
RECENT DEVELOPMENTS IN WASTE MANAGEMENT

*FOREWORD BY
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Environmental protection law did not really emerge among the recent phenomena of our civilization. Many passages from the Bible or the Code of Hammurabi arguably represent the ancient predecessors of our efforts in this area. For example, the incineration of infectious waste, described in *Leviticus* 13:47-52 as a religious ritual and public health measure, remains one of the most preferred waste management techniques more than three thousand years after it was first described by Moses.

Although one can trace through time a continuous evolution in waste management regulations, Congress recently enacted three laws—the Water Pollution Control Act,¹ the Clear Air Act² and the Resource Conservation and Recovery Act³—which represented a significant departure from the Anglo-Saxon legal tradition called precedence. To understand this one must examine the meaning of “law” from the layman’s perspective.

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1. 33 U.S.C. §§ 1251-1376 (1976), *as amended by* Clean Water Act of 1977, 33 U.S.C. §§ 1251-65 (Supp. III 1979).

2. 42 U.S.C. §§ 1857-571 (1970), *amended and recodified at* 42 U.S.C. §§ 7401-7642 (Supp. III 1979).

3. 42 U.S.C. §§ 6901-84 (1976 & Supp. III 1979).

A. *The Esthetics of Environmental Protection Law*

Most people who are not legal experts view the "law" as a great mass of written rules that establishes acceptable behavior between humans. In contrast, what our environmental protection laws regulate is the relationship between humans and their environment. Specifically, environmental protection laws—in particular, the triad of statutes mentioned above—deal with the physical, chemical, and biological characteristics of our surroundings. To be sure, these laws are concerned about physical injury to humans or their property, and penalties are prescribed for the transgressor. But underlying these environmental protection laws is a more philosophical element—a concern for esthetics, those non-tangible aspects of our surroundings that contribute to the quality of *all* life and not just *human* life.

Supporting this contention is the proposition that the water pollution, air pollution, and solid waste disposal laws⁴ directly relate to the National Environmental Policy Act.⁵ This Act requires that any significant *human* activity in the United States be held in abeyance until its environmental impact is determined to be acceptable. By Congressional mandate, this is not to be limited solely to the effect some proposed activity may have upon humans. The required documentation—the environmental impact statement—must contain, whenever appropriate, an assessment of any deleterious effect upon the surrounding air, water and land. The corresponding environmental protection laws⁶ either set specific technical standards against which these effects are to be measured or establish procedures by which a governmental agency may promulgate such standards. In any event, the pervasive theme throughout the body of environmental protection law is a fundamental concern for esthetics.

Two problems inhere in this concern for esthetics. The first involves how the collective citizenry (when assembled in an administrative or legislative convocation) decides when enough is enough (an issue invariably known as the "cost-benefit" debate). The second pertains to how that same citizenry (when assembled in a judicial proceeding) decides that a legal transgression has occurred and that penalties of some sort are in order. The resolution of these problems

4. The Resource Conservation and Recovery Act, *id.*, is actually the solid waste disposal (i.e., land pollution) part of the triad referenced above.

5. 42 U.S.C. § 4321 (1976).

6. *Id.*

will be the single most important determinant affecting the viability of existing and future environmental legislation. This resolution has just begun under the prodding of a new President whose economic policy explicitly demands what environmentalists consider a wholesale dismantling of much of the regulatory system.

B. *The Cost-Benefit Debate*

The advocates of deregulation claim that existing environmental laws have been ineffective and that they have diverted capital into non-productive areas so as to place American business at a competitive disadvantage. These claims bear some examination since deregulation will, of course, affect the environment and may not make business more competitive. An experienced observer will affirm that Cartesian logic does not always apply to such actions. The revocation of a law or regulation perceived as onerous often has unexpected effects.

Just how effective (or ineffective) have environmental laws been? The answer, of course, depends on how one measures effectiveness. In terms of the total amounts of pollutants emitted into the environment, there have been some notable improvements. For example, based on information from the Environmental Protection Agency (EPA) the combined emissions of carbon monoxide and nitrogen oxides from passenger cars and taxis decreased from about eighty-five grams per vehicle per mile driven in the 1960's (i.e., prior to the 1970 Clean Air Act) to about fifty-one grams per vehicle per mile driven in 1981 (when emission controls were really effective).⁷ The steps taken to reduce emissions also resulted in average vehicle gas mileage decreasing from about 14.3 miles per gallon in 1960 to 13.5 miles per gallon in 1975.⁸ Subsequent federal requirements for greater fuel efficiency demonstrate, however, that decreased emissions do not have to result in decreased performance elsewhere.

Similar improvements demonstrate the recent progress made toward bringing other environmental problems under control. According to the EPA, total air pollution emissions from all sources (transportation, industrial, etc.) decreased between 1970 and 1974. These include an eighteen percent reduction in carbon monoxide, an

7. Bennett, *Why the Clean Air Act Needs Adjustment*, 7 E.P.A.J., No. 9, 8 (1981).

8. All statistics in this Forward are derived from the HAMMOND ALMANAC (1980); STATISTICAL ABSTRACT OF THE UNITED STATES (1980).

eight and one half percent reduction in sulfur oxides, a five percent reduction in hydrocarbons, and nearly a thirty percent reduction in particulates. While nitrogen oxides were a disappointment (an increase of little over ten percent), the quantity emitted into the atmosphere was more than offset by reductions in the other pollutants, for an overall reduction of about ten and one half percent between 1970 and 1974 for the five pollutants just mentioned.

The picture for many other environmental problems appears ambiguous, or even discouraging. For example, according to the United States Coast Guard the pollution of United States waterways (which includes coastal waters as well as lakes, rivers, etc.) by oil increased slightly from about fifteen million gallons in 1970 to nearly seventeen million in 1974, then decreased to slightly less than fifteen million gallons in 1975. And the dumping of industrial waste on or in the soil itself has become a near disaster, as will be discussed in some of the following articles. Still the fact remains that there has been a partial improvement in the environment. The Atlantic Salmon has begun to return to the rivers of Maine and the Sockeye Salmon has reappeared in the streams and rivers around Washington's Puget Sound. The Peregrine Falcon has made a small but very significant return to the New Jersey meadows. Many urbanized rivers, such as the Charles in Boston or the Harlem in New York City, are no longer the foul sewers they once were. Such events should be greeted with joy, since they are sensitive indicators of a change in our previous predatory attitude toward our environment. Thus, the qualitative and quantitative evidence does not lend credence to the claim that environmental laws have not been effective.

If anything, the modest improvements seen, coupled with the blunt evidence that much of the environment still remains despoiled, should prompt a more vigorous commitment to continue, and improve, the efforts made so far. Certainly, the environmental damage accumulated through decades of neglect or outright misuse cannot be mended in a year or two. Some pollutants are not biodegradable. For example, non-biodegradable polychlorinated biphenyls, (PCB's) were not banned until nearly forty years after their 1929 introduction to the electric power generation industry. In the interim, literally millions of tons of PCB's have accumulated at the bottom of rivers and in the soil. Removal and disposal of this accumulation by high temperature incineration will require unprecedented effort. On the basis of scientific or technical grounds it is clearly premature to abandon this effort.

What about the criticism based on economic grounds? Many argue that environmental protection costs too much, the costs outweigh the benefits or the necessary investment is non-productive or, more emotionally, jobs will be lost because American industry cannot compete with foreign industry. According to the Department of Commerce, the export of American goods and services has regularly exceeded imports for at least the last eighty years. The sole exceptions to this have occurred in the last decade or so and are primarily the result of sharp increases in the price of imported oil produced by the OPEC cartel. Although these distortions have caused economic havoc, oil imports still represent but a fraction of the total U.S. foreign trade. Indeed, on several occasions, American exports have actually offset OPEC-controlled imports and have produced a trade surplus.

Even more compelling is that fact that some of the primary targets of environmental legislation—the manufacturers of basic chemicals, fertilizers and plastics—have consistently produced exports that have exceeded similar imports, often by a factor of two to one in dollar value. The same is more or less true of other industries (machinery, computers, aircraft, medicines, etc.) as well as agriculture. During the last thirty years, the United States, with about five percent of the world's population, has been responsible for twelve to seventeen percent of the world's exports. Apparently, large numbers of American businesses manage to do quite well in the international marketplace. So, what is the basis for the claim that environmental legislation makes American industry non-competitive? The ostensible answer lies in the economic problems now assaulting a small number of very large companies which, because of their size, affect virtually all the rest.

It is indisputable that the steel and automotive industries are in very big trouble, both domestically and internationally. The dollar value of United States imports of iron and steel products often exceeds exports by a factor of nearly ten to one. While the exports of some types of transportation equipment, such as railway and aircraft, do very well, the importation of foreign-made passenger automobiles has become so huge that the overall dollar value of imported transportation equipment now exceeds exports by as much as a factor of two to one each year. According to the Motor Vehicle Manufacturers Association, imported automobiles have increased from 11.7 percent

of the American market in 1969, to 21.8 percent in 1978.⁹

But is this increase in automobile imports due, in any significant part, to environmental legislation? The evidence suggests that other factors have far more significance. Imported cars must conform to exactly the same safety and pollution regulations as the domestic ones. Such requirements are based on human safety or ecological criteria that are generally independent of vehicle size. Therefore, regulatory costs are usually proportionately higher for the smaller and lower-priced imported automobile. It is difficult to believe that the ills of the auto industry are due to environmental legislation.

The same doubts apply to the problems of the steel industry. The industry is economically sick not only in the United States, but also in such other highly industrialized nations as Great Britain and France. The most likely reason for the poor competitive position of steel is that it is produced by a "mature" industry having an easily transferred technology. Producers can, and do, build steel mills anywhere since their construction and operation no longer require esoteric technical knowledge. Under such conditions, lower manufacturing costs (especially wages), union work rules, monetary interest rates, discriminatory import duties, direct or indirect export subsidies, and differing antitrust laws (if any) become the significant economic factors in plant siting. Changing our environmental protection laws would do little to compensate for these factors.

What about the claim that environmental legislation diverts investment into non-productive areas? In the last one hundred years, the only major technological innovations in the manufacture of steel have been the basic oxygen process (BOP) and the continuous casting of steel slabs. Interestingly enough, not only are these processes more labor efficient, they are also more energy efficient and less occupationally and environmentally dangerous than the open hearth or Bessemer furnaces and ingot-rolling mills they replace. Instead of taking advantage of these technical innovations, the steel industry suggests that the lifetime of existing equipment should be extended by dispensing with anti-pollution controls such antiquated processes would otherwise require.¹⁰

9. The current figure for 1981 is now running well over 30 percent according to verbal information from the Motor Vehicle Manufacturers Association in Washington, D.C.

10. Current interest rates (exceeding 20% at times) obviously militate against either of these alternatives. However, the technical innovations mentioned were avail-

In a parallel fashion, the only recent innovation in automobile manufacturing has been the introduction of computerized, industrial robots. While robots probably offer negligible environmental advantages, they do have a significant potential for reducing occupational hazards along with manufacturing costs. Yet, only reluctantly have American auto makers begun to use them, preferring instead to seek government-backed loans, deferred or reduced employee wages and benefits, and favorable tariffs and import quotas. Again, it is hard to understand how environmental deregulation could possibly offset such self-inflicted economic wounds.

Still, even if legislation does divert investment from the steel or automobile industries, then one also must recognize that this process does have benefits. The diverted capital is most certainly being put to use. It pays for the design and manufacture of smoke precipitators, sewerage treatment plants and other anti-pollution devices. It generates jobs and provides wages. The new and relatively unexploited technical field it now supports has an enormous potential that is only just beginning to be realized. Thus the diverted capital may eventually employ far more people in these new industries.

Another factor to consider is the previously mentioned non-Cartesian consequences of revoking laws. During the last thirty years one of the most significant factors in the persistent deficit in the United States balance of payments—as contrasted to the balance of trade—has been the unrestrained export of American capital. The export of private and corporate money often exceeds the amount of money exported by our government for foreign and military aid.¹¹ Among the most profligate practitioners of overseas capital investment are the American automakers. Were environmental deregulation to occur, there is no assurance that they would reinvest any corresponding savings into American-based plants. At the same time deregulation would presumably free up the cash flow of foreign automakers who compete in the American market place, thus giving the American companies no particular advantage. These considerations would seem, by themselves, to justify retaining present anti-pollution controls.

The current debate over the costs versus benefits of environmental

able long before the rates reached such levels. It is questionable that the present consequences of such inertia is likely to be alleviated by deregulating environmental laws since these antiquated processes would still be uncompetitive.

11. See note 7 *supra*.

legislation invariably seems to focus only on the costs, primarily the economic ones. Indeed, Douglas Fraser, President of the United Automobile Workers, was recently quoted as saying, "In a just society, we [the UAW] would welcome a cost-benefit approach . . . but under the current system, all that cost-benefit analysis represents is an attempt by business and industry groups to fight the adoption of needed regulations and to avoid spending money on safer working conditions."¹² While Mr. Fraser's comments were directed at attempts to change workplace safety laws, the observation equally applies to environmental legislation. Yet, it was never the intent of the Congress to limit regulatory consideration solely to economic costs or benefits. Indeed, for certain activities (such as workplace safety rules), Congress specifically prohibited consideration of cost since safety was to receive the paramount priority.

The environmental impact statement that must accompany all major public works projects—and, depending on individual state laws, many private projects as well—requires that some attempt be made to quantify non-economic costs and benefits. Unfortunately, this has sometimes met only with partial success because an impartial measure of such phenomenon as scenic mountain views is difficult to formulate. In addition, the public's ephemeral support for such attempts often remains limited to what can be readily seen, smelled, or felt without the aid of scientific instruments. The reduction of visible industrial haze is invariably viewed as beneficial but does not by itself alleviate other environmental hazards. Thus, environmentalists face not only the chore of refocusing the current debate away from purely economic factors, but also the job of developing public support for controls on the remaining environmental hazards that are not so obvious as belching smokestacks or odiferous rivers.

C. *Judicial Enforcement*

As stated at the outset, the resolution of the cost-benefit debate is only one problem inherent in our legal concern with esthetics. The judicial process for determining that environmental legislation has been overstepped represents the other principal problem. This centers around the quality of the evidentiary showing needed to prove a violation. It is here that the influence of the legal profession will probably have the greatest impact. In the courtroom the dichotomy

12. 43 *Occupational Hazards*, No. 10, 34, (1981).

between the scientist's and the layman's perception of cause and effect is often resolved to the satisfaction of no one. The confusion caused by these differing perceptions is manifest in several examples involving the disposal of hazardous waste. Notable is the now notorious Love Canal episode and the less-well-known, but equally divisive, Woburn Dump episode in Massachusetts.

In the Love Canal episode the EPA attempted to buttress a \$124.5 million lawsuit against the Hooker Chemical Company by demonstrating that a number of people living near the dumpsite had suffered chromosomal damage. An EPA sponsored study, publicly released on May 17, 1981, appeared to substantiate the EPA claim that the Love Canal residents and their children may be subject to an increased risk of cancer and birth defects because of Hooker's activities. Then, barely ten days later, the EPA abruptly withdrew the report because a panel of eight scientists reviewing the study concluded it had no value and could not be salvaged.¹³ The dispute between the investigator who performed the original study and those who subsequently reviewed it was complex, and included a number of non-scientific issues (such as the makeup of the review panel, etc.). Yet, to the non-expert, this was another example of two presumably equally qualified experts—or group of experts—looking at the same evidence and arriving at completely opposite opinions.

Somewhat different issues arose in the Woburn, Massachusetts episode. The so-called "Woburn Dump" is actually a collection of more than a dozen different disposal sites where a wide variety of industrial wastes were deposited over a period of more than one hundred years. The complex mixture of wastes that were deposited in this relatively small, if non-contiguous, set of geographical areas included many materials known to be highly toxic since antiquity. Disposal of these hazardous wastes was typically no different from the disposal of ordinary domestic trash. Some materials were merely thrown into the back yard.

In 1979, the Massachusetts Department of Environmental Quality Engineering (DEQE) closed several wells in the area that supplied a portion of the town's water because the wells were contaminated with a half dozen or more toxic solvents and hazardous metals. At the same time, through the persistent efforts of a local minister, it was discovered that the residents of this same area suffered from an un-

13. See 208 *Science*, No. 4449, 1239 (1980).

usually high incidence of adult renal cancer and childhood leukemia. The public, quite understandably, concluded that a casual link existed between the water contamination and occurrence of these diseases.

Subsequently, a number of inconsistent factors were also discovered. For example, no unequivocal correlation could be found between the materials located in the various dumpsites and those found in the abandoned wells. Since the wellwater was definitely contaminated, this simply meant that the actual source remained to be discovered, a fact that was not especially alarming in itself. More distressing, however, was the discovery that although some of the wellwater contaminants were known (or suspect) carcinogens, they did not, so far as was then (or now) known, manifest themselves in the types of cancers actually observed in the exposed population. In a report issued by the Massachusetts Department of Public Health (DPH) the conclusions stated that while the incidence of childhood leukemia and adult renal cancer had significantly increased during the period under investigation (1969-1978), no association with the observed environmental hazards could be either proven or disproven.¹⁴ The report then suggested that further investigation into other types of lymphatic diseases and cancer as well as positive determination of the still unknown source of the contaminants actually found might eventually reveal some sort of valid correlation.¹⁵

These examples are not exclusive or unique. The scientific and technical literature contains numerous other examples of first, the subjective nature of many scientific observations, and second, the wide gap between what the scientist and the layman consider adequate proof. Yet these apparent discrepancies are more of degree rather than kind, and once understood ought not cause further confusion.

14. G. PARKER & S. ROSEN, *WOBURN CANCER INCIDENTS AND ENVIRONMENTAL HAZARDS 1969-1978* (Massachusetts Department of Public Health, Boston, MA, January 23, 1981).

15. On November 18, 1981, just before this article went to press, a Boston radio Station (WEEI) broadcast a news item stating that the Massachusetts DPH had found there was now no correlation between the contaminated wells and the cancer found in Woburn because the cancer incidents occurred before the wells were contaminated. The news broadcast did not mention whether some other type of correlation might have been discovered, but even if such a relationship is eventually found, this episode is a perfect illustration of the immense difficulty of trying to demonstrate cause and effect in epidemiological studies.

In the Massachusetts DPH study of the "Woburn Dump", the *significant* incidence of renal cancer and leukemia was defined exclusively in terms of statistical significance. The study disclosed the types of statistical tests used to examine the data and determined that the study's conclusions were supported by a high level of statistical confidence—ninety-five percent. What this means is that there was a ninety-five percent, or better, chance that these two forms of cancer were due to something other than the normal disease hazards we all face even though the precise cause could not be identified.

In the jargon of science, *all* statements have meaning only in such a statistical sense. Even when making pronouncements in a non-scientific forum, scientists still imply a statistical measure. The confidence level implied for such statements, however, may be far less than ninety-five percent. The reason for this is best illustrated by comparison with the wide range of verisimilitude associated with other types of statements. If one equates veracity with confidence level, then death-bed statements and the sworn statements made in court represent one end of the spectrum. At the opposite end might be found the "tall tales" of legends and mythology. Ordinary everyday conversation, stories in the media, public or official pronouncements, and the like would be somewhere in between.

But for any one of these various situations the statements made cannot be forced to have a completely arbitrary confidence level; otherwise their purpose is defeated. In judicial and legislative proceedings the expected confidence levels are high, but not a perfect one hundred percent. The confidence level on the low side is determined by the need for veracity. On the high side it is limited by procedural rules such as those restricting attempts to intimidate witnesses by threats of perjury sanctions or allowing physical evidence and original documents to be given greater preference than the testimony of eyewitnesses. Such considerations result in a judicially acceptable range of confidence levels even though the range is quite narrow.

By way of contrast, the confidence level of statements made by scientists can have a broader range. This results from constraints different from those experienced in the legal environment. The lower limit of the scientist's confidence level may be determined by factors similar to the courtroom's demand for veracity—the opinion of one's scientific peers. But on numerous occasions the confidence level may dip quite low because highly speculative statements are made or the nature of the data prohibits any higher degree of confidence. Such

statements most often are acceptable to the rest of the scientific community provided they are properly identified.

The upper limit of confidence level for scientific statements may also be established by pragmatic considerations similar to those used in a courtroom—such as the amount of time or money available to perform an investigation. Even at its highest point, the confidence level cannot normally be set at one hundred percent. Technical considerations, including the precision of the measurements or observations made, the number of items measured or observed, and so on, prevent the scientist from achieving one hundred percent confidence. In any event, when a scientist wishes to make a scientific statement he or she must also decide where to establish the corresponding confidence level. The scientist must take great care to ensure that the confidence level of any scientific statement is appropriate to the forum in which it is presented—such as a courtroom—and the audience to which it is directed—such as the general public. In a similar fashion, any other person who uses the data in a forum outside the scientific community must ensure that the audience understands the confidence level and other technical details. Otherwise, statistical limitations acceptable to scientists become the seeds for deviousness and confusion in the non-scientific forum. The Love Canal and the Woburn Dump episodes illustrate this syndrome.

In adjudicating the battle of experts over the Love Canal chromosomal study, the EPA ultimately tallied expert opinions as if they were votes—the opinions of the eight reviewers outweighed that of the original investigator, and the study was withdrawn. In the case of the Woburn Dump no one disputed the presence of hazardous industrial waste, the contamination of the wells, and the unusual incidence of certain types of cancers. Yet different people ascribed differing levels of causality between these factors. Acrimonious public confrontations resulted. At one extreme was the opinion of the minister, the cancer victims, their families, and many others that all these things just *had* to be linked. At the other extreme was the expert opinion of an independent state agency that linkage could neither be scientifically proven or disproven with the existing evidence. So, what is one to do?

These disputes must ultimately be resolved in the courtroom where appropriate standards of evaluating the evidence must be used. Should the scientist's range of confidence levels be the rule? Alternatively, perhaps the much narrower range of confidence levels typical of other judicial and legislative proceedings should apply. Or should

we adopt the philosophy of that ultimate courtroom arbitrator (the jury) that so often votes what it *feels* is right rather than what it is *told* is logical? The decision is neither simple to make nor obvious in its outcome. Courtroom conventions used in other areas of law may not necessarily achieve the most equitable results in the area of environmental protection.

D. *Evolution of Environmental Law*

Finally, I suggest that beyond refocusing the cost-benefit debate, developing public support for controls on other hazards, and clarifying the confidence levels expected for scientific opinions used in environmental law proceedings, the environmental statutes themselves should expand even further the principles of skepticism and prudence that lie behind so many other areas of law. When one considers the appalling damage already done, then one must consider increasing prior restraint and accountability for further depredations regardless of how small, how well intentioned or how beneficial they may be in the short run.

The five sections that follow seem to me to indicate that such an evolution has begun. Section I describes how the so-called "Superfund"¹⁶ is intended to expand the hazardous waste laws to clear up the bad practices of the past and allow individual victims easier recovery for damages suffered. Section II describes how several proposed amendments to the Atomic Energy Act¹⁷ intend to meet pervasive local opposition to the siting of nuclear waste disposal facilities. Section III describes how the Water Pollution Control Act¹⁸ and the Safe Drinking Water Act¹⁹ require changes more adequately to control the ground well injection of industrial wastes and sewerage into geological structures where they may linger with the same longevity and virulence of some of the more long-lived radioactive wastes. Section IV describes those parts of the Water Pollution Control Act²⁰ that require the upgrading of existing (if any) sewerage systems and how far we still have to go before we no longer literally

16. 42 U.S.C. § 6902 (1976).

17. 42 U.S.C. §§ 2011-2259 (1976 & Supp. III 1979).

18. 33 U.S.C. §§ 1251-1376 (1976), *as amended by* Clean Water Act of 1977, 33 U.S.C. §§ 1251-65 (Supp. III 1979).

19. 42 U.S.C. §§ 300f-j (1976 & Supp. III 1979).

20. 33 U.S.C. §§ 1251-1376 (1976), *as amended by* Clean Water Act of 1977, 33 U.S.C. §§ 1251-65 (Supp. III 1979).

foul up other people's backyards. Finally, Section V describes how these new sewerage systems have, themselves, produced a different type of waste and how the newer problem of now fouling our own backyards, rather than someone else's, has not yet been solved.

I. DEVELOPMENTS IN HAZARDOUS WASTE MANAGEMENTNANCY JAMES

A. Introduction

One of the foremost environmental problems to emerge in recent years is the disposal and containment of hazardous waste.²¹ Numerous incidents of spills, leaks, or releases of hazardous substances have come to light.²² Ensuing investigation has revealed a threat to human and environmental health of as yet unknown proportions.

The Environmental Protection Agency (EPA) estimates that hazardous waste production reached fifty-seven million metric tons in

21. An official definition of "hazardous waste" appears in the Resource Conservation and Recovery Act of 1976, 42 U.S.C. § 6903(5) (1976). In this article, however, the term will designate residues containing hazardous substances.

The term "hazardous substances" will be used in this paper to mean "elements, compounds, mixtures, solutions, and substances which, when released into the environment may present substantial danger to the public health or welfare or the environment." Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), Pub. L. No. 96-510, § 102 94 Stat. 2767 (to be codified in 42 U.S.C. §§ 9602).

22. One of the most publicized of these incidents is the Love Canal disaster. From 1942 to 1951, Hooker Chemical Corporation dumped over 21,000 tons of toxic chemical wastes into an old canal in Niagara Falls, New York. Hooker then covered the dump and conveyed the canal property to the City Board of Education. The Board built a school and playground on part of the site and conveyed the rest to the city and a developer. Some time in 1976, chemicals from the dump began to seep into the basements of houses encircling the canal. Subsequent studies and tests revealed a high incidence of miscarriage, birth defects, and other medical problems. Monitoring confirmed the existence of significant levels of toxic, carcinogenic, and tertogenic substances inside the houses and in surrounding soil and surface water. See Comment, *Hazardous Waste: EPA, Justice Invoke Emergency Authority, Common Law in Litigation Campaign Against Dump Sites*, 10 ENVTL L. REP. (ELI) 10034, 10035 (1980).

Other examples of toxic pollution are found in the contaminated groundwater of Woburn, Massachusetts; Dover and Jackson Townships, New Jersey; New Hanover County, North Carolina; Hardeman county, Tennessee; and Lathrop, California. Chemical wastes migrated from disposal sites into lakes, rivers, and streams in Muskegon, Michigan; Riverside County, California; West Point, Kentucky; and Saltville, Virginia. Fires and explosions erupted at disposal sites in Gary, Indiana and Elizabeth, New Jersey. See Parisi, *Who Pays? Cleaning up the Love Canals*, N.Y. Times, June 8, 1980, § 3, at 1, col. 1. See also Magnuson, *The Poisoning of America*, TIME, Sept. 22, 1980, at 58.