

Recognizing the complete lack of any direct evidence (epidemiological or otherwise) on the issue of whether the ingestion of fibers poses a risk, the trial court directed that a tissue study be conducted to determine whether the tissues of long-time Duluth residents contain any residue of asbestoslike fibers.

The study sought to analyze by electron microscope the tissues of recently deceased Duluth residents who had ingested Duluth water for at least 15 years; that is, approximately since the beginning of Reserve's operations. As a "control" check on results, tissue samples were obtained from the deceased residents of Houston, Texas, where the water is free of asbestos fibers. Although this study was necessarily expedited, plaintiffs' principal medical witness, Dr. Selikoff, testified to the sound design of the study and expressed his belief that it would yield significant information.

One of the court-appointed experts, Dr. Frederick Pooley,[41] in explaining the results of the study, stated that he found that the tissues of the Duluth residents were virtually free of any fibers which could be attributed to the Reserve discharge. Dr. Brown said of this study:

> It is my conclusion, from the tissue study, that residents of Duluth have not been found to have asbestiform fibers in their tissues when compared with Houston. [A.23:208.]

As we noted in the stay opinion, the parties dispute the significance to be attributed to the results of this study. Dr. Selikoff, prior to the conclusion of the study, expressed this view:

> Now, our feeling was that no matter what air samples show or water sam-

41. Dr. Frederick D. Pooley is a world renowned scientist from Cardiff, Wales, Great Britain, and an expert in the field of identifying physical and chemical properties of asbestos and asbestos-like fibers. Dr. Selikoff, plaintiffs' expert, described Dr. Pooley as the "one man who has competence and knowledge in this matter," *i. e.*, the scientific examination of tissue for the presence of asbestos or asbestos-like fibers.

ples show or anything else, unless it is found that asbestos is in the tissues of people who have drunk this water * * * if we do not find it in the tissues in appreciable quantities, then I would risk a professional opinion that there is no danger, at least up to this point, to the population no matter what our samples show or water samples. [A.11:95.]

After negative results had been actually obtained, however, plaintiffs argued, and the district court agreed, that because the specimens of tissue represented only a microscopically minute body area, the actual presence of fibers may have been overlooked.[42]

We note that this limitation had not seemed dispositive prior to the study when Dr. Selikoff commented:

I would think we should find some fibers there. We're looking for needles in a haystack, but that's all right, we should find needles in the haystack with all the difficulties of the study, the technical difficulties, if we examine sufficiently large numbers of samples in some instances we should find some fibers there. [A.11:77.]

[4] The district court decided, and we agree, that the study cannot be deemed conclusive in exonerating the ingestion of fibers in Lake Superior water as a hazard. The negative results must, however, be given some weight in assessing the probabilities of harm from Reserve's discharge into water. The results also weigh heavily in indicating that no emergency or imminent hazard to health exists.[43] Thus, while this study crucially bears on the determination of whether it is necessary to close Reserve down immediately, the negative results do not dispose of the broader issue of whether the ingestion of fibers poses some danger to public health justifying abatement on less immediate terms.

b. Animal Studies and Penetration of the Gastrointestinal Mucosa.

At a somewhat more theoretical level, the determination of whether ingested fibers can penetrate the gastrointestinal mucosa bears on the issue of harm through ingestion. If penetration is biologically impossible, then presumably the interaction of the fibers with body tissues will not occur.

This medical issue has been investigated through experiments with animals which, unfortunately, have produced conflicting results. For example, Reserve witness Dr. Davis reported on his experiment in feeding crocidolite and chrysotile asbestos to rats for varying periods of up to six months. He killed the rats at the end of the period and examined their gastrointestinal tissues for evidence of fibers. At the time of trial, light and electron microscopy had so far revealed no evidence of fibers in the tissues. [A.16:143–59.]

Plaintiffs, however, cited contrary studies. Research by George Westlake, in which rats were fed a diet including chrysotile fibers, indicated that fibers had traveled through the colon wall and accumulated in the area of the mesothelium.[44] [A.11:23–25.] Pontrefact, who injected chrysotile fibers into the stomachs of rats, found that fibers had dispersed throughout the body tissues.[45] [A.11:37–41.]

42. Dr. Brown did not discount the study because of the limited number of sections that had been obtained:

> * * * I have to go on the data as presented. I think it was a reasonable case. I would have preferred many more sections. I recognize the fact that no such fibers were found to my satisfaction doesn't foreclose the possibility that such fibers exist. I recognize that as a possibility. But for the present I have to assume that fibers aren't there until I see them. [A.23:311–312.]

43. As Dr. Brown testified:

> It [the tissue study] does tell me that it is not an emergency situation, and that's about as far as I can go. [A.23:209.]

44. George E. Westlake, Holland J. Spjut, and Marilyn N. Smith, "Penetration of Colonic Mucosa by Asbestos Particles in Rats, Fed Asbestos Dust," 14 *Laboratory Investigation* 2029.

45. Pontrefact and Cunningham, "Penetration of Asbestos Through the Digestive Tract of Rats," 243 *Nature* 352 (1973).

On this conflicting scientific evidence, Dr. Brown testified that the Westlake and Pontrefact studies provide some support for the hypothesis that asbestos fibers can penetrate the gastrointestinal mucosa.[46]

c. Excess Gastrointestinal Cancer Among the Occupationally Exposed.

The affirmative evidence supporting the proposition that the ingestion of fibers poses a danger to health focuses on the increased rate of gastrointestinal cancer among workers occupationally exposed to asbestos dust. Plaintiffs' experts attribute this excess incidence of gastrointestinal cancer to a theory that the asbestos workers first inhaled the asbestos dust and thereafter coughed up and swallowed the asbestos particles.

The attribution of health harm from ingestion rests upon a theoretical basis. As Dr. Selikoff explained, there are several possible explanations for the increased evidence of gastrointestinal cancer, some of which do not involve ingestion. [A.11:41–43.] Moreover, as noted previously, the excess rates of gastrointestinal cancer are generally "modest" [A.10:220, 223, 226, 279.], and substantially lower than the excess rates of mesothelioma and lung cancer associated with inhalation of asbestos dust. Also, the experts advised that an analysis of a small exposed population may produce statistically "unstable" results. [A.10:278–80.]

The existence of an excess rate of gastrointestinal cancer among asbestos workers is a matter of concern. The theory that excess cancers may be attributed to the ingestion of asbestos fibers rests on a tenable medical hypothesis. Indeed, Dr. Selikoff testified that ingestion is the "probable" route accounting for the excess in gastrointestinal cancer. [A.11:44.][47] The occupational studies support the proposition that the ingestion of asbestos fibers can result in harm to health.

2. *Level of Exposure Via Ingestion.*

The second primary uncertainty with respect to ingestion involves the attempt to assess whether the level of exposure from drinking water is hazardous. Of course, this inquiry is handicapped by the great variation in fiber counts, and Dr. Brown's admonition that only a qualitative, and not a quantitative, statement can be made about the presence of fibers.[48]

46. We note from the record that while attempts to induce tumors in experimental animals through the inhalation of fibers have succeeded, attempts to induce tumors by ingestion have generally failed. [A.15:218–21; A.17:1–21.] Reserve witness Dr. Smith ventured the opinion, based on such studies, that there is no *proof* that the ingestion of fibers causes cancer in man. [A.15:257.] The failure to induce animal tumors by ingestion cannot be dispositive on the issue of whether the ingestion of fibers poses a risk to humans. This is because, as a general matter, animal cancer susceptibility is not directly equivalent to human experience, and, more particularly, because the studies so far undertaken may be criticized for various shortcomings in experimental design. Thus, one of Reserve's own witnesses, Dr. Wright, testified that at least one of the studies may be criticized for using too few animals over too brief an experimental time. [A.17:4.]

47. When asked his opinion as to whether the ingestion of asbestos can cause cancer, Dr. Brown responded:

> * * * I believe the evidence is probably good enough for me to draw the conclusion that it is likely that one could expect an increased incidence of cancer of the gastrointestinal tract in occupationally exposed people. [A.23:156.]

48. Some evidence indicated that the fiber counts in water were approximately one million times higher than those obtained in the air. [A.23:55.] Average fiber counts computed by Dr. Taylor did show that the concentration of amphibole fibers decreased as one moved away from Reserve's Silver Bay facilities, thus supporting plaintiffs' theory of dispersion. [A.23:54–55.] The district court found that Reserve's discharge is largely responsible for the presence of these fibers in the waters along the north shore of the western arm of Lake Superior.

As with the air counts, the water counts apparently include all types of amphiboles, only some of which are consistent with amosite asbestos. Thus, for example, Reserve witness Dr. Champness testified that samples of

In spite of these difficulties, the district court found that the level of exposure resulting from the drinking of Duluth water was "comparable" to that found to cause gastrointestinal cancer in asbestos workers. 380 F.Supp. at 48. The court drew this finding from an elaborate calculation by Dr. Nicholson in which he attempted to make a statistical comparison between the fibers probably ingested by an asbestos worker subject to an excess risk of gastrointestinal cancer with the probable number of amphibole fibers ingested by a Duluth resident over a period of 18 years. [A.22:228–229.] To make this calculation, Dr. Nicholson computed what he believed to be the level of exposure in a typical occupational environment and multiplied this figure by the total amount of air inhaled by the worker over a four-year period (taken to be the relevant period in which a risk of excess gastrointestinal cancer was posed), thereby obtaining total fibers inhaled. A percentage reduction was then applied to obtain the number of fibers brought up the respiratory tract and swallowed. For Duluth residents, Dr. Nicholson calculated the number of fibers ingested over an 18-year period, assuming a daily intake of two liters of water and a fiber concentration of 25 million fibers/liter. From these assumptions, Dr. Nicholson opined that a Duluth resident over a period of 18 years ingested about two-thirds of the amount of asbestos fibers swallowed by an asbestos worker in four years. As is evident, this calculation is beset by several uncertainties. The assumptions as to fiber concentration in occupational settings and the resulting percentage of fibers ingested involve margins of error. Furthermore, in assuming that the relevant fiber concentration in Duluth water was 25 million fibers/liter, Dr. Nicholson used a figure twice that found by the court as the mean concentration of *all* amphibole fibers.[49] Reserve witness Dr. Gross performed a calculation similar to Dr. Nicholson's, but using somewhat different assumptions, and concluded that Duluth water would have to contain several hundred million fibers/liter and be ingested for 60 years before an exposure comparable with occupational levels would be reached. [A.17:37–51.]

The comparison has other weaknesses, for without regard to the comparability of the gross exposure levels, the dynamics of the exposure process are markedly different. The vagaries attendant to the use of assumptions rather than facts result in comparisons which are of dubious accuracy. Thus, Dr. Brown testified that, *if* Nicholson's calculations were correct, he would conclude only that the risk was non-negligible. [Brown dep. at 20.]

The Nicholson comparison, although evidentially weak, must be considered with other evidence. The record does show that the ingestion of asbestos fibers poses some risk to health, but to an undetermined degree. Given these circumstances, Dr. Brown testified that the possibility of a future excess incidence of cancer attributable to the discharge cannot be ignored:[50]

water taken from Two Harbors, Duluth and Reserve's density current showed that the number of amphibole fibers with roughly the chemistry of amosite ranged from 13 to 34 percent. [A.19:5.] Plaintiffs' witness Dr. Langer testified that 47 percent of the fibers present in Duluth tap water were cummingtonite-grunerite and 8–9 percent of these fibers were in turn consistent with amosite. [A.9:314–315.]

49. "The Court finds, consistent with the Court's study of amphibole fiber concentrations in the water supplies of Beaver Bay, Two Harbors and Duluth, that on the 28th of August, 1973, in the samples analyzed by seven laboratories that the mean fiber concentrations were: 12.5 million fibers per liter in the public water system at Duluth * * *." 380 F.Supp. at 48.

50. Since Lake Superior affords water supplies to an estimated 200,000 people of Duluth and other North Shore Minnesota municipalities, as well as Superior, Wisconsin, we think it is essential that the facts regarding the present disease effects of the discharge be accurately stated.

As our review below demonstrates, we conclude that there is no evidence on a scientific or medical basis showing that Duluth residents experience an excess rate of cancer attributable to Reserve's discharge.

> * * * I would say that it is conceivable that gastrointestinal cancers can develop from the ingestion of asbestos, and what I don't know, Your Honor, is just how low that level of ingestion must be before the likelihood of GI cancer becomes so remote as to be, for all intents and purposes, ignored as a real live possibility. [A.23:157.]

We quote at length Dr. Brown's testimony expressing the medical concern appropriate to the continued discharge of asbestos fibers into Lake Superior:

> [Dr. Brown]. After some degree of exposure to the literature and to the testimony given in this trial I would say that the scientific evidence that I have seen is not complete in terms of allowing me to draw a conclusion one way or another concerning the problem of a public health hazard in the water in Lake Superior.
>
> Q. [The court]. Would you define the difference between what you say is scientific proof and medical proof, and then maybe I will give you another kind of proof that I have to live

The district court in its discussion "Present Effects of Discharge," 380 F.Supp. 53–54, implies that cancer statistics show an initial harm to Duluth residents attributable to the fiber contamination of Lake Superior. While the district court made no explicit findings in this regard, the court observed:

> A great deal of information about the cancer experience of the people of Duluth is available as a result of an ongoing study by the National Cancer Institute. It is too early to attach any real significance to the negative cancer experience of the City of Duluth due to Reserve's discharge. It should be pointed out that Duluth residents do not at this time enjoy a fortunate position with respect to the cancer experience for the entire state of Minnesota. There is at this time a statistically significant excess of rectal cancer with an increasing trend. Dr. Thomas Mason, a statistician for the National Cancer Institute, testified that for the period from 1965 to 1969, being the most recent period available for epidemiological study, Duluth had fifty-two extra deaths from cancer compared to mortality rates from the State of Minnesota. Of these, eleven deaths are attributable to the stomach, large intestine and rectum. [380 F.Supp. at 54.]

Moreover, the district court suggests that Dr. Brown did not consider recent statistical studies in reaching his conclusion that no increase in cancer attributable to Reserve's discharge could be predicted. 380 F.Supp. at 51 n. 34.

We have carefully undertaken a review of the statistical evidence bearing on the question of whether Duluth residents are presently experiencing an excess incidence of cancer. Two studies are of particular relevance. The first, conducted by Dr. Thomas Mason, a staff statistician for the National Cancer Institute, analyzed Duluth cancer rates for the years 1950–69. Duluth rates were compared to rates in Hennepin County (Minneapolis) and the State of Minnesota as a whole for five-year periods beginning in 1950 and ending in 1969. The study attempted to isolate any increase in cancer occurring in both men and women and appearing in the 1960's (preferably the late sixties). The focus on increases during the sixties reflected the assumption that any cancer attributable to Reserve's discharge might demonstrate the "lag" phenomenon evident in occupational exposure to asbestos dust. Only cancer of the rectum showed an increase among both men and women during the period 1965–1969. Although this increase was significant, Dr. Mason concluded that the excess was attributable to chance (or, at the least, not attributable to Reserve's discharge). [Tr. 17,-116.] This conclusion was premised on the absence of a theoretical link between the ingestion of asbestos and an isolated increase in rectal cancer; indeed, the occupational studies show that the excess cancers attributable to ingestion occur principally in the upper gastrointestinal tract, with only a slight increase in cancer of the rectum. [Tr. 17,116.] The Duluth statistics reveal no significant excess gastrointestinal cancer apart from the rectal increase.

A second study, conducted by Dr. Barry S. Levy, an epidemiologist assigned to the Minnesota Department of Health by the U. S. Department of Health, Education, and Welfare, covered the years 1969–1972. Simply stated, it found no excess gastrointestinal cancer among Duluth residents.

Dr. Brown stated during the course of the trial:

> *Scientifically* and *medically* I see no evidence for an increased incidence of cancer in those communities [Duluth, Silver Bay, and the other North Shore communities] that could be attributed to the presence of asbestos fibers in air or water. [A.23:22 (emphasis added, spelling corrected).]

During his post-trial deposition, Dr. Brown restated his earlier conclusion, making particular reference to the Levy study: "This paper [the Levy study] completely supports that [earlier] view." [Brown dep. at 30.]

with here and we will see where we are going? A. Well, science requires a level of proof which is pretty high. That is, we do not accept as truth things that seem to be casually associated, a cause casually associated with an effect. We have erected certain statistical barriers which force us to come to conclusions based on probability, and Dr. Taylor used those terms. He used .05 per cent, he used things like .01 per cent, criteria which generally are accepted in the scientific community as levels which are consistent with or from which you can conclude that there is some cause and effect relationship.

Q. All right. Now, scientific proof for what purpose? Doesn't the quantum of proof vary with the purpose? Now, I haven't really asked you this before, but wouldn't scientists be satisfied for one purpose and not another, or is that when you stop and put on your medical hat then, after you get a certain quantum of proof?

A. Well, as a scientist, sir, I would say that there are many questions which have been raised in this trial which would provide me with a hypothesis which I would like to see pursued. This is in the abstract scientific sense of an interesting intellectual question for which there is suggestive evidence.

Now, when I turn, however, to the medical side of things, Your Honor, I am faced with the fact that I am convinced that asbestos fibers can cause cancer, I am faced with the fact that I have concluded that the size of the fibers is not particularly helpful in allowing me to decide whether a given fiber is or is not carcinogenic.

As a medical person, sir, I think that I have to err, if err I do, on the side of what is best for the greatest number. And having concluded or having come to the conclusions that I have given you, the carcinogenicity of asbestos, I can come to no conclusion, sir, other than that the fibers should not be present in the drinking water of the people of the North Shore. [A.23:202–203.]

C. *Conclusion.*

The preceding extensive discussion of the evidence demonstrates that the medical and scientific conclusions here in dispute clearly lie "on the frontiers of scientific knowledge." Industrial Union Department, AFL–CIO v. Hodgson, 162 U.S.App.D.C. 331, 499 F.2d 467, 474 (1974). The trial court, not having any proof of actual harm, was faced with a consideration of 1) the probabilities of any health harm and 2) the consequences, if any, should the harm actually occur. *See* Carolina Environmental Study Group v. United States, 510 F.2d 796 at 799 (D.C.Cir., Jan. 21, 1975).

The District of Columbia Circuit was recently confronted with a problem analogous to the one now before us in Ethyl Corporation v. Environmental Protection Agency, Civil No. 73–2205 (D.C.Cir., Jan. 28, 1975).* The court, faced with a regulation of the Environmental Protection Agency[51] requiring the phased reduction of the lead content in motor vehicle gasoline promulgated pursuant to a statute authorizing a restriction only if the emission product of a fuel or fuel additive "will endanger the public health or welfare," rejected the EPA regulation stating that "the case against auto lead emissions is a speculative and inconclusive one at best." *Id.* at 6–8. The majority reasoned that in the absence of past harm, no potential consequences can be considered.

> If there can be found potential harm from lead in exhaust emissions, the best (and only convincing) proof of such potential harm is what has occurred in the past, from which the Administrator can logically deduce that

* Editor's Note: The judgment and opinions were vacated by order of March 17, 1975, granting rehearing en banc.

51. Section 211(c)(1)(A) of the Clean Air Act, 42 U.S.C. § 1857f–6c(c)(1)(A) (1970), authorizes the Administrator of the Environmental Protection Agency to regulate a fuel or fuel additive "if any emission products of such fuel or fuel additive will endanger the public health or welfare * * *."

the same factors will produce the same harm in the future. [*Id.* at 14.]

Judge J. Skelly Wright, in dissent, approached the problem of potential harm as encompassed within the statutory term of "will endanger" differently. He discussed this concept of danger to the public health in terms of separate but reciprocal evaluations of both risk and harm:

> While "risk" and "harm" are separate concepts that cannot be compared and ranked * * * there is a reciprocal relationship between them, and they may not really be assessed in isolation * * *. The "significance" of the risk * * * can only be ascertained through knowledge of the threatened harm, and it is the total "risk of harm" that must be sufficient to endanger the public health. This relationship does not, however, invalidate the separate analysis * * *, for the parameters of each term must be identified before their interaction can be studied. [*Id.* at 14 n. 14 of dissenting opinion.]

Judge Wright, believing the EPA regulations valid, concluded that the low probability of harm (greater than a remote possibility) shown by the EPA coupled with the potentially dire consequences which could result from lead emissions justified the EPA regulations. *See id.* at 10–11 of dissenting opinion.

These concepts of potential harm, whether they be assessed as "probabilities and consequences" or "risk and harm," necessarily must apply in a determination of whether any relief should be given in cases of this kind in which proof with certainty is impossible. The district court, although not following a precise probabilities-consequences analysis, did consider the medical and scientific evidence bearing on both the probability of harm and the consequences should the hypothesis advanced by the plaintiffs prove to be valid.

[5] In assessing probabilities in this case, it cannot be said that the probability of harm is more likely than not. Moreover, the level of probability does not readily convert into a prediction of consequences. On this record it cannot be forecast that the rates of cancer will increase from drinking Lake Superior water or breathing Silver Bay air. The best that can be said is that the existence of this asbestos contaminant in air and water gives rise to a reasonable medical concern for the public health. The public's exposure to asbestos fibers in air and water creates some health risk. Such a contaminant should be removed.

As we demonstrate in the following sections of the opinion, the existence of this risk to the public justifies an injunction decree requiring abatement of the health hazard on reasonable terms as a precautionary and preventive measure to protect the public health.

III. DISCHARGE INTO THE AIR

The district court enjoined Reserve's discharge of asbestos fibers into the air at Silver Bay, Minnesota, as a federal common law nuisance, as a public nuisance under state law, as a violation of certain Minnesota air pollution control regulations, APC 1, 5, 6, and 17, 380 F.Supp. 55–56, and as a violation of APC 3(a)(2) and its underlying statute, Minn. Stat.Ann. § 116.081(1) (Supp.1974), which require a permit for the operation of emission facilities, United States v. Reserve Mining Co., 394 F.Supp. 233 at 242–244 (D.Minn., Oct. 18, 1974).[52]

A. *Federal Common Law Nuisance.*

[6, 7] We reject the federal common law of nuisance as a basis for relief. As formulated in Illinois v. City of Milwaukee, 406 U.S. 91, 92 S.Ct. 1385, 31 L.Ed.2d 712 (1972), and Texas v. Pankey, 441 F.2d 236 (10th Cir. 1971), federal nuisance law contemplates, at a minimum, interstate pollution of air or water. The United States, while invoking this doctrine, alleges only that Reserve's dis-

52. This order has not been published and will hereafter be referred to as the Order of October 18, 1974.

charge "significantly endangers the health of all those persons living in the vicinity of the defendant's taconite ore processing operations." The States of Michigan and Wisconsin do not complain of air pollution and Minnesota alleges that the discharge causes common law public nuisance but does not allege interstate effects. The pleadings indicate that Minnesota's claim rests on Reserve's violation of Minnesota laws by creating an alleged danger to the health of its citizens. We construe Minnesota's complaint as asserting a state nuisance law violation.[53]

Additionally, in our review of the record, we find no evidence of any interstate health hazard, and no testimony from medical witnesses indicating any substantial concern over the health of any citizens exposed to Reserve's air discharge other then those residing in the Silver Bay, Minnesota, area. Although the district court opinion refers to a measurement of cummingtonite-grunerite fibers in snow samples from northern Wisconsin, 380 F.Supp. at 50, and the district court found evidence of these fibers in the air "as far away as Wisconsin * * *,"[54] 380 F.Supp. at 50, the trial

53. The complaints of the Environmental Defense Fund and the other private intervening plaintiffs allege that Reserve's discharge into the air creates a public nuisance subject to abatement under federal common law. [A.2:140.] We also reject the nuisance claim raised by these plaintiffs. *See* note 54 *infra*.

54. Only sparse evidence supports this finding. The court's study of air samples encompassed only the level of fibers in Silver Bay as compared with the level of fibers in the control city of St. Paul. Although, as noted previously, testimony established that the average level of all five sites in Silver Bay was significantly greater than the level of fibers in St. Paul, the level at two of the Silver Bay sites, considered individually, was not significantly greater than that of the control city. [A.23:98.] Thus, even as to Silver Bay itself, the immediate area of the discharge, at some sites no statistically significant burden of excess fibers was present.

Plaintiffs have not succeeded in showing any significant excess level of fibers outside of Silver Bay. Plaintiffs' witness Dr. Nicholson took several air samples in Duluth, and concluded:

> * * * The sampling periods were fairly short. The density of material on the filters was limited, and in the circumstances it really did not seem profitable to expend that much additional effort to obtain more than these preliminary results. They indicate that amphibole-type fibers can—that is, taking all of them together—that amphibole-type fibers can be found in the air of Duluth, but the amount are in number and mass not what one would term excessively high in comparison with what one can find in other circumstances. [A.8:128.]

Similarly, Dr. Selikoff offered no evidence of any special air pollution problem in Duluth from asbestos fibers.

> * * * I don't think we have evidence one way or the other that at this time general community air pollution by asbestos, either chrysotile or amosite, is a problem. * * *
> Q. [Mr. Hills, attorney for United States.] Now, is that in Duluth you are talking about, not in Silver Bay?
> A. I'm talking about throughout the United States. Let's take chrysotile, general air pollution in the United States has not been shown at this time one way or the other to be or not to be a problem.
>
> Similarly in Duluth, we have very few pieces of information, we have limited data, we have few counts, there are relatively few fibers and although we have not, in such limited studies, seen amosite fibers in several other U.S. cities that we've looked at, the number that we've seen in Duluth is small at this time and I would not say that we have evidence that this—that general community amosite air pollution in Duluth constitutes a problem. I want that perfectly clear because I don't think we have evidence for this in any way one way or the other. [A.11:80.]

In attempting to show that the air discharge has significant interstate aspects and is not confined to Silver Bay, the trial court made the following observation:

> Another study was undertaken to try to quantify the fiber load in the area of Reserve's air discharge. This was a study of the snow in the area as a measure of the number of fibers falling on the ground. The measurements were taken in different areas ranging as far away as 46 miles at the National Water Quality Laboratory and 30 miles at Sand Point and Park Point, Wisconsin. Restricting this evidence to an analysis of those areas where the tracer cummingtonite was found, the study shows emissions from Silver Bay being transported in decreasing amounts as you go away from Silver Bay as far as 46 miles. This includes the two sites in Wisconsin. While there were problems with the study insofar as it applied to Michigan the Court will take it as supplementary and corroborative of the other testimony in the case and as evidence of

court limited to the Silver Bay area any showing of a significant burden of excess fibers. 380 F.Supp. at 48.

B. *Violations of Minnesota Law.*

[8, 9] We turn now to Minnesota's claims that its laws are being violated by Reserve's air discharge.[55] In ordering, on April 20, 1974, an immediate cessation of air discharges containing amosite asbestos, the district court relied upon violations by Reserve of APC 5, 6, and 17—regulations published by the Minnesota Pollution Control Agency pursuant to Minn.Stat.Ann. § 116.07—and the state's public nuisance law which is formulated at Minn.Stat.Ann. § 609.74(1). 380 F.Supp. at 17. Subsequently, Minnesota amended its complaint[56] under Fed.R. Civ.P. 15(b) to allege violations of APC 1 and 3, and Minn.Stat.Ann. § 116.081(1) relating to air emission permits. Because the district court held that Reserve's discharge also violates these provisions, 380 F.Supp. at 56 and Order of October 18, 1974, at 14, we also examine whether these alleged violations provide alternative or additional grounds for injunctive relief.

> the presence of these fibers in the air as far away as Wisconsin and Duluth. [380 F.Supp. at 50.]
>
> This "snow study," conducted by Dr. Philip Cook, a chemist with the National Water Quality Laboratory, fails to provide an adequate basis for concluding that the air discharge has any significant interstate character. Any attempt to attribute the amphibole material present in the snow to Reserve's discharge is rendered suspect by the fact that taconite tailings are spread on the roads passing through the test areas:
>
> * * * * * *
>
> In each case the sampling was done as far away as possible from the road since we have a problem of tailings being spread on the highways which could confuse the measurement.
>
> What we're attempting to measure is the amount of mineral matter which is settling out which would not be coming from the highways, but would be coming from the Reserve Mining Company plant. [A.22:166.]

Moreover, even assuming that the study samples were not unduly contaminated by tailings spread on the local highways, no amphibole levels even remotely comparable to those measured in Silver Bay were found in outlying areas. Thus, in the immediate Silver Bay area, the weight of amphibole per square inch of snow was measured at approximately two milligrams. [A.22:167.] At Two Harbors, some 24 miles to the southwest, the amphibole weight was .01 milligrams, or 0.5 percent of that recorded at Silver Bay. [A.22:172.] At the National Water Quality Laboratory in Duluth, 47 miles to the southwest, the amphibole weight was (somewhat inexplicably) higher than that recorded in Two Harbors, but still only .03 milligrams, or 1.5 percent of the Silver Bay level. [A.22:172.] No attempt was made to test the statistical significance of these levels, or to relate the measurements to fiber concentrations in the air. Three Wisconsin sites were studied, located from 29 to 41 miles from Silver Bay. Cummingtonite was "detected" at two of the sites, but Dr. Cook had not calculated actual amphibole weights. [A.22:172.]

At most, the snow study indicates that Reserve's discharge is "detectable" interstate. It offers no support for the view that a significant burden of excess fibers extends beyond Silver Bay; indeed, it supports a contrary inference because the amphibole concentration in Two Harbors, some 24 miles to the southwest, is only a fraction of one percent of that measured at Silver Bay.

55. In joining Minnesota as a party plaintiff pursuant to Fed.R.Civ.P. 19(a)(2), the district court assumed that it had jurisdiction over the state claims. There is no independent jurisdictional basis for Minnesota's claims against Reserve, a resident corporation. All claims, however, originate out of a common fact situation. At least with respect to water pollution claims, Minnesota should be considered a necessary party under Rule 19(a)(2). As to Minnesota's claims relating to air emissions, we believe this is an appropriate case in which to invoke pendent jurisdiction. *See* Hatridge v. Aetna Cas. & Sur. Co., 415 F.2d 809, 816–817 (8th Cir. 1969) (Blackmun, J.); *see also* United Mine Workers v. Gibbs, 383 U.S. 715, 725, 86 S.Ct. 1130, 16 L.Ed.2d 218 (1966); Almenares v. Wyman, 453 F.2d 1075, 1083 (2d Cir. 1971), cert. denied, 405 U.S. 944, 92 S.Ct. 962, 30 L.Ed.2d 815 (1972); Leather's Best, Inc. v. S.S. Mormaclynx, 451 F.2d 800, 809–811 (2d Cir. 1971); Astor-Honor, Inc. v. Grossett & Dunlap, Inc., 441 F.2d 627, 629–630 (2d Cir. 1971); 73 Colum.L.Rev. 153, 165–69 (1973).

56. To ascertain what wrongs are alleged and the relief requested requires a reading of four different complaints—the second amended joint complaint, the third amended joint complaint, the amended supplemental joint complaint, and the second amended supplemental joint complaint. Rather than filing amended complaint upon amended complaint, the state should have redrafted the entire complaint. If it had done so, we would not now need to struggle with such a disarray of pleadings and allegations.

1. *APC 1.*

[10] The district court observed that studies of suspended particulate matter in the air over Silver Bay for the months of July through October 1972 disclosed only isolated instances of violation of the primary and secondary air quality standards of APC 1.[57]

> The court noted, however, that
>
> the data introduced at trial, * * * reveals that since October 1972 there has been a marked increase in the number of days in which the secondary standard was exceeded and several days in which the primary standard was exceeded. [Order of Oct. 18, 1974, at 14–15.]

On the basis of this evidence, the court properly held that Reserve was in violation of APC 1.

2. *APC 5.*

[11] APC 5 limits the emission of particulate matter from industrial processes.[58] Generally, it prohibits the operation of an existing emission source unless it has filtration equipment with a collection efficiency of 99 percent by weight. The district court found, and Reserve does not deny, that its present methods of filtration fail to comply with this standard.

3. *APC 3 and Minn.Stat.Ann. § 116.081(1).*

[12] APC 3(a)(2)(bb) requires that a person "operating an existing installation which is a source of air contaminants and air pollution shall apply for an operating permit." [59] Minn.Stat.Ann. § 116.081(1) makes unlawful the operation of an "emission facility" [60] without a

57. APC 1 provides in part:

> (a) The "primary" air quality standards are levels of air pollutants above which, on the basis of present knowledge, health hazards or impairment may be produced. Health hazards include not only production, aggravation or possible production of disease, but also interference with function. Health impairment includes sensory irritation and impairment of well being by such phenomena as odor. The "secondary" air quality standards are levels which are desirable to protect the public welfare from any known or anticipated adverse effects, such as injury to agricultural crops and livestock, damage to or deterioration of property, annoyance and nuisance of person, sensory impairment and obstruction, or hazards to air and ground transportation.
>
> (b) No person shall emit any pollutant in such an amount or in such a manner as to exceed any ambient air quality standard herein beyond such person's property line, without respect to whether emission regulations stated in other air pollution control regulations of the Agency are also being violated.

58. APC 5 provides in part:

> (a) General Provisions.
>
> (1) This regulation applies to any operation, process, or activity except the burning of fuel for indirect heating where the products of combustion do not directly contact process materials, except refuse burning and process burning of salvageable material.
>
> * * * * * *
>
> (5) Any existing emission source which has particulate collection equipment with a collection efficiency of 99 percent by weight or any new emission source which is installed with particulate collection equipment of 99.7 percent efficiency by weight shall be considered as meeting the provisions of this regulation.

59. APC 3 provides in part:

> (a) Installation and Operating Permits for Stationary Sources, Fuel-Burning Equipment, Refuse-Burning Equipment and Control Equipment.
>
> * * * * * *
>
> (2) Operating Permit
>
> (aa) No person shall operate any stationary process, fuel-burning equipment, refuse-burning equipment, or control equipment therefore without obtaining an operating permit in accordance with the provisions of Minnesota Laws 1971, Chapter 904.
>
> (bb) A person operating an existing installation which is a source of air contaminants and air pollution shall apply for an operating permit. New operating permits are not required for persons operating emission sources where an operating permit has been issued before January 31, 1972, unless said operating is in violation of Agency air quality rules, regulations and standards.

60. An emission facility is "any structure, work, equipment * * * or other means whereby an emission is caused to occur." Minn.Stat.Ann. § 116.06(5). An emission is "a release or discharge into the outdoor atmosphere of any air contaminant or combination thereof." Minn.Stat.Ann. § 116.06(4).

permit from the Minnesota Pollution Control Agency. The district court properly held that Reserve is in violation of both APC 3 and Minn.Stat.Ann. § 116.081(1) by its failure to obtain a permit for its emissions into the air of Silver Bay.

4. *The Stipulation Agreement.*

[13] Reserve concedes that it does not have a permit as required by APC 3 and Minn.Stat.Ann. § 116.081(1), but contends in its brief that an existing stipulation [A.1:198–210.] with the Minnesota Pollution Control Agency, signed by Reserve in late 1972, "is itself a permit authorizing Reserve's air discharges." That agreement expressly provides that Reserve shall be issued "appropriate installation and operating permits" by the Agency only upon compliance "with applicable laws, regulations and standards of the Agency * * *." [A.1:210.] The agreement does not relieve Reserve of the duty of obtaining the required permits. Reserve also relies upon the stipulation agreement as a defense to Minnesota's claims that it is in violation of APC 1 and 5, standards previously discussed. While the stipulation arguably shields Reserve from criminal liability or civil penalties for its violation of air emission regulations, it cannot shield Reserve from an abatement order based on the existence of a hazard to health from the air emission, for evidence of this hazard had not yet surfaced when Minnesota and Reserve entered into the stipulation.

5. *Public Nuisance.*

[14] Because we affirm the district court's findings that Reserve, by its air emission, is violating APC 1, 3, and 5, and Minn.Stat.Ann. § 116.081(1), it follows that Reserve's violations may be enjoined as a public nuisance. Minnesota's pollution control law so provides:

> *Injunctions.* Any violation of the provisions, regulations, standards, orders, stipulation agreements, variances, schedules of compliance, or permits specified in chapters 115 [water pollution control; sanitary districts] and 116 [Pollution Control Agency] *shall constitute a public nuisance* and may be enjoined as provided by law in an action, in the name of the state, brought by the attorney general. [Minn.Stat.Ann. § 115.071(4) (emphasis added).]

In light of this statute, we deem it unnecessary to discuss whether Reserve's air emissions could constitute a public nuisance independently of violations of the state's air pollution control regulations.

6. *APC 17.*

The district court found that Reserve's emission of amosite asbestos fibers into the ambient air violates the asbestos emission regulation, APC 17, of the Pollution Control Agency.[61]

This regulation designates the use of specific control equipment for emissions within its coverage. The regulation calls for control equipment, referred to in the regulation as a fabric filter and by the

61. APC 17 provides in part:

> (a) Definitions.
>
> The following definitions of words and phrases are controlling for the purposes of this regulation:
>
> * * * * * *
>
> (3) "Asbestos" means any of six naturally occurring, hydrated mineral silicates: Actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite.
>
> * * * * * *
>
> (8) "Manufacturing operation" means the processing of asbestos or the production of any product containing asbestos, with the exception of any process in which an asbestos containing material is sprayed.
>
> * * * * * *
>
> (12) For purposes of this regulation a product shall be deemed to contain asbestos if a detectable amount of asbestos is present in the product or in any material that goes into the product. A detectable amount of asbestos is defined as that amount detectable by the methods of x-ray diffraction, petrographic optical microscopy, or other method approved by the Director.

parties as a baghouse filter, with a mass collection efficiency of 99.9 percent. *See* APC 17(e)(2)(bb)(i).[62]

APC 17 defines "asbestos" as "any of six naturally occurring, hydrated mineral silicates: Actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite." It defines "manufacturing operation" as the "processing of asbestos or the production of any product containing asbestos." A product is deemed "to contain asbestos if a detectable amount of asbestos is present in the product or in any material that goes into the product."

Minnesota contends that the district court's finding that Reserve's emissions into the air "contain substantial quantities of amosite fibers and fibers similar to amosite," 380 F.Supp. at 89, supports the court's holding that Reserve is in violation of APC 17. Reserve takes the position that compliance with APC 17 is unnecessary for any health reason and necessitates economic waste because baghouse filters cost more to install and maintain than air filtration systems meeting other Minnesota emission control standards.

Reserve urges a restricted application of the phrase "manufacturing operation" as it appears in the regulation and argues that, because taconite is not considered asbestos in the ordinary usage of that term, Minnesota improperly interpreted APC 17 and has unreasonably applied it to Reserve's operation. Reserve further questions the reasonableness of the emission standard defined by the regulation. It argues that even if fabric filters do have a mass collection efficiency of 99.9 percent, the quantity of emissions will vary from plant to plant according to the amount of material processed and without respect to what level of emission is safe to health. We need deal only with Reserve's first objection, that it is not a "manufacturing operation" for purposes of the regulation.

62. This collection efficiency should be contrasted with that required by APC 5, which restricts emission of particulate matter generally. APC 5(b)(5) calls for a collection efficiency of 99 percent by weight for an existing emission source and of 99.7 percent by weight for a new emission source.

[15, 16] Is Reserve engaged in "the processing of asbestos" or "the production of any product containing asbestos?" On the basis of the record in this case we cannot say that Reserve's taconite should be considered asbestos for the purposes of this regulation or that Reserve's product, iron ore pellets, contains asbestos within the meaning of APC 17(a)(12). The court below made no finding that the pellets contain asbestos. At the most, asbestos occurs as a contaminant in a component, cummingtonite-grunerite, of the taconite that Reserve processes to produce iron ore pellets.

The State of Minnesota adopted APC 17 following the adoption of a national asbestos emission standard, 40 C.F.R. §§ 61.20–.24 (1974), by the Environmental Protection Agency. The Federal Register published this standard on April 6, 1973, 38 Fed.Reg. 8820, and Minnesota adopted its standard on June 11, 1973. We assume that the Minnesota Pollution Control Agency adopted this regulation, in common with APC 1, 3, 4, 11, 15 and 16, pursuant to the state implementation plan requirements of the Clean Air Act of 1955, as amended, 42 U.S.C. § 1857c–5 (Supp.1974).

In comments accompanying adoption of the national standard the administrator of the EPA identified five major sources of asbestos emissions: 1) mining and milling; 2) manufacturing; 3) fabrication; 4) demolition; and 5) spraying. 38 Fed.Reg. 8820. The administrator made explicit that the EPA regulation, insofar as it relates to mining and milling, applies only to asbestos mines and asbestos mills:

> EPA considered the possibility of banning production, processing, and use of asbestos or banning all emissions of asbestos into the atmosphere, but rejected these approaches. The problem of measuring asbestos emissions would

make the latter approach impossible to enforce. [*Id.*]

The administrator made no specific reference to other mining or milling. With respect to manufacturing, the EPA's standard applies to "selected manufacturing operations." *Id.* [63]

On May 3, 1974, the EPA clarified its asbestos emission standard by stating that it does not apply to asbestos occurring as a contaminant, as distinguished from asbestos as a product. This clarification expressly notes that the release of asbestos as a contaminant in the milling of taconite ore does not constitute milling or manufacturing for purposes of the federal standard. 39 Fed.Reg. 15397 (May 3, 1974). In this revision, the administrator added a definition of "commercial asbestos" to distinguish asbestos which is produced as a product from asbestos which occurs as a contaminant in other materials and to make explicit that materials that contain asbestos as a contaminant do not fall within the standard. The administrator further commented:

> Asbestos is also a contaminant in taconite ore. EPA at this time believes that asbestos releases from the milling of such ores should be covered by the hazardous air pollutant regulations and intends in the near future to propose for comment regulations which would accomplish this. Because the revisions here being promulgated are only *clarifications of the Agency's intentions* at the time the initial hazardous air pollutant regulations for asbestos were published and because they are not being proposed for comment, EPA believes that it is not appropriate to include restrictions on releases of asbestos from taconite milling operations in these revisions. [39 Fed. Reg. 15397 (May 3, 1974) (emphasis added).]

The Administrator then observed that he had not included in the original regulation a definition of "asbestos mill." He clarified the original regulation by defining the phrase and explained the definition in this way:

> The definition excludes the milling of ores that contain asbestos minerals only as a contaminant as previously discussed under the definition of "commercial asbestos." As noted earlier, the Agency intends to propose regulations covering taconite milling operations. [*Id.*]

[17] Minnesota has offered no record of any hearing or other evidence of the purpose of APC 17. We cannot accede to Minnesota's argument that APC 17 should be applied more extensively than the federal regulation after which it is closely patterned in the absence of evidence of an independent background for its adoption. Although Minnesota may adopt more stringent air pollution control standards than the Clean Air Act requires, *see* 42 U.S.C. § 1857d–1, this record furnishes no implication that it has done so. As bearing on this issue, Dr. John Olin, Deputy Director of the Minnesota Pollution Control Agency, testified only that "I wrote that regulation" [Tr. 18,233.] and that "[w]e would feel that the Reserve operation would fall under [it]." [Tr. 18,240.] On this record, we hold APC 17 as inapplicable to the discharge of asbestos fibers occurring as a contaminant in the processing of iron ore.

[18] In summary, we affirm the district court's holding that Reserve is in violation of APC 1, 3, and 5, and Minn.

63. The selected manufacturing operations include the following:

1) The manufacture of cloth, cord, wicks, tubing, tape, twine, rope, thread, yarn, roping, lap or otherwise textile materials.
2) The manufacture of cement products.
3) The manufacture of fireproofing and insulating materials.
4) The manufacture of friction products.
5) The manufacture of paper, millboard, and felt.
6) The manufacture of floor tile.
7) The manufacture of paints, coatings, caulks, adhesives, sealants.
8) The manufacture of plastics and rubber materials.
9) The manufacture of chlorine.

[40 C.F.R. § 61.22(c) (1974).]

Stat.Ann. § 116.081(1). As such, Reserve's continuing violations are subject to an abatement order. We disagree with the district court's application of APC 17 to Reserve.[64]

IV. FEDERAL WATER POLLUTION CONTROL ACT

The district court found that Reserve's discharge into Lake Superior violated §§ 1160(c)(5) and (g)(1) of the Federal Water Pollution Control Act. (FWPCA).[65] 380 F.Supp. at 16. These two provisions authorize an action by the United States to secure abatement of water discharges in interstate waters[66] where the discharges violate state water quality standards and "endanger * * * the health or welfare of persons." § 1160(g)(1).[67]

64. The trial court also found Reserve in violation of APC 6. 380 F.Supp. at 17. That regulation provides:

> (a) No person shall cause or permit the handling, use, transporting, or storage of any material in a manner which may allow avoidable amounts of particulate matter to become air-borne.
>
> (b) No person shall cause or permit a building or its appurtenances or a road, or a driveway, or an open area to be constructed, used, repaired or demolished without applying all such reasonable measures as may be required to prevent particulate matter from becoming air-borne. The Director may require such reasonable measures as may be necessary to prevent particulate matter from becoming air-borne including, but not limited to, paving or frequent clearing of roads, driveways and parking lots; application of dust-free surfaces; application of water; and the planting and maintenance of vegetative ground cover.

Dr. John Olin, Deputy Director of the Minnesota Pollution Control Agency, testified that "APC 6 * * * deals with fugitive dust, for example, dust from roads, dust in outside activities, dust during car unloading, this type of thing." The court gave no explanation how APC 6 has been violated. The stipulation agreement between Reserve and the Pollution Control Agency, to which we have made previous reference, indicated that Reserve was in compliance with APC 6. [A.1:200.] Neither the opinion of the trial court nor Minnesota's brief contains any discussion of the grounds for finding Reserve in violation of APC 6. In the absence of any substantiation or explanation of its reasoning, we reject the court's conclusion that Reserve is in violation of APC 6.

65. 33 U.S.C. § 1151 et seq. (1970), as amended, 33 U.S.C. § 1251 et seq. (Supp.1974). The amendments, passed in 1972, are not applicable to this litigation. *See* note 7 *supra*.

Section 1160(c)(5) reads:

> (5) The discharge of matter into such interstate waters or portions thereof, which reduces the quality of such waters below the water quality standards established under this subsection * * *, is subject to abatement in accordance with the provisions of paragraph (1) or (2) of subsection (g) of this section, except that at least 180 days before any abatement action is initiated under either paragraph (1) or (2) of subsection (g) of this section as authorized by this subsection, the Administrator shall notify the violators and other interested parties of the violation of such standards. * * * The court, giving due consideration to the practicability and to the physical and economic feasibility of complying with such standards shall have jurisdiction to enter such judgment and orders enforcing such judgment as the public interest and the equities of the case may require.

By implication, the text of (c)(5) incorporates the substance of (g)(1) into its provisions. Subsection (g)(1) reads:

> (g) If action reasonably calculated to secure abatement of the pollution within the time specified in the notice following the public hearing is not taken, the Administrator—
>
> (1) in the case of pollution of waters which is endangering the health or welfare of persons in a State other than that in which the discharge or discharges (causing or contributing to such pollution) originate, may request the Attorney General to bring a suit on behalf of the United States to secure abatement of pollution * * *.

66. Lake Superior, of course, is an interstate body of water.

67. The only procedural requirement necessary for initiation of a suit under §§ 1160(c)(5) and (g)(1) is a 180-day notice to the alleged polluter. Other enforcement provisions of the FWPCA require lengthy and complex presuit administrative proceedings. *See* §§ 1160(d)–(g). We note that the discharges of Reserve have been extensively considered by the Lake Superior Enforcement Conference, which was convened on May 13, 1969, by the Secretary of the Interior pursuant to § 1160(d)(1). The Conference met periodically during the next two years in an effort to procure the abatement of Reserve's discharges. The Conference did not resolve the problem, and on April 28, 1971, the Administrator of the Environmental Protection Agency notified Reserve that it was in violation of the federally approved Minnesota state water quality standards, and this suit was initiated February 2, 1972. For a general

Minnesota has adopted water quality standards—Minnesota Water Pollution Control Regulation 15 (WPC 15)—in conformity with the FWPCA.[68] These standards read in relevant part:

> (2) No raw or treated sewage, industrial waste or other wastes shall be discharged into any interstate waters of the state so as to cause any nuisance conditions, such as the presence of significant amounts of floating solids, scum, oil slicks, excessive suspended solids, material discoloration, obnoxious odors, gas ebullition, deleterious sludge deposits, undesirable slimes or fungus growths, or other offensive or *harmful* effects. [WPC 15(c)(2) (emphasis added).]

WPC 15 incorporates selected Minnesota statutory provisions into the water quality standards, including the policy of "protection of the public health" contained in Minn.Stat.Ann. § 115.42 and a definition of "pollution" contained in Minn.Stat.Ann. § 115.01(5) as contamination which renders waters "impure so as to be actually or *potentially harmful or detrimental or injurious to public health*, safety or welfare * * *." (Emphasis added).[69]

[19] The evidence shows Reserve's water discharge to be "potentially harmful" to the public health. As such, these discharges pollute the waters of Lake Superior in violation of the Minnesota water quality standards.

[20] An action under the FWPCA requires proof of an additional element. The United States must establish that the water pollution which is violative of state water quality standards is also "endangering the health or welfare of persons." § 1160(g)(1).

In this review, we must determine whether "endangering" within the meaning of the FWPCA encompasses the potential of harm to public health in the degree shown here.

[21, 22] Provisions of the FWPCA are aimed at the prevention as well as the cure of water pollution. The initial sentence of the FWPCA reads:

> The purpose of this chapter is to enhance the quality and value of our water resources and to establish a national policy for the prevention, control, and abatement of water pollution. [33 U.S.C. § 1151(a).]

The term "endangering," as used by Congress in § 1160(g)(1), connotes a lesser risk of harm than the phrase "imminent and substantial endangerment to the health of persons" as used by Congress in the 1972 amendments to the FWPCA. 33 U.S.C. § 1364 (Supp.1974).[70]

[23] In the context of this environmental legislation, we believe that Congress used the term "endangering" in a precautionary or preventive sense, and, therefore, evidence of potential harm as well as actual harm comes within the purview of that term. We are fortified in this view by the flexible provisions for injunctive relief which permit a court "to enter such judgment and orders enforcing such judgment as the public interest and the equities of the case may require." 33 U.S.C. § 1160(c)(5).

We deem pertinent the interpretation given to the term "endanger" by Judge Wright of the District of Columbia Circuit in his analysis of the congressional use of the word "endanger" in the context of a provision of the Clean Air Act. 42 U.S.C. § 1857f–6c(c)(1)(A)(1970).

discussion of the framework of the FWPCA as it existed prior to the 1972 amendments, *see* Barry, The Evolution of the Enforcement Provisions of the Federal Water Pollution Control Act: A Study of the Difficulty in Developing Effective Legislation, 68 Mich.L.Rev. 1103 (1970).

68. As is required by § 1160(c)(5), WPC 15 was approved by the Secretary of the Interior (the predecessor to the Administrator of the Environmental Protection Agency who now must approve standards) on November 26, 1969.

69. A 1973 amendment altered this section slightly but did not change the portion quoted in the text.

70. The 1972 amendments to the FWPCA grant the Administrator of the Environmental Protection Agency emergency powers to file suit for an immediate injunction where pollution is "presenting an imminent and substantial endangerment to the health of persons." 33 U.S.C. § 1364 (Supp.1974). *Compare* 33 U.S.C. § 1161(d) (1970).

Judge Wright observed:

> The meaning of "endanger" is, I hope, beyond dispute. Case law and dictionary definition agree that endanger means something less than actual harm. When one is endangered, harm is *threatened*; no actual injury need ever occur.
>
> * * * * * *
>
> "Endanger," * * * is not a standard prone to factual proof alone. Danger is a risk, and so can only be decided by assessment of risks.
>
> * * * * * *
>
> [A] risk may be assessed from suspected, but not completely substantiated, relationships between facts, from trends among facts, from theoretical projections from imperfect data, or from probative preliminary data not yet certifiable as "fact." [Ethyl Corporation v. Environmental Protection Agency, No. 73–2205 (D.C.Cir., Jan. 28, 1975) (dissenting op. at 11, 31–33) (emphasis in original) (footnote omitted).]

Although the Supreme Court has not interpreted the concept of "endangering" in the context of an environmental lawsuit, it has emphasized the importance of giving environmental legislation a "common-sense" interpretation. Mr. Justice Douglas, writing for the Court, said:

> This case comes to us at a time in the Nation's history when there is greater concern than ever over pollution—one of the main threats to our free-flowing rivers and to our lakes as well. * * * [W]hatever may be said of the rule of strict construction, it cannot provide a substitute for common sense, precedent, and legislative history. [United States v. Standard Oil Co., 384 U.S. 224, 225, 86 S.Ct. 1427, 1428, 16 L.Ed.2d 492 (1966).]

See United States v. Republic Steel Corp., 362 U.S. 482, 491, 80 S.Ct. 884, 4 L.Ed.2d 903 (1960).

[24, 25] The record shows that Reserve is discharging a substance into Lake Superior waters which under an acceptable but unproved medical theory may be considered as carcinogenic. As previously discussed, this discharge gives rise to a reasonable medical concern over the public health. We sustain the district court's determination that Reserve's discharge into Lake Superior constitutes pollution of waters "endangering the health or welfare of persons" within the terms of §§ 1160(c)(5) and (g)(1) of the Federal Water Pollution Control Act and is subject to abatement.[71]

V. REFUSE ACT

The United States further asserts as a basis for injunctive relief that Reserve's discharge into the water violates § 13 of the Rivers and Harbors Act of 1899. 33 U.S.C. § 407 (1970). The United States contends that Reserve's discharge is "refuse matter" within the meaning of that section,[72] and that Reserve does not

71. We are not here concerned with standards applied to abatement of a nuisance under non-statutory common law doctrines. In most common law nuisance cases involving alleged harmful health effects some present harm or at least an immediate threat of harm must be established. *See* New Jersey v. New York City, 283 U.S. 473, 51 S.Ct. 519, 75 L.Ed. 1176 (1931); Arizona Copper Co. v. Gillespie, 230 U.S. 46, 33 S.Ct. 1004, 57 L.Ed. 1384 (1913); Georgia v. Tennessee Copper Co., 206 U.S. 230, 27 S.Ct. 618, 51 L.Ed. 1038 (1907); Missouri v. Illinois, 200 U.S. 496, 26 S.Ct. 268, 50 L.Ed. 572 (1906); United States v. City of Asbury Park, 340 F.Supp. 555 (D.N.J.1972); City of Louisville v. National Carbide Corp., 81 F.Supp. 177 (W.D.Ky.1948); DeBlois v. Bowers, 44 F.2d 621 (D.Mass.1930). *But see* Harris Stanley Coal & Land Co. v. Chesapeake & O. Ry. Co., 154 F.2d 450 (6th Cir.), cert. denied, 329 U.S. 761, 67 S.Ct. 111, 91 L.Ed. 656 (1946); United States v. Luce, 141 F. 385, 408 (D.Del.1905). *Cf.* Swift & Co. v. United States, 276 U.S. 311, 326, 48 S.Ct. 311, 72 L.Ed. 587 (1928). We comment further on common law nuisance, *see* p. 532 *infra*.

72. Section 407 (the Refuse Act) reads in relevant part:

> § 407. Deposit of refuse in navigable waters generally.
>
> It shall not be lawful to throw, discharge, or deposit, * * * any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, * * provided * * * that the Secretary of the

possess a valid permit sanctioning this discharge. In its Order of October 18, 1974, the district court sustained the position of the United States.

[26] Although the Refuse Act was initially thought to apply to only those discharges which could arguably affect navigation, the cases now make clear that the term "refuse matter of any kind or description" in § 407 includes

> * * * all foreign substances and pollutants apart from those "flowing from streets and sewers and passing therefrom in a liquid state" into the water course. [United States v. Standard Oil Co., 384 U.S. 224, 230, 86 S.Ct. 1427, 1430, 16 L.Ed.2d 492 (1966).]

See United States v. Pennsylvania Industrial Chemical Corp., 411 U.S. 655, 670–72, 93 S.Ct. 1804, 36 L.Ed.2d 567 (1973).

[27, 28] The 67,000 tons of taconite tailings Reserve discharges daily into Lake Superior constitutes "refuse matter" within the meaning of § 407. The broad phraseology of § 407, "any refuse matter of any kind or description whatever other than that flowing from streets and sewers * * *," prohibits virtually all deposits of foreign matter into navigable waters except liquids flowing from streets and sewers, absent a valid permit. United States v. Standard Oil Co., 384 U.S. 224, 226, 230, 86 S.Ct. 1427, 16 L.Ed.2d 492 (1966); United States v. Ballard Oil Co., 195 F.2d 369, 371 (2d Cir. 1952). *Cf.* United States v. Pennsylvania Industrial Chemical Corp., 411 U.S. 655, 658 & n. 3, 670–72 (1973); United States v. Rohm & Haas Co., 500 F.2d 167, 170 (5th Cir. 1974), cert. denied, —— U.S. ——, 95 S.Ct. 1352, 43 L.Ed. 439 (1975); United States v. United States Steel Corp., 482 F.2d 439, 442 (7th Cir.), cert. denied, 414 U.S. 909, 94 S.Ct. 229, 38 L.Ed.2d 147 (1973).

Reserve, however, does have a permit which, it asserts, precludes a finding of a violation of the Refuse Act. The Department of the Army granted this permit in 1948 pursuant to 33 U.S.C. § 403[73] and it authorized Reserve "to construct a steel sheet pile dock * * * and, to deposit tailings from the ore processing mill in [to] Lake Superior * * *." [Reserve Ex. 451, subex. 12.] Reserve received revalidated or modified permits periodically until 1960, when it requested and obtained an amended permit authorizing deposition of tailings "for an indefinite period."

[29] The United States contends, and the district court found, that while this permit is valid as it relates to possible impediments to navigation, it does not now sanction the continued dumping of refuse matter into Lake Superior.

Reserve has not received a revalidation of its permit since 1960 and, as noted above, the judicial and administrative interpretation of "refuse matter" has been greatly expanded beyond its initial application solely to navigational mat-

> Army, whenever in the judgment of the Chief of Engineers anchorage and navigation will not be injured thereby, may permit the deposit of any material above mentioned in navigable waters, within limits to be defined and under conditions to be prescribed by him, provided application is made to him prior to depositing such material; and whenever any permit is so granted the conditions thereof shall be strictly complied with, and any violation thereof shall be unlawful.
>
> Section 16 of the Rivers and Harbors Act (33 U.S.C. § 411) contains criminal sanctions, but the Supreme Court has held that language in the enforcement section (§ 17) is sufficiently broad to encompass civil suits for injunctive relief. United States v. Republic Steel Corp., 362 U.S. 482, 491–492, 80 S.Ct. 884, 4 L.Ed.2d 903 (1960); *see* Wyandotte Transportation Co. v. United States, 389 U.S. 191, 201-04, 88 S.Ct. 379, 19 L.Ed.2d 407 (1967); *see also* United States v. Rohm & Haas Co., 500 F.2d 167 (5th Cir. 1974), cert. denied, —— U.S. ——, 95 S.Ct. 1352, 43 L.Ed.2d 439 (1975); Connecticut Action Now, Inc. v. Roberts Plating Co., 457 F.2d 81, 88-90 (2d Cir. 1972).

73. Section 403 relates exclusively to impediments to navigation. The district court ruled that "Reserve's permit, although by its terms a Section 10 [§ 403] permit, also met the underlying pre-requisites for a Section 13 [§ 407] permit when issued * * *." Order of Oct. 18, 1974, at 3. Thus, according to the district court, when the permit was initially issued in 1948, it was a valid permit under both sections 403 and 407.

ters. Thus, the issue remains whether Reserve's permit sanctions the deposition of refuse matter under the broadened interpretation of the law. On June 29, 1971, at the behest of the Corps of Engineers, Reserve submitted an application for a new permit under the Refuse Act Permit Program.[74] However, before the Corps acted, Congress, in October of 1972, passed the 1972 amendments to the FWPCA which replaced the Refuse Act Permit Program with the National Pollutant Discharge Elimination System (NPDES), 33 U.S.C. § 1342 (Supp.1974), and converted pending Refuse Act permit applications into NPDES permit applications by § 1342(a)(5). The record shows no action on Reserve's application since the Corps acknowledged receipt in early 1972.

[30] The existence of the pending application, however, does not preclude a determination that Reserve is violating the Refuse Act. Although the 1972 amendments to the FWPCA specifically provide that "in any case where a permit for discharge has been applied for" there can be no violation of the Refuse Act until December 31, 1974, 33 U.S.C. § 1342(k) (Supp.1974), a savings provision in a footnote to the 1972 amendments preserves a Refuse Act claim such as this one initiated prior to these amendments.[75] *See* United States v. Rohm & Haas Co., 500 F.2d 167, 170–74 (5th Cir. 1974), cert. denied, —— U.S. ——, 95 S.Ct. 1352, 43 L.Ed.2d 439 (1975); United States v. Ira S. Bushey & Sons, 363 F.Supp. 110, 119–120 (D.Vt.), aff'd mem., 487 F.2d 1393 (2d Cir. 1973), cert. denied, 417 U.S. 976, 94 S.Ct. 3182, 41 L.Ed.2d 1146 (1974); United States v. United States Steel Corp., 356 F.Supp. 556 (N.D.Ill.1973). Since Reserve's current application for a new permit cannot be interposed as a defense to a possible Refuse Act violation, Reserve must premise its defense on its current permit issued in 1960.

[31, 32] Clearly, the Corps considered only navigational matters in issuing this permit. The permit reads, in part, as follows:

> Note—It is to be understood that this instrument does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining *State assent* to the work authorized. IT MERELY EXPRESSES THE ASSENT OF THE FEDERAL GOVERNMENT SO FAR AS CONCERNS THE PUBLIC RIGHTS OF NAVIGATION. [Reserve Ex. 451, sub-ex. 12 (emphasis in original).]

Further, the permit refers almost exclusively to impediments to navigation. A permit which grants government consent to a discharge into waters which does not impede navigation cannot be construed as a consent to continue this discharge upon discovery that the discharged materials may be hazardous to public health. We agree with the district court that Reserve's discharges in the future are subject to abatement under the Refuse Act as we provide in the Remedy Section of this opinion, part VII.[76]

74. The Refuse Act Permit Program was established December 25, 1970, pursuant to Executive Order No. 11574, 3 C.F.R. 292 (1974).

75. That savings provision reads:

> No suit, action, or other proceeding lawfully commenced by or against the [EPA] Administrator or any other officer or employee of the United States in his official capacity or in relation to the discharge of his official duties under the Federal Water Pollution Control Act as in effect immediately prior to the date of enactment of this Act [Oct. 18, 1972] shall abate by reason of the taking effect [of these amendments]. [86 Stat. 816, Pub.L. 92–500, § 4.]

76. Reserve argues that a valid Refuse Act permit would be a defense to an alleged violation of the FWPCA. Although this contention is of doubtful validity, *see* 33 U.S.C. § 1174(1) (1970); United States v. Pennsylvania Industrial Chemical Corp., 411 U.S. 655, 669, 93 S.Ct. 1804, 36 L.Ed.2d 567 (1973); Illinois v. City of Milwaukee, 406 U.S. 91, 104, 92 S.Ct. 1385, 31 L.Ed.2d 712 (1972); United States v. United States Steel Corp., 482 F.2d 439, 449 (7th Cir.), cert. denied, 414 U.S. 909, 94 S.Ct. 229, 38

[33–35] The district court also found that Reserve's discharge into Lake Superior constituted a nuisance under the federal common law of nuisance. 380 F.Supp. at 16, 55. Because relief may appropriately rest on provisions of the FWPCA and on a violation of the Refuse Act, we deem it unnecessary and, indeed, unwise to also rely on federal nuisance law.[77] *Compare* Illinois v. City of Milwaukee, 406 U.S. 91, 107, 92 S.Ct. 1385, 31 L.Ed.2d 712 (1972). *See also* 15 B.C. Ind. & Comm.L.Rev. 795, 811–812 (1974); 14 B.C.Ind. & Comm.L.Rev. 767, 780–85 (1973); Note, Federal Common Law and Interstate Pollution, 85 Harv.L.Rev. 1439, 1451–56 (1972). Thus, we rest our resolution of the water issues solely on the FWPCA and the Refuse Act.[78]

VI. MISCELLANEOUS ISSUES

Before discussing the appropriateness of the remedy imposed by the district court, we resolve a number of issues subsidiary to the parties' main contentions.

A. *Reserve Mining Co. v. Environmental Protection Agency.*

[36] In No. 73–1239, Reserve Mining Co. v. Environmental Protection Agency, Reserve has filed an original petition with this court based on 33 U.S.C. § 1369(b)(1) (Supp.1974), seeking to annul the Minnesota state water quality standards—WPC 15—as arbitrary and unreasonable, and asking that we order the Administrator of the Environmental Protection Agency, pursuant to 33 U.S.C. § 1313(a) (Supp.1974), to direct that Minnesota modify WPC 15 to bring it into conformity with the standards of the FWPCA. Reserve filed this petition on April 13, 1973, but it has not further briefed this question nor has the EPA submitted a brief. Since Reserve has not pressed this issue before us by its briefs or in oral argument, we consider the issue abandoned and we dismiss this petition.

B. *Separate Appeals of Environmental Plaintiffs and State of Michigan.*

In Nos. 75–1003 and 1005, the environmental plaintiffs and Michigan seek to

L.Ed.2d 147 (1973), we do not reach this issue under our holding that Reserve's permit does not sanction a continuing discharge of foreign materials into the Lake which are potentially hazardous to health.

77. We also do not reach the issue of state common law nuisance or whether Minnesota's water quality standards, standing alone, afford adequate grounds for appropriate injunctive relief in this case.

78. The district court also found Reserve in violation of Minn.Stat.Ann. § 115.07(1), Order of Oct. 18, 1974, at 16, requiring a permit for the disposal of industrial waste into surface waters, by the dumping of waste from its mine pit into the Dunka and Partridge Rivers of Minnesota and waste from its pilot plant into Lake Superior. Minnesota, however, did not request injunctive relief for these alleged violations but only civil fines and penalties. Thus, these are not appealable interlocutory orders under 28 U.S.C. § 1292(a), and can be appealed to this court only if they can be considered as final orders under 28 U.S.C. § 1291.

Pursuant to Fed.R.Civ.P. 54(b), the district court sought to certify the above violations as final orders. Order of Oct. 18, 1974, at 19. This certification, however, is insufficient to give this court jurisdiction over these issues since the district court specifically reserved the assessment of fines and penalties for later resolution. Order of Oct. 18, 1974, at 19.

The assessment of fines and penalties cannot be divorced from liability to produce "more than one claim for relief" under Rule 54(b). *See* Keystone Manganese and Iron Co. v. Martin, 132 U.S. 91, 93–98, 10 S.Ct. 32, 33 L.Ed. 275 (1889); Barnard v. Gibson, 48 U.S. (7 How.) 650, 657, 12 L.Ed. 857 (1849); The Palmyra, 23 U.S. (10 Wheat.) 502, 6 L.Ed. 375 (1825); Smith v. Sherman, 349 F.2d 547, 552–553 (8th Cir. 1965); Taylor v. Board of Education, 288 F.2d 600, 602 (2d Cir. 1961); 9 J. Moore, Federal Practice ¶ 110.11 at 137–138 (2d ed. 1974). The partial adjudication of a single claim is not appealable even though the district court has issued a Rule 54(b) certificate. *See* Aetna Cas. & Sur. Co. v. Giesow, 412 F.2d 468, 470 (2d Cir. 1969); United States v. Burnett, 262 F.2d 55, 58–59 (9th Cir. 1958). *Compare* Sears, Roebuck & Co. v. Mackey, 351 U.S. 427, 437, 76 S.Ct. 895, 100 L.Ed. 1297 (1956); 6 J. Moore, Federal Practice ¶ 54.34[1] at 526–527 (2d ed. 1974). *See generally* Frank, Requiem for the Final Judgment Rule, 45 Tex. L.Rev. 292 (1966). Thus, there has been no final adjudication of the issues which would give this court jurisdiction under 28 U.S.C. § 1291, and Reserve may not at this time appeal from the district court's declaration of liability.

perfect an appeal from a portion of the district court's Order of October 18, 1974. The part appealed from reads:

> Evidence that Reserve's discharge harms the ecology of Lake Superior is unnecessary to the entry of final judgment terminating litigation on the merits, and the Court will not allow the introduction of any such evidence by any party.[79]

If we were to reverse the district court on the health issue, then, presumably further hearings would be required on the ecological issues. However, since we affirm the existence of a health hazard and direct its abatement, no additional trial is required on the remaining ecological questions relating to Lake Superior. We dismiss these appeals.

C. *Wisconsin's Claims.*

Wisconsin, as a plaintiff-intervenor, argues that Reserve's water discharge violates various Wisconsin statutes and causes a public nuisance subject to abatement under Wisconsin common law. Since we order abatement pursuant to other statutes, a determination of these issues is unnecessary to a resolution of this case.[80]

D. *Joinder of Armco and Republic Steel Corporations.*

Armco Steel Corporation and Republic Steel Corporation—the two parent corporations of Reserve—appeal from their joinder as defendants pursuant to Fed.R. Civ.P. 19(a)(1). The district court first joined Armco and Republic as defendants on January 2, 1974. On January 22, 1974, this court set aside the joinder order. Armco Steel Corp. v. United States, 490 F.2d 688 (8th Cir. 1974). In that order we stated:

> We make it clear, however, that our direction to the district court to set aside the joinder order is without prejudice to the rights of the plaintiffs to subsequently move that Armco and Republic be joined as parties following completion of the evidence relating to health hazards and liability. At that time, the record may show some basis for joining Armco and Republic in order to provide appropriate relief. Our ruling will not necessarily preclude subsequent joinder of Armco and Republic if the plaintiffs make a proper showing of adequate need for these parties in the litigation. [*Id.* at 691.]

On March 29, 1974, the district court, finding that the evidence relating to public health had been substantially completed, rejoined Armco and Republic. The two corporations claim that they have been denied due process by this joinder at a late stage of the trial and that in any event this joinder under Fed. R.Civ.P. 19 was invalid since they are not necessary or indispensable parties.

We examine these arguments. Armco and Republic allege that their late entrance into the litigation prevented them from adequately protecting their interests. They contend that Reserve is an entity separate and distinct from Armco and Republic and Reserve has not been representative of these newly-joined parties-defendant. On this contention, the district court observed:

> It is the finding of this Court that the independent corporate identity of Reserve Mining Company must be and is disregarded since this Court cannot allow the interposition of corporate entity to frustrate the implementation of a judgment that is required by justice * * *. The Court finds that this subsidiary (Reserve) is so dominated by its parents (Armco Steel Corp. and Republic Steel Corp.) that it is a mere agency or instrumentality of the parents. [380 F.Supp. at 27.]

79. This language was incorporated into the Order of October 18, 1974, *nunc pro tunc* by action of the district court on November 4, 1974.

80. Wisconsin has moved to strike certain documents filed with this court by Reserve relating to the Milepost 7 site. *See* p. 506 *supra*. We deny this motion. However, our reference to these documents is solely for the purpose of supplementing the information presented to us at oral argument by Reserve and Minnesota.

The district court concluded:

> Reserve is the personification of Armco and Republic in the State of Minnesota.
>
> * * * * * *
>
> In addition, the privity between Republic, Armco and Reserve is sufficient to give *res judicata* effect to the decision of this Court against Armco and Republic. Therefore they are not prejudiced by joinder. [*Id.* at 29.]

[37] We believe the evidence amply demonstrates that Armco and Republic, as the sole stockholders of Reserve, have interests substantially identical with those of Reserve and that the district court did not abuse its discretion under Rule 19(a) in ruling "that complete relief [could] not be accorded plaintiffs" unless Armco and Republic were joined. 380 F.Supp. at 27. Moreover, Armco and Republic show no prejudice from this late joinder. We affirm on this appeal.

E. *Filtered Drinking Water Supplies.*

The United States appeals from an order of the district court issued April 19, 1974, requiring the Army Corps of Engineers to provide filtered drinking water to localities along Lake Superior "without [permitting the Corps to obtain] any agreement from the affected cities at this time as to reimbursement." The United States claims that the district court invaded the discretionary powers granted by Congress solely to the Chief of Engineers to "provide emergency supplies of clean drinking water, on such terms as he determines to be advisable * * *." [81]

On April 5, 1974, the Chief of Engineers determined that certain cities on Lake Superior required emergency supplies of clean drinking water and he directed the North Central Engineers to provide the water.

[38] Although the United States seeks to appeal the district court's ruling on this issue, at oral argument counsel for the United States informed the court that the Corps of Engineers was complying with the district court's order and would "continue to do so regardless of the outcome of this appeal * * *." We construe the district court's order as applying only to the existing allocation of federal funds for this purpose. Thus, in light of the Government's statement at oral argument, we dismiss the appeal as moot.[82]

F. *Reserve's Defense of Res Judicata.*

Reserve argues that the Minnesota state district court decision of December 15, 1970 (reproduced in the Supplement to Reserve's brief at 107), and the Minnesota Supreme Court decision reviewing that case, Reserve Mining Co. v. Minnesota Pollution Control Agency, 294 Minn. 300, 200 N.W.2d 142 (1972), operate to bar Minnesota from litigating here those issues decided in the Minnesota courts.

Reserve initiated the Minnesota state litigation in an attempt to determine the validity and applicability to it of the state water quality standards, WPC 15. Minnesota counterclaimed for an injunction, asserting that Reserve's discharges were polluting the lake and constituted a public nuisance. The state district court

81. Section 82 of Pub.L. 93-251, 88 Stat. 12 (Mar. 7, 1974). The full text of § 82 reads:

> The Chief of Engineers, in the exercise of his discretion, is further authorized to provide emergency supplies of clean drinking water, on such terms as he determines to be advisable, to any locality which he finds is confronted with a source of contaminated drinking water causing or likely to cause a substantial threat to the public health and welfare of the inhabitants of the locality.

82. The United States informs us that very little use is being made of the filtered drinking water supplies provided by the Corps of Engineers.

> [O]nly one of the six communities * * * is proceeding to filter its water supply, even under the terms ordered by the Court. The other communities are relying on the stopgap of filtering tap water at public eating places and a few designated fire halls. As a result, no home taps in these communities are receiving filtered water. [Br. for U.S. at 53 n. 6.]

found certain provisions of WPC 15 either not applicable to Reserve or else "unreasonable, arbitrary, and invalid as applied to * * * Reserve." The state district court came to no conclusion as to pollution but directed an alteration in the method of discharge in order to confine the distribution of tailings within the great trough area. *See* note 3 *supra*. The question of a possible health hazard in Reserve's discharges did not come before that court. The appeal to the Minnesota Supreme Court raised only narrow procedural grounds and the court did not consider the merits. 200 N.W.2d at 143. The Minnesota Supreme Court remanded the case to the Minnesota Pollution Control Agency for further proceedings. *Id.* at 148.

[39, 40] The doctrine of *res judicata* serves to bar an action where the prior proceedings have produced a final decision on the merits. G. & C. Merriam Co. v. Saalfield, 241 U.S. 22, 28, 36 S.Ct. 477, 60 L.Ed. 868 (1916); McDonnell v. United States, 455 F.2d 91, 96–97 (8th Cir. 1972); 1B J. Moore, Federal Practice ¶ 0.409[1] at 1003–1004 (2d ed. 1974). The inconclusive and nonfinal decision in the ecological pollution case in the Minnesota courts does not warrant applying the doctrine of *res judicata* in the instant case.

G. *Amendments Under Fed.R.Civ.P. 15(b).*

Reserve contends that the trial court abused its discretion in allowing Minnesota to amend its complaint April 22, 1974, in order to allege violations by Reserve of a number of statutes and regulations relating to air emissions.

[41, 42] Rule 15(a) specifically provides that permission to amend "shall be freely given [by the court] when justice so requires." *See* Foman v. Davis, 371 U.S. 178, 182, 83 S.Ct. 227, 230, 9 L.Ed.2d 222 (1962). Where the trial court has authorized amendment, the standard of review by the court of appeals is abuse of discretion. *E. g.* Zatina v. Greyhound Lines, Inc., 442 F.2d 238, 242 (8th Cir. 1971); Strauss v. Douglas Aircraft Co., 404 F.2d 1152, 1155–58 (2d Cir. 1968). In our review of the record, we find no abuse of discretion by the district court in permitting the amendments.

H. *Reserve's Counterclaims.*

Reserve pleaded various counterclaims seeking compensation for the possible closing of its plant. The district court dismissed all counterclaims and Reserve appeals that dismissal arguing that the counterclaims were not fully litigated. The district court did not allow Reserve to present evidence supporting these claims but dismissed them as without merit in light of its findings in the main action.

The counterclaims were not fully litigated. We cannot say at this time that Reserve cannot sustain any counterclaims on any state of the record as it may develop in the future. Reserve still operates its plant. It seeks the cooperation of the state and federal governments in obtaining a new on-land tailings disposal site. Its assertion of counterclaims is premature until the state or federal government takes improper action which forces Reserve to close. On remand, the judgment shall show the dismissals as without prejudice.

VII. REMEDY

As we have demonstrated, Reserve's air and water discharges pose a danger to the public health and justify judicial action of a preventive nature.

In fashioning relief in a case such as this involving a possibility of future harm, a court should strike a proper balance between the benefits conferred and the hazards created by Reserve's facility. In its pleadings Reserve directs our attention to the benefits arising from its operations, as found by a Minnesota state district court, as follows:

> In reliance upon the State and Federal permits as contemplated by [Reserve] and the agencies issuing the permits prior to such issuance [Reserve] constructed its plant at Silver Bay, Minnesota. [Reserve] also developed the Villages of Babbitt and Silver

> Bay and their schools and other necessary facilities where many of [Reserve's] employees live with their families, as do the merchants, doctors, teachers and so forth who serve them. [Reserve's] capital investment exceeds $350,000,000. As of June 30, 1970 [Reserve] had 3,367 employees. During the calendar year 1969, its total payroll was approximately $31,700,000; and it expended the sum of $27,400,000 for the purchase of supplies and paid state and local taxes amounting to $4,250,000. [Reserve's] annual production of 10,000,000 tons of taconite pellets represents approximately two-thirds of the required pellets used by Armco and Republic Steel, the sole owners of Reserve, 15% of the production of the Great Lakes [ore] and about 12% of the total production of the United States. Between four and six people are supported by each job in the mining industry, including those directly involved in the mining industry and those employed in directly and indirectly related fields. [Reserve Mining Co. v. Minnesota Pollution Control Agency (Dist. Ct., Lake County, Dec. 1970), reproduced at A.1:261 and Supplement to Reserve's Br. at 114.]

We understand that plaintiffs do not deny these allegations.

The district court justified its immediate closure of Reserve's facility by characterizing Reserve's discharges as "substantially" endangering the health of persons breathing air and drinking water containing the asbestos-like fibers contained in Reserve's discharges. 380 F.Supp. at 16. The term "substantially" in no way measures the danger in terms of either probabilities or consequences. Yet such an assessment seems essential in fashioning a judicial remedy.

Concededly, the trial court considered many appropriate factors in arriving at a remedy, such us a) the nature of the anticipated harm, b) the burden on Reserve and its employees from the issuance of the injunction, c) the financial ability of Reserve to convert to other methods of waste disposal, and d) a margin of safety for the public.[83]

An additional crucial element necessary for a proper assessment of the health hazard rests upon a proper analysis of the probabilities of harm. *See* Ethyl Corporation v. Environmental Protection Agency, No. 73–2205 (D.C.Cir., Jan. 28, 1975) (dissenting op. at 10–19); Carolina Environmental Study Group v. United States, 510 F.2d 796, at 799 (D.C.Cir., Jan. 21, 1975). *Cf.* Society of Plastics Industry, Inc. v. Occupational Safety & Health Administration, 509 F.2d 1301 (2d Cir., Jan. 31, 1975), cert. denied, — U.S. — (1975), 95 S.Ct. 1998, 44 L.Ed.2d 482; Gelpe & Tarlock, The Uses of Scientific Information in Environmental Decisionmaking, 48 S.Cal.L.Rev. 371, 412–427 (1974).

With respect to the water, these probabilities must be deemed low for they do not rest on a history of past health harm attributable to ingestion but on a medical theory implicating the ingestion of asbestos fibers as a causative factor in increasing the rates of gastrointestinal cancer among asbestos workers. With respect to air, the assessment of the risk of harm rests on a higher degree of proof, a correlation between inhalation of asbestos dust and subsequent illness. But here, too, the hazard cannot be measured in terms of predictability, but the assessment must be made without direct proof. But, the hazard in both the air and water can be measured in only the most general terms as a concern for the public health resting upon a reasonable medical theory. Serious consequences could result if the hypothesis on which it is based should ultimately prove true.

A court is not powerless to act in these circumstances. But an immediate injunction cannot be justified in striking a balance between unpredictable health effects and the clearly predictable social and economic consequences that would follow the plant closing.

83. *See* Note, Imminent Irreparable Injury: A Need For Reform, 45 S.Cal. L.Rev. 1025 (1972).

In addition to the health risk posed by Reserve's discharges, the district court premised its immediate termination of the discharges upon Reserve's persistent refusal to implement a reasonable alternative plan for on-land disposal of tailings. *See* discussion pp. 503–504 & note 14 *supra*.

During these appeal proceedings, Reserve has indicated its willingness to deposit its tailings on land and to properly filter its air emissions. At oral argument, Reserve advised us of a willingness to spend 243 million dollars in plant alterations and construction to halt its pollution of air and water.[84] Reserve's offer to continue operations and proceed to construction of land disposal facilities for its tailings, if permitted to do so by the State of Minnesota, when viewed in conjunction with the uncertain quality of the health risk created by Reserve's discharges, weighs heavily against a ruling which closes Reserve's plant immediately.

Indeed, the intervening union argues, with some persuasiveness, that ill health effects resulting from the prolonged unemployment of the head of the family on a closing of the Reserve facility may be more certain than the harm from drinking Lake Superior water or breathing Silver Bay air.

Furthermore, Congress has generally geared its national environmental policy to allowing polluting industries a reasonable period of time to make adjustments in their efforts to conform to federal standards. *See, e. g.*, Federal Water Pollution Control Act, 33 U.S.C. § 1160 (1970); Clean Air Act, 42 U.S.C. §§ 1857c–5 to –8 (1970); National Environmental Policy Act, 42 U.S.C. § 4331 (1970). In the absence of an imminent hazard to health or welfare, any other program for abatement of pollution would be inherently unreasonable and invite great economic and social disruption. Some pollution and ensuing environmental damage are, unfortunately, an inevitable concomitant of a heavily industrialized economy. In the absence of proof of a reasonable risk of imminent or actual harm, a legal standard requiring immediate cessation of industrial operations will cause unnecessary economic loss, including unemployment, and, in a case such as this, jeopardize a continuing domestic source of critical metals without conferring adequate countervailing benefits.

[43, 44] We believe that on this record the district court abused its discretion by immediately closing this major industrial plant. In this case, the risk of harm to the public is potential, not imminent or certain, and Reserve says it earnestly seeks a practical way to abate the pollution. A remedy should be fashioned which will serve the ultimate public weal by insuring clean air, clean water, and continued jobs in an industry vital to the nation's welfare.

The admonition of Chief Justice Burger, sitting as a circuit justice, in refusing a stay order in Aberdeen & Rockfish R.R. v. SCRAP, 409 U.S. 1207, 93 S.Ct. 1, 34 L.Ed.2d 21 (1972), is pertinent here:

> Our society and its governmental instrumentalities, having been less than alert to the needs of our environment for generations, have now taken protective steps. These developments, however praiseworthy, should not lead courts to exercise equitable powers loosely or casually whenever a claim of "environmental damage" is asserted. * * * The decisional process for judges is one of balancing and it is often a most difficult task. [*Id.* at 1217–1218, 93 S.Ct. at 7.]

Reserve must be given a reasonable opportunity and a reasonable time to construct facilities to accomplish an abatement of its pollution of air and water and the health risk created thereby. In this way, hardship to employees and great economic loss incident to an immediate plant closing may be avoided. *See* Georgia v. Tennessee Copper Co.,

84. *See* p. 506 *supra*. This commitment exceeds by 40 to 60 million dollars the amount found by the district court that Reserve could afford to spend to abate the hazards. *See* 380 F.Supp. at 19.

206 U.S. 230, 239, 27 S.Ct. 618, 51 L.Ed. 1038 (1907); United States v. City and County of San Francisco, 23 F.Supp. 40, 53 (N.D.Cal.1938), rev'd, 106 F.2d 569 (9th Cir. 1939), rev'd (aff'g district court), 310 U.S. 16, 60 S.Ct. 749, 84 L.Ed. 1050 (1940); *see also* Transcontinental Gas Pipe Line Corp. v. Gault, 198 F.2d 196, 198 (4th Cir. 1952).

We cannot ignore, however, the potential for harm in Reserve's discharges. This potential imparts a degree of urgency to this case that would otherwise be absent from an environmental suit in which ecological pollution alone were proved. Thus, any authorization of Reserve to continue operations during conversion of its facilities to abate the pollution must be circumscribed by realistic time limitations. Accordingly, we direct that the injunction order be modified as follows.

A. *The Discharge Into Water.*

[45] Reserve shall be given a reasonable time to stop discharging its wastes into Lake Superior. A reasonable time includes the time necessary for Minnesota to act on Reserve's present application to dispose of its tailings at Milepost 7 (Lax Lake site), *see* p. 506 *supra*, or to come to agreement on some other site acceptable to both Reserve and the state. Assuming agreement and designation of an appropriate land disposal site, Reserve is entitled to a reasonable turnaround time to construct the necessary facilities and accomplish a changeover in the means of disposing of its taconite wastes.

We cannot now precisely measure this time. Minnesota must assume the obligation of acting with great expedition in ruling on Reserve's pending application or otherwise determining that it shall, or that it shall not, afford a site acceptable to Reserve. We suggest, but do not determine, that with expedited procedures a final administrative decision should be reached within one year after a final appellate decision in this case.

Upon receiving a permit from the State of Minnesota, Reserve must utilize every reasonable effort to expedite the construction of new facilities. If the parties cannot agree on the duration of a reasonable turn-around time, either party may apply to the district court for a time-table which can be incorporated in the injunction decree, subject to our review.

Should Minnesota and Reserve be unable to agree on an on-land disposal site within this reasonable time period, Reserve, Armco and Republic Steel must be given a reasonable period of time thereafter to phase out the Silver Bay facility. In the interests of delineating the rights of the parties to the fullest extent possible, this additional period of time is set at one year after Minnesota's final administrative determination that it will offer Reserve no site acceptable to Reserve for on-land disposal of tailings.

If at any time during negotiations between Reserve and Minnesota for a disposal site, the United States reasonably believes that Minnesota or Reserve is not proceeding with expedition to facilitate Reserve's termination of its water discharge, it may apply to the district court for any additional relief necessary to protect its interests. Nothing in this opinion shall be construed as prohibiting the United States from offering advice and suggestions to both Reserve and the State of Minnesota concerning the location of the site or the construction of the on-land disposal facilities.

B. *Air Emissions.*

[46] Pending final action by Minnesota on the present permit application, Reserve must promptly take all steps necessary to comply with Minnesota law applicable to its air emissions, as outlined in this opinion.

Reserve, at a minimum, must comply with APC 1 and 5. Furthermore, Reserve must use such available technology as will reduce the asbestos fiber count in the ambient air at Silver Bay below a medically significant level. According to the record in this case, controls may be

deemed adequate which will reduce the fiber count to the level ordinarily found in the ambient air of a control city such as St. Paul.[85]

We wish to make it clear that we view the air emission as presenting a hazard of greater significance than the water discharge. Accordingly, pending a determination of whether Reserve will be allowed to construct an on-land disposal site or will close its operations, Reserve must immediately proceed with the planning and implementation of such emission controls as may be reasonably and practically effectuated under the circumstances. We direct that the injunction decree incorporate ¶ B2 of the stipulation between Reserve and Minnesota relating to air emissions, reading as follows:

> However, if following final court or administrative agency action relating to the existing discharge to Lake Superior, Reserve decides to substantially suspend or reduce, or to discontinue, its pelletizing operations at Silver Bay then Reserve, upon giving reasonable notice, shall be relieved from further implementation of the compliance program scheduled in this Stipulation, provided that the Agency may reasonably retain such conditions of this Stipulation, or reasonably impose such other or modified conditions as may be appropriate in connection with such suspension, reduction or discontinuance of operations. [A.1:203.]

Assuming that Reserve is granted the necessary permits to build an on-land disposal site, the existing stipulation between Minnesota and Reserve relating to air emissions, subject to modification because of litigation delay to this date, shall serve as a general guideline for time requirements on air controls.[86] If the parties are unable to come to an accord for a time-table for installation of emission controls based upon the stipulation agreement, either Minnesota or Reserve may apply to the district court for an appropriate order to supplement the injunction decree in conformity with the views expressed here. We reserve jurisdiction to review any such supplemental order.

C. *Additional Directions.*

[47, 48] We believe some additional directions will be helpful to the district court in fashioning its decree in conformity with this opinion. The matters of furnishing Reserve with an on-land disposal site and issuing necessary permits relevant to the air and water discharges are governed by provisions of Minnesota state law. *See* Minn.Stat. Ann. §§ 116.07(4a) and 115.05 (Supp. 1974). The resolution of the controversy over an on-land disposal site does not fall within the jurisdiction of the federal courts.[87] Moreover, it follows that neither Michigan, Wisconsin, nor the environmental groups have any right of participation in that decision-making process

85. We here order Reserve to meet a court-fashioned standard which may exceed the standards of existing air pollution control regulations, excepting APC 17. The Minnesota Pollution Control Agency may condition issuance of a permit for the emission of air contaminants or the operation of an emission facility, such as the Reserve plant, upon the prevention of air pollution. Minn.Stat.Ann. § 116.07(4a). Minnesota defines air pollution as

> * * * the presence in the outdoor atmosphere of any air contaminant or combination thereof in such quantity, of such nature and duration, and under such conditions as *would be injurious to human health or welfare* * * *. [Minn.Stat.Ann. § 116.06(3) (emphasis added).]

By this injunction we impose upon Reserve the duty not only to comply with APC 1 and 5 but also to take additional steps, if any are necessary, to abate its air pollution within the meaning of Minn.Stat.Ann. § 116.06(3). The broad remedial policy behind Minnesota's pollution control laws authorizes injunctive relief of this scope. *See* Minn.Stat.Ann. § 115.071(4).

86. That stipulation may be found at A.1:198–210.

87. We note that both the district court and this court have sought to encourage a settlement among the parties on an on-land disposal site. While these efforts were judicially proper during the course of the litigation, upon entry of a judgment in this case the federal courts must permit the State of Minnesota and Reserve to resolve the question of an on-land disposal site under the appropriate state procedures.

except as may be otherwise provided by Minnesota law.[88]

Although we requested the district court to resolve all issues before it, the court reserved the question of possible fines and penalties against Reserve, stating that

> the Court has some discretion in the matter and it is this Court's view that it is not in a position to evaluate the equities until it is apprised of the course of action defendants must take in order to come into compliance with applicable law. [Order of Oct. 18 at 19.]

Unfortunately, it is possible that some parties may read this statement as a veiled threat that, if Reserve closes its plant rather than acquiesces to Minnesota's proposals for an on-land site for tailings disposal which Reserve deems unsuitable, the district court will levy substantial fines and penalties against it. While we are quite sure the district court intended no such implication and would not use its judicial power for such an improper purpose, we believe it is proper to comment that Reserve is free to close its operation if it cannot practicably meet Minnesota's requirements for an on-land disposal site without the fear of substantial fines and penalties being levied against it because of this election.

Upon remand, we suggest that the district court request Dr. Brown to advise the court concerning new scientific or medical studies which may require a reevaluation of the health hazard (either as more or less serious than as apprehended during this lawsuit) attributable to Reserve's discharges. A similar request should also be posed to Dr. Selikoff and his group of researchers. Either party may apply for a modification of the time requirements specified herein should significant new scientific information justify a reassessment of the hazard to public health.

Additionally, the district court should take proper steps to ensure that filtered water remains available in affected communities to the same extent as is now provided by the Corps of Engineers, although not necessarily at the expense of the Corps.

Finally, this court deems it appropriate to suggest that the national interest now calls upon Minnesota and Reserve to exercise a zeal equivalent to that displayed in this litigation to arrive at an appropriate location for an on-land disposal site for Reserve's tailings and thus permit an important segment of the national steel industry, employing several thousand people, to continue in production. As we have already noted, we believe this controversy can be resolved in a manner that will purify the air and water without destroying jobs.

The existing injunction is modified in the respects stated herein. This case is remanded to the district court for the entry of a decree in accordance with our directions and for such further proceedings consistent with this opinion as may be just and equitable.

ORDER ON REMAND

For reasons stated below, we find it necessary to issue this special order on remand to protect the integrity of the processes of this court.

We filed our detailed and carefully drawn, unanimous *en banc* opinion in these cases on March 14, 1975. Although these cases remained exclusively in our jurisdiction subject to any request for reconsideration by any of the parties, *see* Fed.R.App.P. 40, and before issuance of any mandate, the district court called the parties and other persons together for a hearing the very next day, March 15, 1975. After learning of this hearing through news dispatches published in the daily press, we requested that the clerk of the district court furnish each mem-

88. Minnesota, of course, in ruling upon any proposed on-land disposal site must abide by the basic principles of due process of law. Should Minnesota, acting in an arbitrary and capricious manner, deny Reserve a permit for an on-land disposal site, thus forcing Reserve to close, Reserve's claims, if any, against Minnesota resting on provisions of the state or federal constitutions are preserved by reason of our direction that Reserve's counterclaims shall be dismissed without prejudice.

ber of the *en banc* court with a transcript of the hearing.

[49] We have reviewed this transcript. We can only characterize the district court proceedings of March 15 as irregular. Indeed, since no mandate had yet been issued from this court to the district court, the various orders, directions to parties, suggestions to the Governor of Minnesota, members of Congress, and the Minnesota State Legislature, and all other actions taken by the trial judge at these proceedings are a complete nullity. Until we issue our mandate, the district court lacks jurisdiction over these cases. *See, e.g.*, G & M, Inc. v. Newbern, 488 F.2d 742, 746–47 (9th Cir. 1973); *see also* Bailey v. Henslee, 309 F.2d 840, 844 (8th Cir. 1962).

We have an additional concern over the actions of the district court judge at that hearing. The judge initiated steps which appear to be in conflict with the express language of this court's opinion of March 14, 1975. Moreover, the district court judge and counsel for certain of the plaintiffs suggested in that hearing that Reserve Mining Company will be able to continue its present discharges for seven to ten years as a consequence of our modification of the district court's injunction. We made no such prediction nor authorized any unnecessary delay in abatement of air and water discharges.[1]

We recognize that by March 15 insufficient time had elapsed from the issuance of our opinion for the district court judge and counsel to study and reflect on all matters covered in it. This lack of time may explain but it does not excuse conduct, statements, or requests for and the issuance of orders contrary to this court's opinion.

[50, 51] Because of the nature of the March 15 proceedings, we deem it necessary to advise the trial judge and counsel for all parties, including intervenors, that they must respect the letter and spirit of our opinion as incorporated in the mandate of this court. *See* In re Potts, 166 U.S. 263, 267–68, 17 S.Ct. 520, 41 L.Ed. 994 (1897); Thornton v. Carter, 109 F.2d 316, 320 (8th Cir. 1940); Goldwyn Pictures Corp. v. Howells Sales Co., 287 F. 100, 102–03 (2d Cir. 1927); *see also* Sibbald v. United States, 37 U.S. (12 Pet.) 487, 492–95, 9 L.Ed. 1167 (1838). Neither the district court nor any party is free to ignore our determinations, including the determination that "[t]he resolution of the controversy over an on-land disposal site does not fall within the jurisdiction of the federal courts[,]" opinion of March 14, 1975 at 539. We think it inappropriate to characterize such a determination as "advisory" or dictum. [Mar. 15 Tr. at 43.] Until modified by us or reversed or modified by the Supreme Court, our opinion governs the rights and obligations of the parties and all intervenors.

We expect and insist that our mandate be carried out promptly, fairly, efficiently, and without deviation from its letter and spirit. *See* Cascade Natural Gas Corp. v. El Paso Natural Gas Co., 386 U.S. 129, 136, 142–43, 87 S.Ct. 932, 17 L.Ed.2d 814 (1967). Furthermore, the district court judge should not interfere in matters concerning the parties which lie outside his jurisdiction in these cases.

[52] Finally, we believe it is appropriate to caution counsel that although each may be an adversary with regard to opposing parties, all serve as officers of the court and all are bound to respect

1. *See* our opinion of March 14, 1975, at 537–540. In light of the comments which surfaced at this March 15 hearing, we think it appropriate to note that during oral argument before us on December 9, 1974, Reserve stated that following approval by the State of the tailings disposal site now proposed, it could complete construction of new facilities in three years or less. [Dec. 9 Tr. at 26.] We also understand that partial abatement of discharges into Lake Superior would take place in advance of such construction completion date. Reserve also represented during this oral argument that it could begin installing air pollution control equipment on existing facilities immediately. [Dec. 9 Tr. at 178.] The initiation of this timetable in part now depends upon action yet to be taken by the State of Minnesota on Reserve's application for a disposal site.

and follow the law as laid down by a final appellate judgment in this case.

We direct that a copy of this order be incorporated into and made a part of the judgment on remand.

WESTERN ADDITION COMMUNITY ORGANIZATION et al., Appellees,

v.

Frank N. ALIOTO et al., Appellants.

WESTERN ADDITION COMMUNITY ORGANIZATION et al., Cross-Appellants,

v.

Frank N. ALIOTO et al., Cross-Appellees.

WESTERN ADDITION COMMUNITY ORGANIZATION et al., Appellees,

v.

Frank N. ALIOTO et al., Intervenor (Firefighters), Appellant.

WESTERN ADDITION COMMUNITY ORGANIZATION et al., Appellees,

v.

Frank N. ALIOTO et al., Intervenor (Balich), Appellant.

Nos. 74-1570, 74-1529, 74-1562 and 74-1563.

United States Court of Appeals, Ninth Circuit.

March 27, 1975.

Rehearing Denied May 30, 1975.

Plaintiffs filed civil rights class action to obtain relief against alleged discriminatory effects of written examination employed by San Francisco fire department to select new firemen. The United States District Court for the Northern District of California, William T. Sweigert, J., 369 F.Supp. 77, entered temporary order requiring that existing "Fireman H-2" vacancies in department be filled by qualified minority and nonminority applicants on an alternate basis, and defendants appealed, and plaintiffs cross-appealed from a subsequent refusal to make temporary order permanent. The Court of Appeals held that compliance with order rendered appeal moot, notwithstanding claim that controversy remained alive because ten of 118 minority applicants declined job offers, where order required no more than bona fide offers of employment, not acceptance of offers by all qualified minority applicants; further, mootness precluded consideration of question whether order mandated employment of a racial preference in violation of equal protection clause of Fourteenth Amendment, and trial court's refusal to make the temporary order permanent was not an abuse of discretion under evidence in record.

Appeal dismissed as moot; order challenged on cross appeal affirmed.

Barnes, Circuit Judge, concurred and filed opinion.

1. Courts ⇐405(2)

Since a finding of mootness serves to deprive Court of Appeals of its jurisdiction, there no longer being an actual case or controversy, Court of Appeals is obligated to consider question of mootness, even though it was not raised by parties. U.S.C.A.Const. art. 3, § 2.

2. Appeal and Error ⇐781(7)

Compliance with decree requiring existing "Fireman H-2" vacancies in San Francisco fire department to be filled with qualified minority and nonminority applicants in an alternate manner served to render moot appeal filed from decree, notwithstanding claim that controversy remained alive because ten of 118 minority applicants declined offers to fill vacancies that had been tendered to them, where decree required no more than bona fide offers of employment, rather