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UNITED STATES OF AMERICA, THE STATE OF NEW YORK, and UDC-LOVE CANAL, INC., Plaintiffs, v. (Love Canal Landfill) HOOKER CHEMICALS & PLASTICS CORPORATION; HOOKER CHEMICALS CORPORATION; OCCIDENTAL PETROLEUM INVESTMENT CORPORATION; THE CITY OF NIAGARA FALLS; and THE BOARD OF EDUCATION OF THE CITY OF NIAGARA FALLS; Defendants.

79-CV-990C

UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF NEW YORK

850 F. Supp. 993*; *1994 U.S. Dist. LEXIS 3237

March 17, 1994, Decided

CASE SUMMARY:

PROCEDURAL POSTURE: Plaintiff state and plaintiff federal government brought suit against defendant chemical corporation to recover costs of cleaning up and insuring the safety of a landfill pursuant to the Comprehensive Environmental Response and Liability Act, *42 U.S.C.S. § 9607(a)*.

OVERVIEW: Plaintiff state and plaintiff federal government sued defendant chemical corporation for funds used to clean up a landfill pursuant to the Comprehensive Environmental Response and Liability Act (CERCLA), *42 U.S.C.S. § 9607(a)*. This clean up was authorized when New York declared a state health emergency when a noticeable quantity of defendant's chemical residue began surfacing and seeping into homes. Plaintiffs claimed that defendant was liable for punitive damages in addition to compensatory damages under the New York state common law for the public nuisance created by the chemical residues. Plaintiffs also urged that the evidence of chemicals leaching out from the landfill should have been considered as at least partial proof of defendant's knowledge and intent at the time of the deposit of waste. The court held that although plaintiffs documented many specific instances of defendant's negligence, they failed to prove by a preponderance of the evidence that defendant's actions and omissions in operating the canal landfill displayed a reckless disregard for the safety of others. Thus, plaintiffs did not meet the standard necessary for an award of punitive damages under CERCLA.

OUTCOME: The court denied plaintiff state and plaintiff federal government's request for punitive damages against defendant chemical corporation because plaintiffs failed to prove by a preponderance of the evidence that defendant's conduct at a landfill met the standard necessary to secure the award under the Comprehensive Environmental Response and Liability Act.

LexisNexis(R) Headnotes

Civil Procedure > Remedies > Damages > Punitive Damages

Torts > Damages > Punitive Damages > Conduct Supporting Awards

[HN1] Punitive damages may be awarded if the defendant's conduct was determined to be wanton and reckless' or done in such a manner and under such circumstances as to show heedlessness of or utter disregard of the effect upon the rights and safety of others. While each state employs its own specific language to describe conduct warranting punitive damages, most circuits relying on state standards include the same or equivalent terms.

Civil Procedure > Remedies > Damages > Punitive Damages

Torts > Damages > Punitive Damages > Conduct Supporting Awards

Torts > Negligence > General Overview

[HN2] A reckless disregard of safety is defined as follows: the actor's conduct is in reckless disregard of the safety of another if he does an act or intentionally fails to do an act which it is his duty to the other to do, knowing or having reason to know of facts which would lead a reasonable man to realize, not only that his conduct creates an unreasonable risk of physical harm to another but also that such risk is substantially greater than that which is necessary to make his conduct negligent.

Civil Procedure > Remedies > Damages > Punitive Damages

Torts > Negligence > Standards of Care > General Overview

[HN3] In negligence law, an understanding of what the industry was doing at the time helps determine whether a particular defendant exercised due care.

Torts > Negligence > Standards of Care > General Overview

[HN4] The trier of fact must weigh the probability of harm, its severity, defendant's knowledge, and other circumstances. While there is no formula for assigning relative weights for each factor, when the harm is likely to be severe, the weight assigned to conformity is greatly diminished. And where the defendant knew the serious hazard to be "a particular and known condition, the custom defense is defeated.

Evidence > Relevance > Relevant Evidence

[HN5] Evidence of industry practice of warnings where exposure to extremely hazardous chemicals may occur may be so devoid of probative value as to be inadmissible. These principles apply with equal force to determination of reckless conduct.

Civil Procedure > Remedies > Damages > Punitive Damages

Torts > Damages > Punitive Damages > Conduct Supporting Awards

[HN6] Punitive damages in New York State may be assessed against a wrongdoer for conduct which shows reckless or wanton disregard of safety or rights.

Torts > Negligence > Duty > General Overview

[HN7] The New York caveat emptor doctrine of the day imposes no general duty on a seller's part to disclose. Rather, the buyer had to satisfy himself as to the quality of the property.

Real Property Law > Deeds > Delivery

Real Property Law > Purchase & Sale > Fraudulent Transfers

Torts > Negligence > Duty > General Overview

[HN8] The exception to this general rule as applied to nuisance claims in the early 1950s required sellers to disclose latent, dangerous conditions about which they had knowledge. The seller could not prevent purchasers from examining the property or other relevant information. Conversely, purchasers could not claim fraudulent conveyance where, at the time of sale, they were aware of the relevant problem or capable of ascertaining it. This rule applied equally to transfers for value and to gifts of property.

Torts > Negligence > Duty > General Overview

Torts > Procedure > Commencement & Prosecution > Survival > Particular Causes of Action

[HN9] While a former landowner's liability in nuisance for off-site property damage terminated when the buyer had a reasonable time to discover and abate the condition, a 1926 New York Court of Appeals decision held that a former landowner could be found liable for off-site personal injury if it had created the nuisance that caused the injury.

Real Property Law > Torts > Nuisance > Types > Public

Nuisance
Torts > Premises Liability & Property > Lessees & Lessors > Liabilities of Lessors > General Overview
Torts > Premises Liability & Property > Lessees & Lessors > Nuisance
[HN10] Moreover, under landlord-tenant law, when a landlord was required to abate a nuisance, the fact that the nuisance was on land he no longer possessed did not remove his duty to abate it. The landlord was also liable to third parties for injuries resulting from a public nuisance from the time he knew of the dangerous condition, even after he had let the premises.

Torts > Negligence > Duty > Foreseeability of Injury
Torts > Products Liability > Duty to Warn
[HN11] Products liability law creates a higher standard for post-transfer disclosure and remedy of defects for a product sold to the public than does property law, because the assumption is that the producer not only has superior knowledge at the time of transfer but continually increases that knowledge in efforts to improve the product. In the products liability realm, the duty to warn encompasses an obligation to advise foreseeable users of the nature and mechanism of the injury which is known to be associated with product use, along with appropriate precautions.

COUNSEL: [**1] UNITED STATES DEPARTMENT OF JUSTICE, Environmental and Natural Resources Division, (LEWIS M. BARR, ESQ.; STEVEN NOVICK, ESQ.; and JARED SNYDER, ESQ., of Counsel), Washington, D.C., and PATRICK H. NeMOYER, ESQ., United States Attorney (MARTIN J. LITTLEFIELD, ESQ., of Counsel), Buffalo, New York, for Plaintiff United States of America.

G. OLIVER KOPPELL, ESQ., Attorney General of the State of New York (EUGENE MARTIN-LEFF, ESQ.; ROBERT E. HERNAN, ESQ.,C. MICHAEL BRYCE, ESQ.; and H. JOHANNES GALLEY, ESQ.; OYMIN CHIN, ESQ, of Counsel), New York, New York, for Plaintiff State of New York.

PIPER & MARBURY (THOMAS H. TRUITT, ESQ.; STEVEN K. YABLONSKI, ESQ., and ANTHONY L. YOUNG, ESQ., of Counsel), Washington, D.C., PHILLIPS, NIZER, BENJAMIN, KRIM & BALLON (LOUIS NIZER, ESQ., and GEORGE BERGER, ESQ., of Counsel), New York, New York, and PHILLIPS. LYTLE, HITCHCOCK, BLAINE & HUBER (DAVID K. FLOYD, ESQ., of Counsel), Buffalo, New York, for Defendant Hooker Chemicals & Plastics Corporation.

GELLMAN, BRYDGES & SCHROFF (EARL W. BRYDGES, JR., ESQ., and RICHARD STANTON, ESQ., of Counsel), Niagara Falls, New York, for Defendant City of Niagara Falls.

PHELPS, GRAY & HEWITT (BENJAMIN N. HEWITT, [**2] ESQ. and JAMES P. HEWITT, III, ESQ., of Counsel), Niagara Falls, New York, for Defendant Board of Education, City of Niagara Falls.

HURWITZ & FINE (THEODORE J. BURNS, ESQ., of Counsel), Buffalo, New York, for Defendant County of Niagara.

JUDGES: CURTIN

OPINION BY: JOHN T. CURTIN

OPINION

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In 1979, plaintiffs State of New York ("State") and the United States of America ("United States") brought suit against defendant Hooker Chemicals & Plastics Corporation ("Hooker," "OCC," or "the Company") [1] to recover the costs of cleaning up and insuring the safety of the Love Canal area pursuant to Section 107(a) of the Comprehensive Environmental Response, Compensation and Liability Act, *42 U.S.C. § 9607(a)* ("CERCLA"), [*998] and New York common law of public nuisance. Between 1942 and 1954, the site was used by Hooker as a landfill for toxic chemical wastes from its Niagara Falls plant. In 1953, the Company transferred the site to the City of Niagara Falls School Board ("School Board" or "Board"), and an elementary school was built in the central section the next year. A State Health Emergency was declared in 1978 when a noticeable quantity of the chemical residues began surfacing and seeping into neighboring [**5] homes.

1 When this suit was filed, the defendant's official name was Hooker Chemicals & Plastics Corporation. Incorporated in the State of New York in 1909 as The Development and Funding Company, the Company first changed its name to Hooker Electrochemical Company and then to Hooker Chemical Corporation. In 1974, the Company's name became that which appears on the title of this lawsuit. It became Occidental Chemical Corporation in 1982. Throughout this decision, the designation "Hooker" is used to refer to the Company and its activities during the events in question. "OCC" is used to refer to the current defendant.

The case was bifurcated into two phases: Phase I--to determine the liability of all parties and the principles of contribution or indemnification; and Phase II--to determine the nature and amount of the remedy. Item 741 at PP 2 & 7. Prior to trial on the Phase I issues, this court granted summary judgment against the defendant for joint and several liability under both § 107 of CERCLA and the common-law [**6] public nuisance claim. *United States v. Hooker Chemicals & Plastics Corp., 680 F. Supp. 546 (W.D.N.Y. 1988)* (Supplemental Order 20); *United States v. Hooker Chemicals & Plastics Corp., 722 F. Supp. 960 (W.D.N.Y. 1989)* (Supplemental Order 41). [2]

2 In addition, the court granted summary judgment in favor of Niagara County on OCC's cross-claim against the County for indemnity or contribution (*United States v. Hooker Chemicals & Plastics Corp., 739 F. Supp. 125 (W.D.N.Y. 1990))*, and denied OCC's motion to dismiss the State's claim for punitive damages or, in the alternative, for partial summary judgment on that claim. *United States v. Hooker Chemicals & Plastics Corp., 748 F. Supp. 67 (W.D.N.Y. 1990)*. The court has also granted in part OCC's motion to compel discovery from the United States relating to the issue of whether the United States Army ("Army") had also dumped hazardous substances at the Love Canal landfill, notwithstanding any privileges that might otherwise have precluded access to the information, but denied as premature OCC's motion for sanctions against the United States. *United States v. Hooker Chemicals & Plastics Corp., 136 F.R.D. 559 (W.D.N.Y. 1991)*.

[**7] The State's claim for punitive damages, based upon OCC's creation of a public nuisance at Love Canal in allegedly reckless disregard of the health, safety, and property of the local residents, as well as various counterclaims and cross-claims, remained for trial, which began on October 24, 1990. Testimony was heard

through June 25, 1991, and the parties made closing arguments on January 7, January 29, February 11, and February 12, 1992. The following decision pertains solely to the punitive damages claim. The balance of the issues covered by the Phase I trial will be addressed separately in future orders. [3]

> 3 The Phase I trial also encompassed OCC's counterclaims against the State, the City of Niagara Falls ("City"), the Board of Education of the City of Niagara Falls under CERCLA § 107(a), and the common law of public nuisance, and against the United States under CERCLA § 107 (a)(3). The City's cross-claim against OCC for response costs for creation of a public nuisance is included as well.

The State claims that [**8] OCC is liable for punitive damages for Hooker's activities and omissions regarding the method of waste disposal at Love Canal, the site's transfer to the School Board in 1953, and a subsequent failure to respond adequately to the problems and potential hazards which arose once Hooker relinquished control of the Canal area. In its proposed conclusions of laws (Item 1175 at 363), the State asserts that Hooker acted with reckless or wanton disregard for the health and safety of others in each of five particulars:

> 1. Knowingly dumping tons of toxic chemicals in a canal used as a recreational area by children, with knowledge of actual and potential exposure of these children, and others, to harm;
>
> 2. Failing to fence a contaminated swimming and recreational area or to institute other protective measures, including warnings, in the face of knowledge of actual and potential exposure of children, and others, to harm;
>
> 3. Abandoning an insecure toxic landfill knowing children and an increasing population of residents abutting the [*999] Canal would be exposed to toxic chemicals as a result of subsidence and subsurface migration;
>
> 4. Transferring a toxic waste dump to an inappropriate [**9] custodian, the Board of Education of the City of Niagara Falls, while imparting insufficient information of hazards to the School Board given Hooker's special knowledge of toxicity of its own waste materials;
>
> 5. Failing to reassume responsibility for the maintenance of a transferred toxic waste dump after exposure of the public to the wastes had become recurrent and widespread.

The heart of the case presented by the State to meet its burden of proof and the rebuttal evidence of OCC lies in the transfer of the site to the School Board. Indeed, the State asserted that if Hooker had kept control over Love Canal, there would not have been a punitive damages claim. Item 1186 at 34. Thus, the following discussion focuses on that event, but an examination of the transfer and its attendant problems also necessitates a description of the area and its history before, during, and after Hooker's tenure.

Before setting forth the factual findings, a few general remarks should be made about the unusual difficulties facing the litigants and the court in this case. While a trial which lasts over 70 days is in itself not extraordinary, such a lengthy trial, coupled with voluminous, weighty [**10] documents and conflicting scientific evidence made reaching a fair conclusion an arduous task. The difficulty was increased by the fact that almost all of the evidence concerned events which occurred 40 to 50 years ago, and the authors of most of the documents were unavailable for examination to help interpret their content.

The testimony at trial and in deposition came from employees and contractors of Hooker, School Board members, area residents, and experts. However, many of the individuals who were in executive positions at Hooker or who were on the School Board at the time of transfer died before trial or deposition. Of those who did testify, some found it difficult to recall exactly what occurred, or were not in a position to control policy or to know exactly why certain decisions were made. My assessment of both parties' witnesses is that their recollection was often influenced by the passage of time, rumor, subsequent conversations, media coverage, and their interest in the outcome of the case.

Therefore, despite the large number of witnesses overall, the parties offered little reliable testimony in support of their positions on several crucial issues. Occasionally, both [**11] parties offered the same testimony, but with different interpretations. For example, Jerome Wilkenfeld, a long-time Hooker employee, was called as a witness by both the State and OCC. He started working for Hooker in 1935, functioned as a junior executive in the 1940s and early 1950s, and eventually rose to a senior management position. Hooker relied on his testimony to prove that it acted responsibly, while the State offered the same testimony to show that Hooker acted recklessly. At the time of the disposal operation in the 1940s and the transfer in the early 1950s, Wilkenfeld was not at the decision-making level. He did not know how the top management arrived at certain essential decisions, but was able to provide background and the result of investigations which he was ordered to make. He gave his personal opinion as to the worth of certain Hooker decisions, but he was not privy to all the information known to management and how those in charge reached their decisions.

For some events, no live testimony was presented. For example, no School Board members who were intimately connected with the transfer were available. In other instances, it was difficult to assess the reliability [**12] of the testimony. The witnesses who had lived in the Canal area and described the events of the 1940s and 1950s were often in their early teens or younger during the relevant time period. Some only recalled one or two particular events and had difficulty pinpointing when they occurred, creating problems when timing became important in the context of the case. Many of these witnesses had little reason to remember the events precisely, and their testimony often differed [*1000] from those who actually participated in the digging and disposal operation. For all these reasons, the testimony must be approached cautiously.

The court was frequently asked to rely on contemporaneous letters and documents of Hooker employees and management. In almost every case, the writer was not available for cross-examination. Even when an author did testify, the circumstances surrounding the writing of the document, the reason why it was written, the writer's position in the Company, and the source of his information were often difficult to reconstruct. When the accuracy of the document could not be tested by examination, its credibility was necessarily limited.

Difficulty in pinning down the State's legal theory [**13] concerning Hooker's liability for punitive damages added to the evidentiary problems. Although the State asserted that its principal claim related to the transfer, both parties devoted considerable attention in their briefs and during oral arguments to Hooker's dumping practice at the landfill, the conditions there during and after disposal, and the ultimate leaking of leachate to the surrounding area.

The importance of risk assessment, a scientific method of estimating how a given population's past and current exposure to toxic wastes might affect future health, was debated. Before trial, the State objected to the receipt of risk-assessment evidence; but its introduction was permitted because the court thought that it might have some bearing on Hooker's knowledge and intent and might be of assistance in resolving the cross-claims and counterclaims. Much time was spent in listening to this complicated and conflicting testimony. At the conclusion of trial, all agreed that this evidence was not helpful. See Closing Arguments of January 7, 1992. The State's motion to preclude risk assessment evidence, denied prior to trial, is hereby granted.

OCC argued that its actions had to be [**14] judged within the context of industry practice of the time. While the advances in science and engineering made since the 1940s would lead contemporary environmentalists to condemn many of the practices used by Hooker at Love Canal, it would be unfair to judge the Company by the application of knowledge obtained after the disposal and transfer were completed. Therefore, an effort was made to ascertain the disposal methods of the industry and extent of Hooker's knowledge compared to its competitors. Many difficult legal questions had to be considered. Did the State have the authority or standing to press a civil punitive damages claim instead of charging a violation of criminal law? If so, what was the proper legal standard? Did the statute of limitations foreclose suit after the passage of many years? After intensive study and debate in the years following Hooker's waste disposal at Love Canal, both state and federal governments enacted environmental statutes providing for civil and criminal sanction. However, not a single piece of legislation provides for punitive damage. Under these circumstances, should the State be permitted to rely upon the common law in seeking punitive relief,

[**15] especially as the authority for a government to seek punitive damage is scant?

An array of questions regarding the appropriate legal standard and the type of evidence necessary to sustain the burdens of proof was also considered. What was the appropriate burden of proof? What was the state and applicability of property and products liability law at the time of the transfer? What responsibilities did Hooker have after the transfer? Should the eventual sub-migration of leachate in the late 1970s be considered in this phase?

As a result, a discussion of the legal standard concludes Part I, prefacing the factual findings in this decision. It is hoped that an exposition of the standard will put the facts in context and explain the relative weight given to certain events and details. Part II, the factual section, begins with a brief history of Hooker Chemical Corporation in Niagara Falls and the factors precipitating the need for a waste disposal site, followed by a description of the means by which the Company obtained and prepared the site and ran its disposal operation between 1941 and 1954. Parts III and IV recount the transfer of the site to the School Board and the post-transfer [*1001] events [**16] of the 1950s and 1960s, including the activities of third parties at the site. Part V summarizes the investigation which led to State and Federal intervention at Love Canal in 1978 and reviews the geological and stratigraphical evidence which explains the chemical migration off the site. Hooker's knowledge of the hazards of disposal and the state of industry practice is explored in Part VI. In Part VII the legal analysis is applied to these facts.

This is not the full story of Love Canal. Much of the information reported in books and through the media which form the basis of public opinion was not included in the trial for punitive damages. In particular, the court was presented with no evidence of any serious personal injury in this phase of the proceedings. The large number of exhibits and the length of the testimony forced the court to rely heavily on the parties to identify and emphasize those aspects which they deemed important. Many marked exhibits and much testimony taken at trial were never mentioned again, or only given slight attention at briefings. Further, the evidence was limited to the problems which arose at the site and in the houses on the immediate perimeter (Ring [**17] I homes), risk assessment was not considered, and the theory of punitive damages urged by the State focused the trial on Hooker's knowledge of the potential for harm rather than the actual harm which may have occurred. With these limitations, the court has attempted to sift carefully through the voluminous documentary evidence and witness testimonies to determine what occurred and to reach a fair conclusion. The findings of fact and conclusions should be accepted in this light.

B. LEGAL STANDARD OVERVIEW

The Second Circuit's standard for what constitutes the requisite showing for an award of punitive damages was defined in *Roginsky v. Richardson-Merrell, Inc., 378 F.2d 832 (1967)*. "[HN1] Punitive damages may be awarded if the defendant's conduct was determined to be 'wanton and reckless' [or] . . .'done in such a manner and under such circumstances as to show heedlessness of or utter disregard of the effect upon the rights and safety of others . . . .'" *Simpson v. Pittsburgh Corning Corp., 901 F.2d 277, 282 (2d Cir. 1990)* (reaffirming Roginsky). While each state employs its own specific language to describe conduct [**18] warranting punitive damages, most Circuits relying on state standards include the same or equivalent terms as those in Simpson. [4] See, e.g. *Borden v. Paul Revere Life Ins. Co., 935 F.2d 370 (1st Cir. 1991)*(Rhode Island--willfulness, recklessness or wickedness which for the good of society and warning to the individual ought to be punished); *Marshall v. El Paso Natural Gas Co., 874 F.2d 1373 (10th Cir. 1989)* (Oklahoma--wanton or reckless disregard for rights of plaintiff); *Ingram v. Acands, Inc., 977 F.2d 1332 (9th Cir. 1992)* (Oregon--wanton disregard for the health, safety and welfare of others); *Glasscock v. Armstrong Cork Co., 946 F.2d 1085, 1097 (5th Cir.1991)*, cert. denied, *112 S. Ct. 1778 (1992)* (Alabama--acting willfully, maliciously, intentionally, or with heedless and reckless disregard for plaintiff's rights). The *Restatement (Second) of Torts § 500* (1965), [HN2] defines a reckless disregard of safety as follows:

> 4 For a complete list of punitive damages standards by state, see Punitive Damages: Law & Practice § 5.01, Clark, Boardman, Callaghan (1987 & Supp. 1992).

[**19]

> The actor's conduct is in reckless disregard of the safety of another if he does an act or intentionally fails to do an

> act which it is his duty to the other to do, knowing or having reason to know of facts which would lead a reasonable man to realize, not only that his conduct creates an unreasonable risk of physical harm to another but also that such risk is substantially greater than that which is necessary to make his conduct negligent.

The State claims that OCC is liable for punitive damages in addition to compensatory damages under New York State common law for the public nuisance created by the chemical residues which surfaced and the leachate which flowed out of the Love Canal landfill. The State argues that punitive damages are appropriate in this case to punish OCC and serve as a warning to others. *Home Insurance Co. v. American Home* [*1002] *Products Corp., 75 N.Y.2d 196, 203, 551 N.Y.S.2d 481, 550 N.E.2d 930 (1990)*. Environmental actions are "a fair field for punitive damages." *Doralee Estates v. Cities Service Oil Co., 569 F.2d 716, 722 (2d Cir. 1977)*. "Those who have been given authority [**20] to avert environmental damage should be given some incentive to do so. 'Smart money' is the traditional way . . . . Id.

The State further asserts that there is no requirement that serious injury or damage occur in order to warrant punitive damages. "Although a defendant has inflicted no harm, punitive damages may be awarded because of, and measured by, his wrongful purpose or intent . . . ." 4 *Restatement of Torts 2d. § 908* (1979). This court agreed prior to the Phase I trial that "evidence of actual adverse health effects is . . . unnecessary to the question of proof of a health threat." Supp. Order 16, Item 573 at 6. However, in all the cases involving environmental polluters submitted by the State in support of an award of punitive damages, the defendant corporations had prior knowledge that serious harm had occurred or had been cited for violations of health codes or regulations and had failed to respond. See, e.g., *Doralee Estates, 569 F.2d at 716*; *Sterling v. Velsicol Chemical Corp., 855 F.2d 1188 (6th Cir. 1988)*; *Exxon v. Yarema, 69 Md. App. 124, 516 A.2d 990 (1986)*, [**21] cert. denied, *309 Md. 47, 522 A.2d 392 (1987)*. In fact, the State did not present a single case in which punitive damages were awarded absent actual serious injury.

Prior to trial, the court denied OCC's motion for partial summary judgment on the punitive damages claim, postponing a final determination of whether punitive damages were available to the State until a more complete record was made. *U.S. v. Hooker Chemicals & Plastics Corp., 748 F. Supp. 67 (W.D.N.Y. 1990)*. In its post-trial brief, OCC reiterated some of the arguments made in its pretrial motion, once again urging the court to reject the punitive damages claim as a matter of law. [5]

> 5 OCC also argues that the State's claim is barred by a three-year statute of limitations for tortious nuisance actions in New York because, unlike the accrual date for compensatory damages (which is measured from the day the condition exists), accrual for punitive damages is based entirely on the conduct of the defendant which gave rise to the underlying cause of action. Item 1178 at 22-26. Most recently, OCC called to the court's attention a New York Court of Appeals decision, *Jensen v. General Electric Co., 82 N.Y.2d 77, 623 N.E.2d 547, 603 N.Y.S.2d 420*, Oct. 21, 1993, which concerns the statute of limitations under *C.P.L.R. 214-c(2)* as applied to recovery of damages for a continuing nuisance. Although *§ 214-c(2)* became effective in 1986 and is not applicable to this case, OCC contends that Jensen confirms its assertion that public nuisance claims filed prior to 1986 are limited to recovery for damage incurred during the three years prior to the filing date. Item 1330.
>
> The State counters that its claim for punitive damages cannot be barred by a statute of limitations unless the underlying cause of action of public nuisance is time-barred. Item 1205 at 34-38. The State responds only briefly to Jensen, arguing that its holding is inapplicable and that the dicta regarding pre-1986 nuisance claims does not discuss punitive damages. Item 1327.
>
> My initial reading of the Jensen decision does not convince me that it is applicable. Therefore, I decline to consider this argument within the context of this decision.

[**22] OCC asserts that (1) the Penal Code provides the State with the sole punitive remedy for criminal nuisance, superseding any common-law punishment, and (2) there is neither statutory authority nor case law precedent sanctioning recovery of punitive damages by the State, as opposed to a private party. Analogous federal statutes provide the government with

the option of criminal sanctions, but not punitive damages. OCC argues strongly that the State had the recourse to use criminal penalties provided by the Penal Code, and that awarding punitive damages to a government entity for creation of a public nuisance would provide a remedy that had never been envisioned.

The State counters that these issues were fully briefed and argued prior to the denial of OCC's motion to dismiss (Supp. Order 52); but following oral argument, the court directed the parties to rebrief them. As it had previously, the State cited *City of New York v. Taliaferrow, 158 A.D.2d 445, 551 N.Y.S.2d 253 (2d Dept. 1990)*, in support of the right of government entities to recover punitive damages under the common law theory of public nuisance. It could produce no additional [**23] authority on this important question. The defendant [*1003] and the court were similarly unsuccessful.

In Taliaferrow, a civil action was brought by the City of New York under the local Nuisance Abatement Law to enjoin the use of certain premises for prostitution and to seek damages. In a prior action, an injunction had issued barring the use of the premises for such purposes. The defendant argued that relief of punitive damages should be denied because the Code provided the exclusive remedy and did not include punitive damage. The court rejected the defendant's argument, finding that the section's language authorizing enforcement "without prejudice to the use of procedures under existing . . . laws" permitted the additional imposition of punitive damage. 158 A.D. at 446.

Strangely, this is the sole authority for the State's position. Although punitive damage is an ancient remedy, it evidently has not been relied upon in the past by governmental entities seeking punitive relief. In Taliaferrow, the court was able to use favorable statutory language to help justify its authority to impose additional relief. In this case, the State's punitive damage claim [**24] is based solely on common law.

The court is also troubled by the fact that in all the state and federal environmental legislation considered and enacted in the last several decades, punitive damage relief is never included as a remedy. If the legislatures believed that additional relief should have been afforded to the State or federal government in these cases, they could have easily provided for it. The State correctly argues that there is nothing in the New York Penal Code or any other federal or state statute which precludes the State from seeking punitive damages for the tort of public nuisance in the same way that a private plaintiff could. However, OCC is also correct in countering that no New York or federal statute explicitly gives the State the right to seek punitive damage under these circumstances.

Despite the slim support for this cause of action, the court has decided not to alter its prior holding that as a matter of law, the State is not prohibited from seeking punitive damages on a common-law theory of public nuisance. While OCC correctly points out the dearth of case law directly addressing this issue, it has not offered either new argument or precedent precluding [**25] a grant of punitive damages per se under New York State law. Further, the evidence received on the punitive damage claim is pertinent to the resolution of the cross-claims and counterclaims. Therefore, the court will proceed on the theory that punitive damages are available to the State. However, the meager case law and lack of statutory support for such a determination behooves the court to approach the overall evaluation of the merits and any actual award of punitive damages with care.

OCC has raised again the question of the proper standard and burden of proof. Those issues were also dealt with in my prior decision, and I see no reason to modify them. The applicable standard of proof for punitive damages is preponderance of the evidence, which the Supreme Court held "suffices even in civil suits involving proof of acts that expose a party to criminal prosecution." *United States v. Regan, 232 U.S. 37, 47-48, 58 L. Ed. 494, 34 S. Ct. 213 (1914)*, most recently affirmed by *Pacific Mutual Life Insurance Co. v. Haslip, 499 U.S. 1, 113 L. Ed. 2d 1, 111 S. Ct. 1032 (1991)*. [**26] While both Supreme Court decisions involved private parties, this case still involves a civil remedy and does not merit the standard of proof reserved for criminal cases.

The legal standard by which Hooker's conduct should be measured in order to determine whether in fact it acted in a wanton or reckless manner has not yet been addressed. After trial, the court asked the parties to submit supplemental briefs addressing the legal nature of OCC's responsibility in terms of both existing property law and duty-to-warn products liability case law. Of particular concern were the obligations of a seller to inform the purchaser of the condition of the property at the time of purchase, the post-transfer duties to warn and remedy defects, and any impact the status of the buyer or seller may have on these duties (Supp. Order 66).

Property law at the time of the transfer [*1004] required the seller to disclose dangerous latent conditions about which it had knowledge. *McCabe v. Cohen, 294 N.Y. 522, 63 N.E.2d 88 (1945)*. However, the extent of Hooker's legal responsibility under this standard, including the nature of the disclosure, the state of Hooker's knowledge [**27] when the transfer occurred, the degree to which the Company's duty continued after it relinquished ownership is necessarily factually based. An analysis of Hooker's duty to the Board will be discussed in more detail after the facts have been presented.

II.

WASTE DISPOSAL AT LOVE CANAL

A. HOOKER'S EARLY GROWTH

Hooker was formed in 1905, and its Niagara Falls plant began operating the following year. By 1910, the Niagara Falls plant was producing 20 tons of caustic soda and 42 tons of bleach per day. Ex. 2786, p.25. In the Company's early days, the plant employed a process of electrolyzing salt to form chlorine, which was then reacted with other chemicals to form the finished products. T. 4514-15 (Wilkenfeld). The Company sold its products to the chemical industry for use in many consumer items. T. 5153-55 (Cull).

In 1915, in response to World War I shortages, Hooker built the first monochlorobenzol plant in the United States. By the end of the war, Hooker's monochlorobenzol production was the largest in the world, exceeding 1.5 million pounds a month. Id. After World War I, the Company started to diversify with other organic and inorganic compounds. [**28] By the beginning of World War II, Hooker was well known as a manufacturer of diversified chemicals, primarily based on chlorine and caustic. T. 4514-16 (Wilkenfeld).

The Company grew substantially during World War II because of the demands of the United States government and defense contractors. From 1940 until 1953, its sales grew from $ 7.1 million to $ 38.7 million. Ex. 2823, T. 1540-42 (Cull). This dramatic growth continued, and by 1970 its annual sales reached $ 450 million. T. 4542-43 (Bryant).

Until Hooker began its wartime production, it was able to sewer and dispose of chemicals on-site. Increased volume of chemical waste, combined with growing opposition to open dumping in streams, forced Hooker to consider alternative means of waste disposal. Incineration could not handle the anticipated heavy waste disposal demands. In-ground disposal developed as a viable alternative.

Hooker became interested in the nearby Love Canal site as a landfill for wastes from its Niagara Falls plant in 1941 and obtained permission from the owner, the Niagara Power Development Corporation, to use the site without the expense of an outright purchase. None of the executives who were involved in [**29] the decision to bury Hooker's wastes or in the efforts to locate a landfill area were available for trial, and the written record is quite sparse. Thus, it is very difficult to reconstruct the process by which the Company decided to use Love Canal as a landfill. However, the site posed several obvious advantages. Its proximity to the Niagara Falls plant reduced transport costs and avoided the difficulty of moving odorous chemicals long distances by truck. There was a general perception, held by Hooker executives and residents in the Niagara Falls area, that the soils at Love Canal were composed largely of clay. Lastly, there were no zoning restrictions on the Canal's use, although the Company realized that the operation of a landfill would require measures to keep people and animals from coming in contact with the wastes. Ex. 8.

B. DESCRIPTION OF THE SITE

1. Historical Development

The Love Canal site is a roughly rectangular, 16-acre parcel of land located in the City of Niagara Falls, New York. It is bounded to the west and to the east by what became the rear property lines of homes on 97th and 99th Streets, to the north by Colvin Boulevard, and to the south by what [**30] became Frontier Avenue. At the time it was acquired by Hooker, Love Canal was situated on the outskirts of the City, close to the eastern border at 102nd Street. The "northern section" of [*1005] Love Canal refers to that portion extending south from the northern boundary along Colvin Boulevard to Reed Avenue, the "central section" to that portion extending south from Reed Avenue to Wheatfield Avenue, the "southern section" to that portion extending south from Wheatfield Avenue to the southern boundary line along Frontier Avenue. See Appendix A-1, Ex. 1433.

The Canal was developed in the 1890s by an entrepreneur named William Love, who hoped to create

an industrial community which would use the Canal as a source of electric power and as a means of transportation. Love planned to connect the upper and lower Niagara River, bypassing Niagara Falls. He began excavating the Canal in 1894, but abandoned the project when he lost financial backing. Thereafter, the site remained unused, except for informal recreation by people living in the area. Evidently without objection by the owner, it was used for swimming, fishing, trapping, and ice-skating.

The unfinished Canal, located near the center [**31] of the parcel, was approximately 3,000 feet long and varied from 8 to 16 feet deep and from 60 to 80 feet wide over most of its length. In 1941, there were mounds of excavated earthen material located along most of the east and west banks of the Canal. The size of mounds varied in height from 10 to 20 feet, and in width from 30 to 40 feet. They were comprised of a mix of clay and silty sand and were covered and surrounded by various forms of vegetation, brush, and grass.

The general area was best described by two expert witnesses on photographic interpretation: Robert Colwell for the State and Samuel Gowan for OCC. They examined aerial photographs of the Canal and its environs taken between 1927 and 1979. Ex. 1216; T. 2980-3067, 3977-4055. The area portrayed was bounded by Colvin Avenue to the north, Frontier Avenue to the south, 93rd Street to the west, and 102nd Street to the east. It encompassed 250 acres, with an average of one residence per acre, including the Griffin Manor Housing Project, which was about 400 feet from the northern section of the Canal to the west. The photographs picture a mostly rural and agricultural landscape with open fields and orchards, with six homes [**32] and a church near Frontier Avenue, along what would eventually be 99th Street. T. 2991 (Colwell).

By 1928, the land immediately west and east of the Canal had been subdivided into building lots; by 1939, the City had planned the installation of Reed and Wheatfield Avenues across the Love Canal site. Before 1940, the population of Niagara Falls had been gradually spreading eastward toward and past Love Canal. This development is apparent from the aerial photographs. Still, by 1954, over 75 percent of the houses were on the east side of 99th Street. [6] Only a few homes had been built adjacent to the site when Hooker began its operations, and new street development did not materialize until much later.

6 The State asserts that the land to the east had been subdivided into individual lots, and the properties on the west side of 99th Street had already been subdivided. Item 1175, P 163. This statement is misleading. Only six houses were located on the strip of land between Love Canal and 99th Street.

The area to the east [**33] of Love Canal began to develop after 1950, when the City rezoned the east side of 99th Street (the side furthest from the Canal) from an "unclassified" to a "second residence" district. Ex. 3626 P16. Only one house was built on the west side of 99th Street during the time of Hooker's disposal operations. T. 417 (Voorhees), Ex. 1216. By 1954, 33 of the 40 homes under construction were on the rezoned east side of the Canal. Ex. 176. See Appendix A2 (Ex. 1394).

On the west side of the Canal, the Griffin Manor Housing Project was under construction by 1942, but there were no houses or streets built between the housing project and Love Canal during the period when Hooker was dumping in the northern sector. Ex. 1216. By World War II, Griffin Manor had about 750 apartments. When disposal operations began in the northern section, the nearest [*1006] house was approximately 400 feet away. Ex. 1216.

2. Soil and Drainage Conditions

Charles Adams, who began trapping in the area in the 1930s, summed up the local knowledge of the soil at the Canal. He said there was a natural well in the middle which provided a continuous flow of water. The topsoil was eight to ten inches deep, underlain [**34] by soil which was half clay and half dirt, below which was what he called Tonawanda clay, identifiable by its bluish cast. The clay was very hard and good for brick-making, but it was difficult to dig through below the surface. Generally, the soil was very poor for farming, with very little topsoil and with clay underneath. T. 37-41. Several Hooker employees confirmed that the soils were basically clay, T. 4184, 4153 (Wilkenfeld), T. 1180 (Schultz), Ex. 1704 (Colpoys), and (Ex. 119) (Klaussen), as did John Boddecker, a civil engineer employed by the City of Niagara Falls, who observed the construction of the Reed Avenue sewer in 1958. T. 10053. However, William Wagner, a contractor for Hooker who was employed in the actual disposal operation at the site, described the sides of the Canal as sandy loam. T. 815.

The drainage at Love Canal was described by Robert Cohen, one of the main hydro-geologist witnesses for the State. His report stated:

> The Love Canal landfill and area are characterized by poor natural drainage due to several factors including: A) the relatively flat topography, B) the presence of subsoils of low permeability, C) the shallow depth of the nearby river and [**35] streams, D) the rate of precipitation, E) the absence of a well-developed natural drainage network. As a result, the Love Canal site has historically experienced a high water table and both subsurface and surface drainage problems.

Ex. 718A, Finding 21. For the most part, this is a fair assessment of drainage. However, as Mr. Cohen noted, the rate of precipitation must also be taken into account. Evidence from several witnesses leads to the conclusion that the water table fluctuated. Sometimes the water in the Canal was six feet below the banks. At other times, it rose much higher, averaging two or three feet below ground level, or even at ground level, depending upon the time of the year and the rainfall. Ex. 161.

Ditches draining water into the Canal from the surrounding area, mainly from properties to the east, remained in place until about 1951. Water drained from the Canal through a swale or natural drainage way which flowed out of the Canal in a northerly direction, first to the northwest, then north, and finally northeast back across the northern edge of the site toward Black Creek. Dr. Gowan observed from aerial photographs four ditches flowing into the Canal and three [**36] flowing to the swale. Ex. 1216. Generally, the area was flat, with poor drainage. During rainy spells, the fields bordering the Canal were often wet, with puddling sometimes occurring.

Hooker's analysis of the soil and drainage conditions at the time it decided to use the Canal as a landfill was probably no more sophisticated than the descriptions given by laymen who testified. F. Leonard Bryant, who was assistant plant superintendent in 1948, testified that Hooker management did not believe there would be any difficulty with groundwater contamination, because Love Canal was looked upon as a large bathtub lined with clay through which nothing would ever go. T. 4566. The Company apparently believed that the barrier was sufficient to prevent migration of chemicals and did not seek advice from geologists.

C. DISPOSAL OPERATIONS

OCC offered evidence of the Company's preparations for use of the site. In a plan dated December 19, 1941, Hooker's Engineering Department depicted how the northern section of Love Canal would be used for disposal operations. The plan took note of the principal features of the area, including property lines, topography of the site, existing drainage [**37] ditches, surface-water flow patterns, and berms up to 13 feet high along the sides of the Canal. It also showed the proposed location of dams 60 feet long and 16 feet wide which spanned the width of the Canal, dammed-off disposal areas in the Canal, [*1007] a fence which enclosed the northern disposal areas, an access road with a gate, and a culvert under the road to maintain natural drainage. T. 5199-5205 (Cull); Ex. 1197A, 2002.

In April 1942, Hooker obtained an operating license from the Niagara Power Development Corporation to begin waste disposal operations. Shortly thereafter, the Company acquired title of the property. Hooker continued to send waste materials from its Niagara Falls plant to the Canal until 1954. At trial, most of the evidence about disposal practices was given by Hooker employees, with some reference to Hooker records. No one lived near the northern section of the Canal while Hooker was using it as a dump site, and only six to ten houses had been built close to the southern section prior to 1954, when building on 97th and 99th Streets began. For this reason, the non-Hooker witnesses who testified about the disposal operation were primarily individuals who had played [**38] at the site as children.

The evidence supports a finding that, except for the erection of a fence, the Engineering Department's plan was carried out with only slight modification. The plan provided for construction of at least two earthen dams across the northern part of the Canal before disposal operations began. The purpose of the dams was to prevent contaminated liquids from flowing from disposal areas into the rest of the Canal and nearby creeks and the swale. Ex. 46 at 1; Ex. 1216; T. 4628-29 (Gowan). At the same time, dams prevented water from adjoining areas of the Canal from entering disposal areas. Ex. 7124, No. 13 (State-OCC Stip.); Ex. 1216; T. 5096-97 (Fekete); T.

5204-05 (Cull); T. 2631 (Owens); T. 826-27 (Wagner). In addition, the dams allowed water to be pumped out of a disposal cell, if appropriate, immediately prior to waste burial. T. 826-27 (Wagner); T. 5096-98 (Fekete). The dams, which were constructed from the surrounding soil, were wide enough to accommodate vehicle traffic. T. 5096 (Fekete); T. 5204 (Cull); T. 4154-55 (Wilkenfeld); Ex. 1216. They thus created disposal cells up to 60 feet wide, several hundred feet long, and 10 feet deep. Id.

Hooker deepened [**39] and widened portions of the Canal for waste disposal. In addition, the Company dug disposal pits between the Canal and the rear property lines of residential lots on the east side of 97th Street and the west side of 99th Street. [7] The pits were generally 30 to 50 feet in diameter, 20 to 30 feet deep, and took some time to fill. In most cases, if there was water in the pit, it was pumped out before disposal began, leaving only a small amount in the bottom. Following these practices, Hooker's early dumping operations proceeded south from the northern end of the Canal.

7 These properties became known as the "Ring I" homes. The homes eventually built on the west side of 97th Street, on the east side of 99th Street, and on the north side of Colvin Boulevard between 97th and 99th Streets became known as the "Ring II" homes. See Appendix A2.

An internal Hooker memorandum indicated that the Company had determined that there were no legal restrictions on dumping "so long as the property is either owned or leased by the [**40] party doing the dumping." However, "the property should be adequately protected so as to prevent the possibility of persons or animals coming in contact with the dumped materials." Ex. 8. Therefore, the original plan included the installation of a fence that would enclose all areas in which chemical wastes were to be dumped. The fence was to run across the northern entrance, down the east and west sides of the northern section, and across the southern-most portion of the northern section where dumping was to occur. Ex. 2002. T. 6762-63. However, the general consensus among the witnesses was that the area was not fenced. While at least one internal Hooker memorandum refers to a fence around a portion of the northern section, [8] those most familiar with the area could not recall any [*1008] fence along the sides of the landfill, but only one at the northern tip of the Canal designed merely to prevent other dumpers from using the site. T. 820.

8 Ansley Wilcox, the Secretary of the Corporation, inspected the property on August 14, 1946. The next day he wrote a memorandum to President Bartlett in which he described a fence 6' high "around the part we were using for a dump, and also . . . a gate, which was kept locked at all times except when dumping was in process, in order to keep trespassers (principally children) away from the dump." Ex. 46. Wilcox also reported that the fenced area was completely filled, and dumping had begun outside the fence.

[**41] In 1946, Hooker finished the bulk of its northern section dumping and began waste disposal operations at the extreme southern end of the site near Frontier Avenue, moving northward toward the point where Wheatfield Avenue would later be built. See Appendix A1. As it had done in the north, Hooker constructed dams to facilitate disposal. The northernmost dam in the southern section was located just south of the eventual location of the 99th Street Elementary School and near Wheatfield Avenue. Hooker also had widened and deepened portions of the Canal and dug pits outside the Canal to a much greater degree than had been done in the northern section in order to accommodate the volume of chemical wastes being transported to the dump.

Jerome Wilkenfeld visited the site in 1948 when he was a young engineer assigned to Hooker's process study group. He began working for Hooker in 1945 and was curious to find out how waste disposal was carried out. He recalled that a truck carrying waste drums proceeded to the south end of the Canal on the west side. The drums in the truck were not leaking. He noticed a large earthen dam substantial enough to permit earth-moving equipment to drive over [**42] it. The dam across the Canal created a deep pit which had been pumped almost dry, with a few feet of water at the bottom. The water in the unused portion of the Canal looked clean. There was a substantial berm on the west side of the Canal, extending for some distance to the north. Looking further north, he could see another dam, and beyond that a stretch of leveled earth. To the south, dumping was evidently finished and the earth was filled in and covered, but there were signs of settling. He thought that the method of disposal was reasonable. T. 4150-55 (Wilkenfeld).

No fencing was installed around the southern and central sections of Love Canal where 75 percent of the

dumping occurred. T. 837 (Wagner). Hooker did not construct fencing along the residential property lines bordering the west and east sides of the site, nor did it post any warning signs.

T. 295 (Corp).

Although the focus of its disposal operations shifted to the southern section in 1946, Hooker continued to dispose of wastes in the central and northern sections even after 1952. In the central section, Hooker's dumping extended to an area near Wheatfield Avenue. At least two large pits, one south and the other east [**43] of the eventual location of the school, were dug and filled with waste before the school was constructed (Exs. 180, 1442, and 1445). In the northern section, Hooker dumped mostly trash after 1950, but small quantities of chemicals were deposited in the swale area. T. 3062-63 (Colwell); T. 4634-35 (Gowan).

The frequency of dumping at Love Canal varied. Some witnesses reported that wastes were hauled from the plant several times a week. However, Hooker's general practice was to accumulate between 500 to 2,000 drums of chemical wastes at its plant before hauling them to Love Canal. That occurred on roughly a monthly basis, although at times there were longer intervals between these relatively large-scale dumping operations.

Hooker usually stored chemical wastes at its plant in 55-gallon metal or fiberboard drums, each of which weighed between 200 and 500 pounds when full. The drummed residues included both liquid and solid chemical wastes. When the disposal operation began, the contents of the waste barrels could not be discerned by looking at the barrels.

T. 5088. Later on, Hooker began a practice of marking the drums with different-colored dots of paint in order to distinguish materials [**44] believed to be reactive from those considered nonreactive. T. 4159-60. The plan was to keep reactive, highly odorous, and fuming material away from populated areas. However, the marking practice was often not followed.

The drums were used or reconditioned rather than new. Some witnesses who visited the dump site described the drums as rusty and leaking. However, William Wagner, who worked at Love Canal from 1948 to 1953, testified that most of the drums were in [*1009] pretty good shape and did not leak. Only four or five drums per day would break open when they were rolled into the Canal. T. 826-31 (Wagner). Sometimes liquid wastes went directly to the Canal from tank trucks. Other laborers confirmed Wagner's recollections. T. 909 (Fekete). Wagner worked at the Canal almost every day, and his memory seemed reliable. T. 844. He said that when a drum broke open, the material would be covered right away. T. 832.

To prepare for the dumping of drums, the crew dug a hole 20 to 30 feet deep and about 30 to 40 feet wide. T. 826 (Wagner); Ex. 180. The contractor built a small dam made of flyash and dirt to keep water out of the digging area. Then, the workers pumped most of the water out of the [**45] excavated part, leaving only a foot of liquid at the bottom of the pit. The pits extended out from the Canal to about 25 feet from property lines. After a pit was dug, 600 to 1,000 drums could be buried in one day and cover placed over the pit. T. 829-30 (Wagner).

Evidence about Hooker's disposal practice was also given by Frank Fekete. Along with Mr. Wagner, he worked at the site almost daily. Fekete was employed by Hooker for 37 years, beginning as a yard laborer in 1940. During the 1940s, he delivered and dumped steel, paper, and drums into the Canal. He testified that when the trucks reached the Canal, they were driven to a dammed off area of the Canal or to one of the excavated pits, at which point drums would simply be dumped or rolled directly from the trucks. At times, a crane was also used to deposit drums at the site. The drums were neither segregated by content nor stacked, but instead were randomly dumped. [9] T. 5088-94.

9 Jerome Wilkenfeld, who observed the dumping operation on several occasions, said that it was not safe nor practical to stack the drums carefully, since they weighed between 300 to 700 pounds. T. 4153. It would have been hazardous to put someone in the hole in order to line up the drums before they were covered. T. 6777-78 (Metzler). Further, there was no good reason to stack the drums in order, because some waste was dumped directly into the pit from tank trucks. T. 4154 (Wilkenfeld).

[**46] Several witnesses testified about the degree and quality of the cover of the landfill. William Wagner said that when he first came to the northern section, he put in fill, including cinders, clay, and loam, graded the surface, and built up a mound three to four feet above

grade. He was told to form a mound in the center so that rainwater would run off to the east and west sides. By 1951, the cover was a series of hummocks. T. 818-20, 860 (Wagner). As Wagner continued to work in the northern section, he noticed that the ground was settling. T. 841. Although Wagner said that a cover was put over material on the same day it was dumped, there was no attempt to cover the drums completely or grade the surface until the pit was filled. This meant that some drums usually remained uncovered at the end of each day. Ex. 1708; Cohen, T. 2950; A. Voorhees, Dep. 126.

During its disposal operations, Hooker dumped drums to within one-half to four feet of the original ground surface. The plan was to have at least a four-foot cover, but often this goal was either not attained or not maintained. On many occasions, the cover was only one-half foot deep (T. 840 (Wagner)), thus placing the drums within [**47] the most permeable portion of the Canal stratigraphy. See Part V, Section C, infra. Furthermore, Hooker did not place topsoil, seed, or vegetation on the cover. In the southern section, there often was virtually no buffer zone between the Ring I properties and the wastes dumped in the disposal pits. Ex. 718a, F. 7. Pits were dug outside of the Canal itself and quite close to the rear property lines. Ex. 1442; (Gibson); Aileen Voorhees Dep., 121.

Some Hooker workers and contractors experienced firsthand the dangers of contact with the chemical wastes being dumped at the site. Occasionally, when drums broke during disposal operations, men would be splashed and burned by chemicals, sometimes forcing them to seek help from nearby residents to wash off. Chemicals often burned holes in their clothing. In one vivid example, a former worker gave the following account of the corrosiveness of some of the chemical residues being dumped:

> On one occasion I had purchased a new pair of workboots and during that day they [*1010] became wetted with chemicals from the dump. That evening prior to entering my home I removed the boots and left them sitting in the garage overnight. The next morning [**48] in preparation to return to work I found only the soles and heels of the boots remaining. The uppers were entirely eaten away.

Ex. 6510.

D. CHEMICAL COMPOSITION OF THE WASTE MATERIAL

The parties agree that about 25,000 tons of chemical wastes, plus flyash and general refuse from the plant, were deposited at Love Canal from the time Hooker began to use the site in the early 1940s until it ceased operations in 1954. The available records made it difficult to determine the types and quantities of the wastes sent to Love Canal. Thus, estimates of the amount and concentration of the individual chemicals buried at the landfill differed widely.

The principal testimony concerning the nature of the chemicals deposited at Love Canal was supplied by Jay Cull, a chemical engineer employed by OCC. Mr. Cull has a B.C.E. from Brooklyn Polytech and an M.B.A. from the University of Buffalo. He has worked for Hooker and OCC in various capacities from 1953 to the present, interrupted only by military service. In 1975, he became technical manager of the plant and head of a staff whose job it was to become familiar with the details of the various processes used in the plant and make [**49] suggestions for improving the efficiency of the chemical production. In 1978, he was assigned to gather information about the nature and quantities of the wastes that had been sent to Love Canal. To carry out this assignment, he examined written records and questioned individuals knowledgeable about disposal practices in the 1940s.

Mr. Cull's investigation was greatly hampered by the lack of accurate waste disposal records available. In the 1940s, the materials sent to Hooker's landfills were recorded in what the Company called "level books." By 1980, these records were no longer available. Moreover, many of the people who were involved in Hooker's disposal operations during the 1940s and who had the most exact information were either deceased or ill and unable to be of much assistance.

Sales records were available for two of the twelve years during which Love Canal was used for waste disposal. From the sales figures, Cull was able to estimate the quantities of the chemicals produced in those years. His understanding of the chemical production processes then enabled him to estimate the volume of waste generated. Further information was obtained through the Love Canal Interagency [**50] Task Force, which had

been formed by the State and federal governments in 1978 to investigate and propose solutions to the problems created by the landfill. Ex. 2725. See Part V, Section A, infra.

Mr. Cull admitted that there were so many variables in his procedure that he was precluded from testifying with certainty about which chemicals were sent to Love Canal in what volumes. Nevertheless, his was the best estimate presented to the court. The State did not offer any comparable analysis. Cull's estimates of the total amount of waste materials generated by Hooker during the 1940s and early 1950s are summarized in Exhibit 2218. These estimates were based on the information he gathered during his own investigation, combined with figures from several other reports which were unknown or unavailable to him during his investigation. At page 2 of the exhibit, a table details the waste categories, the total amount of waste produced by Hooker, and the amount sent to Love Canal. At Cull's cross-examination, some minor changes were made in these figures.

Most of the chemical wastes transported by Hooker to Love Canal were soluble in water and are known as aqueous-phase liquids ("APL"). [**51] As much as 3,000 tons of the wastes were relatively insoluble in water and are known as nonaqueous-phase liquids ("NAPL"). About 2,100 tons of the NAPL were in the form of denser-than-water nonaqueous-phase liquids ("DNAPL"). Other waste material took the form of less-dense-than-water nonaqueous-phase liquids ("LNAPL"), which tended to rise toward the surface of the landfill.

T. 5170 (Cull).

[*1011] The chemical found in the largest quantity was benzene hexachloride ("BHC"), in an amount estimated at 7,159 tons. See description of BHC residues or "spent cake" below. The second-largest deposit was of the chlorobenzenes (mono-, orthodi-, tri-, and tetra-) (3,506 tons), followed by dodecyl mercaptan ("DDM") (2,090 tons), sulfides (1,951 tons), benzyl chloride (1,757 tons), and benzoyl chloride (1,230). The remainder of the estimated 22,000 tons of chemical residues buried at the Canal included: thionyl chloride, trichlorophenol ("tcp"), metal chlorides, liquid disulfide ("lds"), monchlorotolunene ("mct"), and miscellaneous acid chlorides and chlorination products and other unidentified residues. Ex. 2218A.

E. TOXICITY AND DISPOSAL METHODS FOR SPECIFIC CHEMICALS

Many of the chemicals [**52] used by Hooker during the production process were highly toxic and hazardous. The State's accusation of reckless disregard for public safety is premised on the danger posed by chemical wastes both during and after disposal. Several specific chemicals and their waste products were the subject of special attention during the trial because potentially hazardous disposal methods were employed, there were recurring incidents of exposure, or the substances continued to cause problems during or after the disposal operations.

The following section sets out a general description of the dangerous properties of the chemicals handled by Hooker. [10] Next, the problems associated with disposing of the waste materials of several chemicals are reviewed. Particular chemicals which were discussed at length during trial or were the subject of concern during or after the landfill operation are highlighted. The section ends with the State's argument that Hooker's disposal procedures were unsafe and a brief discussion of the viability of alternative methods such as incineration.

10 The industry's knowledge regarding the toxicity of its products is discussed below. See Part VI, infra.

[**53] Dr. Kelley Ann Brix gave expert testimony for the State regarding the toxic chemicals which Hooker used or produced in its Niagara Falls plant as well as a review of the extent of the Company's knowledge about the dangers associated with these chemicals. Dr. Brix is a public health physician for the Bureau of Environmental & Occupational Epidemiology of New York State Department of Health, Director of the Master of Public Health Degree Program at SUNY Albany, and consultant to physicians about clinical care patients who have been exposed to environmental agents. She received an M.S. in zoology (1974) and an M.D.(1978) from the University of Michigan. She also has a Master of Public Health degree (1980) from the University of Illinois. Ex. 1128. Dr. Brix was asked by the State to review internal Hooker memoranda and reports, operating and first-aid manuals, product warning labels, and reports and journals issued by organizations such as the Manufacturing Chemists' Association, the National Safety Council, the American Industrial Hygiene Association, the United States Department of Labor, and the American Medical

Association. She focused primarily on the time period prior to 1954, but [**54] included some post-1954 materials.

Dr. Brix discussed Hooker's knowledge of the dangers posed by these chemicals as raw or finished commercial products. Her report (Ex. 1335) covers 17 chemicals or classes of chemicals, including those listed above, and relates a considerable amount of toxicological information. See Appendix B for her "Executive Summary" of this report. She determined that Hooker "definitely recognized that these materials were toxic." Exhibit 1335 at 1. She also concluded the following:

> [Hooker] recognized a broad spectrum of serious toxic effects, including damage to the majority of major organ systems, which could be caused by these substances. Hooker also contracted for animal toxicity tests on some of these materials, while obtaining other information from other chemical manufacturers, trade associations, academic institutions and, on occasion, governmental agencies. Hooker appears to have referred to and relied upon [*1012] the toxicological literature of the time (both texts and periodicals). Hooker was also aware of several factors which contributed to wide variation in individual susceptibilities to these toxic materials.

Id. at 1. However, very few [**55] documents covered in the report refer to the content or potential harm from exposure to the waste materials or residues created by Hooker's processes. Dr. Brix also could not testify about Hooker's knowledge of the possible hazards of burying toxic wastes because this information was not included in the documents she reviewed. She is not an expert in waste disposal, hydrology, or geology. T. 425-31.

The disposal methods of four of the chemicals reviewed by Dr. Brix--thionyl chloride, TCP, dioxin, DDM--were discussed at length during the trial because of the exposure problems which occurred during Hooker's landfill operations at the Canal. Although the parties did not give the disposal of spent cake, the waste product of lindane, a great deal of attention, it is also included in this section because it was deposited in enormous quantities at the landfill and was the subject of several reports of surface exposure after the site had been transferred.

1. Lindane and Spent Cake

Between 1946 and 1953, Hooker manufactured large quantities of lindane [11], the commercial name for the gamma isomer of hexachlorocyclohexane ("HCH"), also known as benzene hexachloride ("BHC"). Waste residues [**56] generated in the production of lindane, which was widely used as an insecticide, were variously called "spent cake," "BHC spent cake," "spent BHC," "FBHC spent cake," "HGI residue," "HGI cake," and "'A' cake." Spent cake made up between 1/4 and 1/3 of all chemical waste products buried at Love Canal. Although it contained only a small percentage of lindane, the most acutely toxic of the HCH isomers, spent cake consisted very largely of the alpha, beta, and delta isomers, all of which are also toxic.

> 11 An August 1950 internal memorandum stated that "present plans for 1951 call for the HGI [lindane] Plant to operate for 8 months at a rate of 50,000 lbs per month". Ex. 1515. In November, 1953, a document concerning the disposal of wastes from the production of HGI assumed a lindane production rate of 65,000 lbs. per month. Ex. 963.

Lindane or high gamma isomer ("HGI") was isolated from an industrial mixture of HCH which included 13.5-14 percent gamma. Ex. 1515. The isolation process seems to have involved at least two [**57] steps which produced residues. The first step produced "fortified BHC" (FBHC), which contained about 40 percent gamma isomer. The second isolated the gamma isomer (99 percent gamma) from the FBHC. This two-step process left large quantities of spent cake, rich in HCH/BHC isomers other than gamma. The various names for spent cake appear to have been used interchangeably even though residues produced in the second stage of isolation probably differed in the proportions of the isomers to those produced in the first stage. [12]

> 12 There are only a few references in the record to the relative proportions of the four main HCH/BHC isomers present in spent cake. In a letter dated December 26, 1946, J.S. Sconce, head of Research at Hooker, told a client that "samples of the by-product obtained in preparing high gamma isomer [HGI] contain approximately . . .

20% gamma isomer." Ex. 53. By contrast, an internal memorandum written in June 1952 by J.A. Sonia of the Research Department reported that the gamma content of "spent cake" was approximately 1 percent. Ex. 123. Similarly, in July 1953, the average gamma content of "spent cake from Bird Young filter and No. 4 centrifuge" was noted as 1 percent. Ex. 962. The apparent discrepancy might be due to differences in the HGI isolation processes used in 1946 and 1952-53. Alternatively, the sample supplied to the client in 1946 and those analyzed in 1952-53 may have come from different steps in the HGI isolation process. In any case, spent cake contained at least 1 percent gamma HCH (lindane), and some of the discarded residues may have had a considerably higher gamma content.

Sonia's memo also listed the approximate amounts of the other ingredients in spent cake as follows: HCH alpha isomer--25%; HCH beta isomer--13 percent; other impurities--2 percent. Ex. 123. Presumably the delta isomer made up the other 60 percent.

[**58] These residues were produced in very large quantities. By the summer of 1950, Hooker was dumping them at a rate of close to 300 tons (600,000 lbs.) per month. Ex. 951. Jay Cull testified that far more "BHC, [*1013] otherwise known as hexachlorocyclohexane," was deposited at Love Canal than any other chemical. He estimated that by the time Hooker had finished its disposal operation at the Canal, the landfill contained some 6,000-7,000 tons (12-14 million lbs.) of BHC spent cake, most or all of which was buried in the southern section of the Canal. T. 2187, 5437-5438 (Cull).

Two methods of disposal of spent cake were described. In one method, the spent cake was dumped into pits 12 to 15 feet deep and covered by cinder and ash. Ex. 1516. See also, T. 5437 (Cull). Impurities later found in this material consisted of dirt particles approximately the same size as the cake particles. Ex. 962. In the other method, spent cake which may have been the residue from the later stage of the process when lindane was present in higher concentrations, was first packaged in wax-coated fiber drums. This was once described as "'A'-cake," a substance which looked similar to chalk and contained approximately [**59] 11 percent "volatiles" or materials other than HCH/BHC. Ex. 962.

By 1950, the Company's top management officials were well aware that spent cake contained very large quantities of undegraded (though gamma-depleted) HCH/BHC isomers. This knowledge is demonstrated in a August 1950 memorandum detailing a proposal discussed by Hooker management to install the equipment necessary to convert HCH/BHC present in spent cake into up to 250,000 lbs. per month of pyrolytic trichlorobenzene ("PTCB") by high temperature degradation or pyrolysis. Exs. 951 & 1515. Hooker management apparently found this proposal attractive because PTCB could be produced at a much lower cost than trichlorobenzene prepared by chlorination of benzene. [13] Exs. 951, 1514, and 1515. The proposal was approved by Hooker's

13 Additional justifications included "improved quality of Pyrolytic Trichlorbenzene; partial relief of the Niagara disposal problem; reduced benzol and chlorine requirements in the face of tight supplies; and the release of chlorinator and still capacity at the Benzol Department for further expansions." Ex. 1515.

[**60] president and senior management in September 1950. Ex. 1515.

According to Cull, Hooker installed the necessary equipment and began converting some or all of the spent cake produced in the FBHC process to PTCB in 1951 or 1952, thereby drastically reducing the amount of waste generated from HGI production. T. 5190. In early 1953, however, the Company cut FBHC production. Ex. 1516. Hooker's production personnel were concerned that there would be insufficient "BHC spent cake" available from the FBHC process to meet the demand for PTCB. Id. This led to a proposal that the Company's Process Study group investigate the practical problems that might be involved in recovering spent cake from "the dump," in quantities of up to 190 tons per month, for use in PTCB production. Id. Such a study was performed (see Exs. 961 and 962), and a recommendation was made that "facilities be provided for return of spent cake from the dump . . . ." Ex. 962. Nothing in the record indicates whether spent cake was ever actually recovered on a large scale.

The proposal to recover spent cake from "the dump" for use in PTCB production demonstrates that in 1953, Hooker's production personnel understood [**61] (1) that HCH/BHC isomers were present in "the dump" in very large amounts, (2) that the HCH/BHC isomers

remained in the ground in an undegraded state, suitable as raw material for PTCB production, and (3) that they were in the ground in a sufficiently concentrated form that they could be readily "mined," cleaned up, and utilized.

Dr. Brix testified that Hooker knew that all four isomers of BHC were toxic by 1953. Her report reviewed at least 18 documents obtained from Hooker files which relate to the toxicity of BHC. Ex. 1335 at 44-54; T. 522-542. In addition to several internal memoranda, she noted a 1951 article in the Journal of the American Medical Association (Ex. 1159) which described lindane, the gamma isomer, as the most acutely toxic form of BHC, but warned of the ill effects of all the isomers. The article reported that the estimated fatal oral dose of lindane in adult humans was less than a quarter of an [*1014] ounce. The alpha and delta isomers had been found to be about 1/9 and 1/6 as potent, respectively, as lindane in single-dose acute toxicity tests on laboratory animals. The beta isomer is the least acutely toxic of the four isomers but the most chronically toxic, meaning [**62] that it could be stored and built up in the body over a long period of time. The article described the pathological effects of cutaneous absorption (absorption through the skin) in laboratory animals as "liver necrosis,. . . hyaline granular degeneration of the renal convoluted tubular epithelium as well as mild changes in the bone marrow, lymphoid tissues, adrenal cortex, and cerebrum." Ex. 1159.

Dr. Brix testified that she examined both internal documents and scientific articles found in Hooker's files which discussed the toxicity of the BHC/HCH isomers. She concluded:

> Hooker Chemical Company recognized the toxicity of HCH isomers as early as 1945
>
> . . . . Fatal poisonings [of humans] due to gamma HCH were reported as early as 1951. Poisonings could occur through ingestion or skin absorption. Symptoms of acute poisonings could include loss of consciousness and grand mal convulsions. As early as 1953 chronic poisonings were reported which included symptoms [such as] severe anemia and easy bleeding, probably due to decreased platelets. Hooker exchanged information on the toxicity of HCH isomers with other companies, kept apprised of the toxicological literature, was familiar [**63] with research at academic institutions, recommended several safety precautions for its employees exposed to HCH isomers, and closely followed the concern of regulatory agencies in gamma HCH.

T. 540-42; Ex. 1335 at 53-54.

2. Dioxin and Trichlorophenol

The State urges that Hooker's method for disposal of trichlorophenol ("TCP") and dioxin wastes and its attitude toward the employees who handled these chemicals demonstrate its negligence and malicious intent. Dioxin is a byproduct of the manufacture of TCP. It was buried at Love Canal and detected in sump pumps of Ring I homes in 1978.

Dr. Brix testified that between 1949 and 1952, about 200 tons of TCP were dumped in Love Canal. She calculated that the TCP residue contained about 300 parts per billion, or 120 pounds, of dioxin. Ex. 446; T. 605.

The amount of dioxin which migrated to the area of the homes cannot be ascertained.

The State contends that by 1941, Hooker knew that workers exposed to TCP could develop chloracne, a serious skin disease which was difficult to cure. T. 552 (Brix). During the 1940s, some Hooker employees did suffer from this condition, but their condition was caused by handling chlordiphenyloxide [**64] and related chemicals, rather than TCP. Hooker did not start the production of TCP until 1949. Before it embarked upon the chemical's manufacture, the Company was advised that TCP "is by a wide margin the least toxic of the chlorinated phenols." Exs. 66 and 69. The Company manufactured TCP from about 1949 to 1960, but did not learn until 1957 that dioxin was a byproduct. T. 5194 (Cull). Dr. O'Keefe, a chemical expert testifying for the State, said that the 2,3,7,8 TCDD (dioxin) isomer was not isolated until 1980. Hooker was aware in the 1950s that workers could develop chloracne from TCP production, but did not understand precisely what caused the condition.

While Hooker's protection of its workers is not at

issue in this case, the court will consider the steps the Company took to protect the health and safety of its employees and whether it was careless. In the early 1940s, Hooker consulted with governmental and other experts to find out how to prevent chloracne (Exs. 66, 97, 778, 1219, and 2502). The Company modified mechanical, ventilating, and operating procedures to improve industrial hygiene. T. 4264-66. In the latter part of the decade and the early 1950s, the incidence of [**65] chloracne continued to decline. The State's view that Hooker did not attempt to protect its employees from the harmful exposure is not supported by the evidence.

3. Thionyl Chloride

Thionyl chloride, another highly toxic chemical deposited at Love Canal, was used [*1015] extensively in the chemical, dyestuff, and pharmaceutical industries. Ex. 1196 at 160. Brix explained that this substance is "very irritating to skin, eyes, nose . . . . It caused burning and blistering of skin, and the odor was suffocating." T. 580. Mr. Schultz described this residue as "miserable and dangerous." T. 1152.

Thionyl chloride reacts vigorously with water to produce hydrochloric acid and sulfur dioxide. It is not dangerous in diluted form and it dissipates quickly. T. 4557 (Bryant). Accordingly, when drums containing thionyl chloride waste arrived at the Love Canal, they were first punctured and then rolled into a disposal pit that had water at the bottom. The contents of the drum reacted with the water, and the resulting gas quickly dissipated. In this way, the toxic effect of any remaining thionyl chloride in the waste barrels was simply and efficiently neutralized.

This method succeeded in dissipating [**66] most of the toxic material, but occasionally barrels were buried without first being punctured or with rework residue which still contained traces of thionyl chloride. T. 157; Item 1021, P 309. The residue would then continue to react slowly with water and eventually burst the drum, releasing hydrochloric acid (HCL) and sulfur dioxide (SO2), and whatever traces of thionyl chloride or purifiers like toluene were left. T. 1078-79, 1085 (Schultz). Nevertheless, Hooker engineer Jerome Wilkenfeld said he felt this was the best way to dispose of the highly reactive material when questioned about the safety of this procedure. If the drums had simply been buried in the soil, water would eventually leak in and react with the chemical, causing the drums to expand and then burst. T. 4130. Wilkenfeld's opinion was seconded by Dwight Metzler, one of the experts called by OCC to review the disposal operation. [14]

14 Mr. Metzler's testimony is discussed in Part VI, infra.

From the time Hooker started disposing of thionyl chloride [**67] in 1941, it worked continuously to improve production methods to reduce waste from this process. T. 1173 (Schultz). The waste material from the initial process used was highly acidic and reacted strongly with water. A high degree of sulfuric acid remained. The second method employed toluene, which is similar to benzene but less toxic, less volatile, and less flammable, to remove further impurities. The resultant waste product was a mixture of tars and oils containing some toluene derivatives, sulfur monochloride, and some traces of thionyl chloride itself, although the exact composition is unknown because analysis of waste materials for chemical structure at that time was very difficult and therefore rarely done. T. 1078-79 (Schultz). By the end of the disposal period, Hooker had perfected a manufacturing process for thionyl chloride which left very little waste. T. 1085.

4. Dodecyl Mercaptan or DDM

The State also highlighted the dangers of dodecyl mercaptan ("DDM"), waste products from lauryl chloride production, a DDM precursor, and some other small-volume-related compounds. Hooker knew by 1945 that DDM residues were lighter than ground water and could rise to the ground [**68] surface when it seeped out of the drums. Ex. 34. The State claims that the Company continued to the dump the DDM residues into the Canal without regard for the hazards posed by the chemical.

Dr. Brix testified that mercaptans are similar to hydrogen sulfide, which is one of the most toxic gases in existence. In her report, she discussed the various hazards associated with mercaptans and quoted a 1944 publication of the Rubber Reserve Company which said that methyl and ethyl mercaptan could cause "convulsion and paralysis and finally death." Exs. 26, 1335 at 66; T. 564-71 (Brix). OCC chemical engineer Jay Cull countered that the highly toxic chemical Brix described was not dodecyl mercaptan, but rather methyl mercaptan, which was never manufactured by Hooker. Cull's opinion is supported by the documents. Ex. 26, 44. While all

mercaptans are toxic to a degree, the description of the toxic propensities of methyl and ethyl mercaptan did not apply to DDM. T. 5191. Butyl, iso-butyl, and propyl mercaptan were listed as harmless in a Rubber Reserve Company report referenced by [*1016] Brix, and dodecyl mercaptan was not mentioned at all. This did not mean that DDM was harmless. A Hooker memorandum [**69] instructed men loading tank cars with DDM to use adequate ventilation and to wear a respirator. Ex. 44. It was clear that DDM was a substance to be treated with respect, but it did not have the highly dangerous qualities of methyl mercaptan.

Hooker disposed of drums of DDM residue at Love Canal between 1942 and 1953. (Stipulations of Fact (OCC-State), 25). At some point in 1944, Hooker realized that DDM was seeping out of drums and rising to the ground surface. Ex. 34B. After a failed attempt to incinerate the residue, the Company returned to landfilling and there were no further reports of DDM migrating to the surface after 1945. Ex. 2218; T. 4138, 4398 (Cull).

5. Incineration of Wastes

At various times during trial, the possibility was raised that incineration could have been used by Hooker as an alternative to landfilling. The State contends that during the 1940s, incineration was a more efficient way to dispose of wastes than landfilling, and that Hooker chose landfilling only because it was cheaper. OCC admits that incineration was more expensive but asserts that there were better reasons to opt for burial of wastes. A review of the effectiveness of incineration techniques [**70] at the time of waste disposal at Love Canal reveals that it was not a viable alternative for Hooker.

Hooker's records show that it considered incineration on several occasions. In 1944, Mr. Van Horn, who was supervisor of the Hooker Process Study Department, stated in an annual report that:

> With the expansion of the DDM plant, this became a major item. The thionyl chloride incinerator was altered to burn organic residues. Up to this time, we had buried our residues at Luve [sic] Canal but this is creating a potential future hazard. DDM residue being lighter than water rose to the ground surface as it seeped out of the drums. The author feels that an adequate incinerator for burning all organic residue should be built. It costs about twice as much to burn the residues as it does to bury them but I feel that eventually we will have a quagmire at the Luve [sic] Canal which will be a potential source of law suits in the future.

Ex. 778, p.8737; T. 4136-37.

Van Horn repeated this recommendation in 1945 (Ex. 34), and again in 1949 (Ex. 946). Mr. Bentley of the Hooker Yard Department urged greater use of incinerators in 1953 (Ex. 174), and other Hooker personnel suggested that incinerators [**71] be developed (T. 5356-57).

In response to these suggestions from Van Horn and others, Hooker made several attempts to use incineration in the 1940s. For example, in about 1944, the Company paid the Army approximately $ 5,700 for an incinerator, which was used for a short time to burn thionyl chloride and DDM wastes. T. 5351-52. This operation was suspended because it was inefficient and unable to comply with pollution ordinances. T. 5240.

To explain why incineration was abandoned in these early attempts, OCC offered the testimony of Jay Cull, Hooker's principal witness on the use and development of incinerators who was well qualified to give an opinion. After receiving a chemical engineering degree in 1953, he joined Hooker; and in 1957, Hooker gave him the task of designing an incinerator adequate to handle Hooker's wastes. Before attempting to design an incinerator, he examined Company records and interviewed personnel who were familiar with the use of incinerators in the 1940s. Although the complete history was not available, Cull was able to determine that Hooker was faced with many problems. T. 5351, 5354. Chlorinated organic chemicals, including DDM and thionyl chloride, discussed [**72] above, manufactured by Hooker were very difficult to destroy by incineration. T. 5228. In the 1940s, good thermal technology and effective air pollution control did not exist to control gas emissions. Severe air pollution resulted, causing a corrosive impact on the surroundings and on nearby electrical equipment. T. 4137. Cull noted that the scrubbing of hot incineration gases is a complex engineering problem (T. 5369-72, Ex. [*1017] 1502), and the construction materials needed to overcome corrosion were not available in the 1940s. T.

5229. For these reasons, incineration was abandoned. T. 5228.

Jerome Wilkenfeld, another Hooker manager, corroborated Cull's testimony. He recalled that the incinerator installed during the 1940s did not run for more than one year. The residual substance it produced was gummy and difficult to handle, and the discharge caused considerable corrosion to other machinery. T. 4125. For these reasons, Hooker ceased incineration of thionyl chloride waste in about 1944. Some thionyl chloride waste was sent to Love Canal between 1945 and 1948 (Ex. 2218), but most ended up in the "S" Area Landfill. T. 4137, 4146 (Wilkenfeld).

Other companies engaged in chemical manufacturing [**73] encountered similar difficulties. For example, an incinerator operated by DuPont was shut down by the City of Niagara Falls in 1942 because precipitators were not in place to keep particles out of the air. Ex. 3089; T. 5230, 5234, 5367.

Hooker was not able to use incineration for the type of wastes it buried at Love Canal until 1961, when Cull finally came up with a successful design. His device introduced steam into the residues (T. 5236, 5150; Ex. 2820), and his concept is still used by OCC to destroy Hyde Park NAPL at the Niagara plant (T. 5236). However, the Cull device only permitted incineration of liquid, not solid, waste. Good air pollution control for solid waste was not developed until 1970. Research and development into more efficient incinerators continues. T. 5151, 5236.

G. CHEMICAL EXPOSURE AT THE LANDFILL

Individuals who lived in the vicinity of the Canal during the disposal period testified about problems caused by chemical wastes. Only six homes had been built close to the site before 1954. The witnesses, many of whom were still children at the time, either lived adjacent to the site or went to the Canal area to play. Their testimony usually was brief, giving [**74] an overall impression or recalling a specific incident. Their credibility was not substantially challenged, but their testimony must be considered in the proper context. The events at issue occurred more than 40 years ago, often when the witnesses were quite young; and in the intervening years, Love Canal has received considerable media coverage. There is little question that the incidents described occurred, but it is difficult to tell exactly when they took place, how often, and to what extent they created problems.

Some of the chemicals buried at Love Canal were flammable, and others had flash points of less than 100 degrees Fahrenheit. Ex. 921. As a result, there were frequent fires. The danger of fires was enhanced by the presence of chlorobenzenes and hexachlorocyclopentadiene ("C-56"), which form phosgene if burned. In addition, deposits of sulfides and acids had the potential of forming hydrogen sulfide gas when mixed together. Moreover, the flammable character of some of the chemical residues sent by Hooker to Love Canal was such that it was impossible for workers at the site to compact the wastes once they were dumped, which contributed to the subsidence of the cover. Olotka [**75] Dep., T. 26-31.

One resident recalled that between 1947 and 1949, she observed fires from her backyard at least once a week. T. 93-49 (Wirth); see also A. Voorhees, Dep. 326. Another witness recalled going to the banks of the Canal as a child to watch the fires, which at times would reoccur so frequently that the local fire department would give up trying to put them out. T. 274-75 (Corp). Some fires lasted several hours, with flames as high as 20 feet. T. 326 (Moriarty).

Hooker was contacted when the fires occurred. The fire department was called several times during the 1940s, and its records show responses to at least two calls in 1952 and 1953. T. 274-75(a) (Corp); Ex. 2231, 2237A. There is no evidence that the fires caused any injuries.

There were also explosions at the site. Dine Bouley, a former resident who lived on 100th Street, stated that explosions sometimes launched burning debris into the road in front of her house, and sometimes sent [*1018] debris as far as 102nd Street. Children would sometimes play with the cooled material (Bouley Dep. 28-29). Other witnesses recalled explosions, but none supported her recollection that burning pellets from the Canal were hurled that [**76] far.

When fires and subsurface explosions occurred, the covered soil was displaced, exposing previously buried drums and wastes. Gerald Craig recalled that when he was a teenager in the 1950s, the ground around buried drums subsided allowing him and his friends to play on the exposed tops. T. 102-17. June Craig Wirth, his sister,

recalled that once when she touched a black liquid in the pit, it caused a burning sensation. T. 91-92; 95-96.

After a rainstorm, the surface area would become very muddy and swampy and would emit strong, noxious odors which pervaded the neighborhood. T. 274 (Corp); T. 133 (Moriarty); Bouley Dep. at 48A; Voorhees Dep. at 245. Timothy Moriarty recalled that once while walking across the Canal, he sank into the ground to his knees and had to pull his feet from his boots to escape. T. 133, 144-45. Dust, powder, and flyash flew from the dumpsite and from trucks into the neighborhood, soiling and sometimes damaging the paint on nearby properties. Bouley Dep. at 28, 48; Voorhees Dep. at 328-29; T. 187 (Wahl); T. 850 (Wagner).

In spite of these reportedly foul conditions, the residents, especially children, continued to swim and fish in the unfilled part of the [**77] Canal. Two witnesses remembered developing a rash or burning skin sensation after swimming. T. 190-91 (Wahl); T. 275 (Corp). However, there is no evidence that any serious or permanent injury resulted.

Throughout the disposal period, Hooker personnel and contractors observed that previously filled and covered areas of the landfill were settling and subsiding. The subsidence began to occur as early as 1942, exposing the tops of drums and waste material and increasing chemical odors and puddling. Ex. 781A, 35; T. 2836 (Cohen); T. 3334 (Pinder); T. 4155 (Wilkenfeld).

Hooker received complaints concerning chemical odors in 1950, and Mr. Wilkenfeld was directed to go to the site and investigate. He reported in a memo that the ground had settled enough in some places to open potholes and expose portions of buried drums. T. 4171; T. 4163-64; Ex. 96. His description of the area was similar to the recollection of the residents. See T. 131-33 (Moriarty); T. 91-92 (Wirth). He noticed that a thin, discontinuous oil slick with some globules had formed in the water of the dammed-off portion of the Canal. An odor was noticeable, although not at a distance. T. 4164. On cross-examination, he [**78] could not recall whether the slick was located south of Wheatfield Avenue, in the midst of an active disposal operation, or in the central area to the north. However, he testified that if the water in the rest of the Canal had been contaminated, he would have reported it. T. 4165, 4319. He did note in his memo that flyash was blowing toward the houses and ordered a bulldozer to level the area to prevent a reoccurrence. Several Hooker executives expressed concern about the potential hazards posed by the Company's disposal operations. Ansley Wilcox II, Hooker's Secretary and General Counsel, visited the site in 1946 and wrote a memorandum to E. R. Bartlett, Hooker's President, describing what he saw and offering recommendations for safety. Ex. 46. He wrote that there was a fence in the northern section but none in the southern end. The filled area was in good condition and did not constitute a hazard. However, he reported that to his "inexperienced eye," the part of the Canal filled with water appeared contaminated. He heard that children swam there, and while he was there he saw youngsters with "what appeared to be bathing costumes in their hands." Id. He felt strongly that Hooker [**79] would be "running a real hazard in not taking steps to prevent possible injuries to persons who may swim in the canal." Id.

Wilcox suggested that guards be placed on the property at times when the workers were not present to keep people out. Alternatively, he proposed that a fence be built around [*1019] the portion being used as a dump. He warned Bartlett about the potential liability facing the Company if someone were injured. Id. [15] Two subsequent memoranda showed that Hooker executives discussed Wilcox's suggestions, but the fence was never built. Exs. 47, 48.

15 Wilcox's memorandum reads:

> Supplementing [illegible] memo of August 15, 1946, I am in accord with his statements with reference to that portion of the canal south of Buffalo Avenue.
>
> At the same time we inspected the dump south of Buffalo Avenue we also inspected the balance of the Love Canal property. We originally started dumping chemical residues at the extreme north and near Colvin Boulevard and at that time we constructed a fence 6' high, the top 2' being barbed wire, around the part we were using for a dump, and also constructed a gate, which was kept locked at all times except when

dumping was in process, in order to keep trespassers (principally children) away from the dump. We also constructed a dam in the canal proper so that there would be no seepage of chemical residues into the balance of the canal.

The part which is now surrounded by a fence has been completely filled and covered over with dirt and we recently have been dumping at the opposite end of the property immediately north of the railroad tracks. This portion of th eproperty is not surrounded by a fence. When we inspected it on August 14th it was in excellent condition, having been refilled with dirt, and the actual point where the dumping took place I believe does not constitute a hazard. On the other hand, the entire length of the canal is filled with water and to my inexperienced eye it seemed clear that the water was contaminated. I understand that children in the neighborhood use portions of the water for swimming and, as a matter of fact, just before we left the site we saw several young children walking down the path with what appeared to be bathing costumes in their hands.

I feel very strongly that if this water is contaminated as a result of our dumping chemical residues we are running a real hazard in not taking steps to prevent possible injuries to persons who may swim in the canal. When dumping operations are in process I assume our employees are present so that there is little chance of anyone coming in direct contact with the residues, but between periods of dumping, even though the residues are covered with earth, a seepage into the waters might cause serious damage with resulting liability to us. Although persons are trespassers when they go on the property and use the water, this does not relieve us from liability. The only possible relief from liability would be to keep guards at all times who would prevent people from using the property. This of course would not be practicable. The next best step would be maintain a fence around the property of sufficient height to make it difficult of access, together with signs spaced at regular intervals forbidding trespassers to go on the property. Even those procedure might not be complete insurance against liability, but it would go a long way toward minimizing the possibility.

Ansley Wilcox 2nd

P.S. I should point out that we have specifically covered this property and its use as a chemical refuse dump under our public liability policy. At the time this was done we advised the insurance company that we were erecting a fence around that portion used as a dump. The wording of the policy does not limit the insurance to the fenced portion, but I feel the insurance company might raise a question about continuing the coverage if there is a hazard which we are not taking all possible steps to minimize.

[**80] Wilkenfeld recalled that in 1953, the unfilled portion of the Canal was a few hundred feet long. By that time, Hooker had finished its disposal operations in the northern and southern sections, but it continued to dump chemical wastes, trash, and flyash in the central section through early February 1954. T. 4325. At the

same time, the City disposed of trash and garbage in the central section. T. 4216. Overall, approximately 75 percent of the wastes disposed of at Love Canal by Hooker were deposited in the southern section and portions of the central section, with the majority in the southern section.

III.

THE TRANSFER OF THE LOVE CANAL SITE TO THE NIAGARA FALLS BOARD OF EDUCATION

By early August 1946, Hooker knew that the Niagara Falls Board of Education was interested in constructing a new public school in the vicinity of Love Canal in order to accommodate the area's growing population. Toward that end, a representative of the Board expressed interest in acquiring a portion of the site, specifically the portion of the parcel that ran along Colvin Boulevard to the extreme north. The School Board's interest, however, was contingent on additional frontage along Colvin [**81] Boulevard on property adjoining Hooker's land. Ex. 45. Thus, the original plan was for school grounds extending along Colvin Boulevard, using property both to the east and to the west of Love Canal.

[*1020] In early 1952, the Board again expressed an interest in obtaining a portion of the Love Canal property. Hooker also learned that a developer had voiced interest in purchasing the entire site. Thomas Willers, [16] who served as Hooker's Comptroller in the early 1950s, attended a management meeting, in which Vice President R. W. Hooker announced that he had been approached by the Board of Education to discuss Hooker's willingness to sell the Love Canal property to the Board. [17] Over the course of the year, there were several discussions about the Board's proposal. [18] During the first discussion in early 1952, Willers recalled that Bjorn Klaussen, Hooker's Executive Vice President, and Hiram Young [19], Works Manager, immediately reacted to the proposal by stating that they thought the transfer to a school was undesirable. Mr. Young, who was responsible for waste disposal, said that Hooker needed the Canal property and had no immediate substitute for it. Both Klaussen and Young also questioned [**82] the desirability of land "which had been put to the use that Hooker had put it to being used for any other purpose, frankly, than what it was being used for." Ex. 1703 at 23 (Willers Dep.). Willers remembers that R. W. Hooker, who was handling the communications with the Board because he was a friend of William Small, the Superintendent of Schools, was told to communicate to the Board

> very early in the [**83] game . . . that the Hooker Company felt that [a sale] . . . was inappropriate, regardless of our need for it, because of the toxic nature of some of the materials that were being dumped there and [it] wouldn't be right for utilization for other than commercial or industrial development.

Id. at 101. At the next discussion with the Management Committee, Hooker reported a further conversation with Small, in which he informed the Superintendent of the Company's negative attitude toward the purchase.

A March 27, 1952, memorandum from Klaussen to Vice President Young discussed the requests to sell Love Canal and explained the Company's refusal to consider transferring even a portion of the property:

> About a month ago Architect Russell Larke said that a certain party was interested in purchasing Love Canal for the purpose of building low-cost houses and asked if we were interested in selling it, which I told him we were not.
>
> Just a few days ago, Superintendent of Schools Bill Small called at this office and explained that the school board is planning to erect a large school in the general

16 Thomas Willers was deposed on May 19, 1986, and portions of his testimony were read into the record. Exs. 1703 and 7141; T. 668-83.

17 See Appendix C, Ex. 2787, for an organizational chart of Hooker's management.

18 According to Leonard Bryant, Plant Superintendent at that time, the decisionmaking process of Hooker management through the 1940s and 1950s was not autocratic. It included a lot of "give-and-take" with the management group. T. 4565.

19 Neither Bjorn Klaussen nor Hiram Young was deposed or testified at trial. Frequent reference is made to memos written by Mr. Klaussen. Exs. 118, 199.

> locality of the Love Canal and he asked if we would be willing to sell our property. [**84]
>
> Wilcox [the Company's attorney] and I discussed this with Small for some time and we pointed out that we used the Love Canal for plant refuse containing some chemicals which were buried approximately six feet underground and covered. We informed Mr. Small that we were not in a position to sell the property and that the property was not suitable for the erection of school buildings.
>
> At a later date Mr. Small asked if we might sell part of the property for a school ground and I again gave a negative answer.
>
> It is rather clear that the territory on each side of the Love Canal will be used rapidly to provide buildings or a school and it may be advisable for us to discontinue using the Love Canal property for a dumping ground. It is also rather clear to me that we should not sell the property in order to avoid any risks.

Ex. 118 (emphasis added). Klaussen went on to state that the purpose of the letter was to [*1021] suggest that Young look for another site suitable for dumping, to ask Operations to prepare a map of the Canal dump, and "suggest ways and means and costs to prepare the property in such a way that it will not create a nuisance." Id. He also suggested filling [**85] in the property and creating gardens for the employees, "possibly with a lease which would protect us from any damage." Id. The memorandum was distributed, among others, to E. R. Bartlett, Hooker's Chairman of the Board; R. L. Murray, Hooker's President; R. W. Hooker and J.H. Babcock, both Hooker Vice Presidents; and Wilcox. See Appendix C.

Within a month, however, at least some members of Hooker management had changed their minds. An April 25, 1952, memorandum written by Klaussen to Hooker's President, R. L. Murray, told Murray that he and Ansley Wilcox, the Company's attorney, had talked several times with Superintendent Small and a representative of the City Planning Board for Niagara Falls about the Board's desire to build a school on or near the Love Canal property. After noting that he and Wilcox had initially opposed the idea, Klaussen wrote: "The more we thought about it, the more interested Wilcox and I became in the proposition and finally came to the conclusion that the Love Canal property is rapidly becoming a liability because of housing projects in the near vicinity of our property." Ex. 119.

Klaussen and Wilcox eventually "became convinced that it would be a [**86] wise move to turn the property over to the schools provided we would not be held responsible for future claims or damages resulting from underground storage of chemicals." Id. Klaussen suggested that a school could be built on a portion of the central section that had not been filled, and that areas to the north and south that had been filled with chemicals could be used for school grounds and athletic fields. Klaussen added that Hooker would feel free to continue dumping chemicals at Love Canal, but indicated that only flyash would be dumped in the area contemplated for the school. Id.

Several reasons for this sudden shift have been suggested. OCC insists that the reason for the transfer was Hooker's belief that the Board intended condemnation proceedings if the Company refused to convey title voluntarily. T. 670, 673-74 (Willers); T. 4177-78 (Wilkenfeld); T. 4560-61 (Bryant); T. 5118-20 (Chambers); T. 1178 (Schultz), Ex. 256. Willers remembered Hooker reporting to the committee that the Board "might have to insist in some legal way of having us give up the property" (Ex. 1703 at 100), such as condemning it for public use. Mr. Young reportedly told his assistant that because [**87] the School Board was insistent and had threatened to start condemnation proceedings, the Company decided to donate the site instead, making sure the Board understood the hazards and attaching clear language about the hazards in the deed. Bryant Dep., Ex. 1697 at 238. Jerome Wilkenfeld remembered someone telling him that the decision to give Love Canal to the Board was made because:

> The School Board had threatened legal action . . . to take the property from us under eminent domain . . . . And that Hooker is a good local citizen and was not going to get involved in that kind of fight with the School Board and would deed it to them for $ 1 and include some advisory

> on . . . the fact that the site had buried chemicals on it.

Ex. 1702 at 595. Willers also recalled that the management committee members were indignant when they heard of the threat but did not think it had any impact or effect on the ultimate decision. [20] Ex. 1703 at 317.

> 20 Later in September 1952, the Board did commence condemnation proceedings for the acquisition of other properties located between Reed and Wheatfield Avenues to the east of Love Canal (Ex. 3535).

[**88] The attitude of Hooker's executives may also have been affected by the results gathered from test holes dug on April 19 and 20, 1952. The digging was done to determine whether the chemical wastes had moved through the soil. In his memorandum to President Murray, Klaussen reported that ten deep holes had been dug at the site in order to test for subsurface chemical migration, and "in no case were chemicals found [*1022] nor was soil saturated with chemicals up to within twelve inches of the excavation." Ex. 119. A map purporting to show the location of the test holes was given to Small and Collins, the City representative. On the map there is a note, apparently in Klaussen's handwriting, saying that there was no evidence that wastes were migrating from the site. See Appendix D-1, Ex. 2019; Exs. 119, 3626 P 18 (City-OCC Stip); T. 4187 (Wilkenfeld). Klaussen noted in his memo that the "whole matter was discussed freely with Small and Collins." Ex. 119. The Board told Hooker that it still wanted the property, but Klaussen felt that Hooker would have to study the soil conditions further before it could consider a transfer. Id.

The evidence concerning the number [**89] and locations of holes dug to test the soil is inconclusive. OCC's contention that Hooker dug ten test holes is based on Klaussen's memo and a map of the Canal which identifies the location of the ten holes. [21] William Beck, who joined Hooker in 1952 as part of the Process Study Group, an entering group for newly hired engineers, testified about the map. Although he was not at all involved in digging test holes, he used a blueprint map prepared in 1952 by an unidentified Hooker employee when he went to the Canal in 1957 at the request of the Group's leader, Jerome Wilkenfeld, to determine where wastes were buried. T. 749-53, 755; Appendix D-2, Ex. 2044.

> 21 Five different versions of this map were offered into evidence: Exs. 2019, 2044 (previously OCC Ex. 89), 2045, 4047, 5018. They are all attached as Appendix D.

Several types of markings and notations had been added to the map prior to Beck's use of it, including ten circular symbols, each with an "X" inside. [22] T. 770. Over objection, Beck read into record the [**90] handwritten notes which were already on the map when he first saw it:

> 22 The crayoned additions on Ex. 2044 were added by Beck in 1957. See Appendix D-2.

> Test holes were dug in this area on April 19-20, 1952. B.K. noted the following on the original drawing: "No evidence of chemicals any place digging down 10-feet right up to within 1 foot of the excavations."
>
> "In places where we have dumped chemicals the chemicals are almost unchanged in form and found 4 feet below surface."

T. 760; Ex. 2044.

Mr. Wilkenfeld identified two other versions of this map. Exhibit 2019, which OCC contends is the map that Hooker provided to the Board, [23] includes the phrase, "Holes were dug on April 19th and 20th, supervised by Bentley. BK 4-21," which was written in Klaussen's handwriting. T. 4181. Wilkenfeld explained that Bentley was supervisor of the Yard Department in 1952-53. The second had a legend at the bottom explaining that the circles with the "X" inside symbolized: "test holes dug to determine underground [**91] seepage of chemicals, if any. There was none April 19, 20, 1952, except where noted." Ex. 2045;

> 23 However, the Board asserts that the only map it received prior to the transfer in 1952 had no test hole markings. Amendment to OCC-Board Stip. PP 7-8; Appendix D-4, Ex. 5018.

Appendix D-2. Wilkenfeld explained that he had added "except where noted" because liquid chemical residue was found in the two holes dug inside the Canal where disposal occurred. T. 4272. This finding is shown on the map by two notations, one in the far north and the other in the far south of the Canal, stating, "chemicals contacted 4' below grade." Ex. 2045. Beck and Wilkenfeld agreed that the "BK" in the notations was Bjorn Klaussen, Hooker's Executive Vice President in 1952. T. 760 (Beck); See, Appendix C. Wilkenfeld said that he did not know whether Klaussen went to the site in 1952, but the handwriting appeared to be Klaussen's. T. 4180, 4364.

Despite this evidence, the State disputes OCC's assertion that ten holes were dug and refers [**92] to the testimony of William Wagner, the only living witness who actually dug the holes. Wagner recalled that his supervisor, Mr. Bentley, told him to dig a test hole in the southern section in 1952 or early 1953. He [*1023] dug a pit close to the disposal area 8' by 12' and 15' deep. It was a dry day, and the hole was all dry. The soil consisted of sandy loam and red clay just above the blue clay. The pit was left open for 1 1/2 -2 weeks and remained dry the whole time. Bentley was there while the pit was being dug and checked it later. T. 852-55. Wagner only knew of one other hole dug at that time--in the northern section. T. 880 (Wagner).

Although Wagner was only able to recall the digging of two holes, it is likely that the various maps with their circled "X" symbols marked the locations where Hooker tested for chemical seepage under Bentley's supervision. When the holes outside the disposal site remained free of liquid chemical residues, Klaussen was able to report to the rest of Hooker's management and to the School Board that there was no evidence of underground migration. Hooker's decision to transfer the site was probably most influenced by the understanding that the Company could [**93] not continue to use the Canal efficiently. At the same management meeting in which Mr. Hooker reported on the threat of condemnation, he stated that the Canal was nearing its exhaustion point, "on its capability of handling what we wanted to put in there . . . [and that] there were real possibilities of substituting, either through new acquisition or expansion, the real estate needed to continue the dumping needed based on the current output." Willers Dep., Ex. 1703 at 100. Mr. Young reported that in the long term, Love Canal was not as important for the disposal of residues as they had initially thought, and that they could cope with waste disposal at other sites. However, there was no change in the general opinion that the area in which chemical wastes were located had to be kept intact. "It was made abundantly clear that the only condition or one of the conditions . . . if it was going to be used for a playground . . . that the land could not be disturbed." Id. at 109.

Hooker's change of position regarding a transfer of Love Canal to the School Board caused concern within the Company. Robert Schultz, then an Assistant Technical Superintendent and [**94] Wilkenfeld's supervisor, stated during his deposition that he had heard "around the office that . . . our management or some of our executives were opposed to the sale." Schultz Dep. 285, T. 1128. He reported that his immediate associates "were sort of concerned about the possible sale of the property because of its nature." Dep. 289, T. 1133. He himself felt that "it was patently clear that anyone unknowingly

purchasing the property and using it could cause a hell of a problem." Dep. 286, T. 1132.

However, when questioned about these statements at trial, Schultz gave somewhat conflicting testimony. He claimed he was unaware that any of the executives opposed the transfer at the time it occurred, although he did learn of some opposition later. T. 1127; 1130. He explained that in 1952, he was a fairly low man in the organization and was not involved or privy to any of the negotiations with the Board. What he did know was simply gossip or hearsay. T. 1130. Through hearsay, he later came to understand that some executives were opposed to the sale, but he could not recall who they were. However, he did confirm that upon learning of the possible transfer, he and some of his associates [**95] were concerned that the property would not be used or maintained safely. They were anxious about maintaining the integrity of the property once someone started building on the site. He was afraid that if the cap was disturbed, chemical wastes could be spread and tracked around the school grounds, and children could end up playing in the wastes. It does not appear that Schultz conveyed his fears to management. T. 1133-36.

Jerome Wilkenfeld, the supervisor of the Study Process Group working under Schultz in 1952, also testified about his response to the decision. During negotiations, Schultz assigned him to develop information for Hooker to give to the Board about the

Canal property. At trial, he expressed a more strongly negative position about the transfer than did Schultz. The weight of his testimony on this issue, however, must be considered in proper context. In 1952, Wilkenfeld was only 33 years old. His position as a junior executive who had only joined the [*1024] Company in 1945 meant that he was not familiar with much of the information that management considered in deciding to convey the property.

Wilkenfeld testified that he was strongly opposed to transferring even a portion of [**96] the property to the School Board since he felt that a chemical dump site, even if enclosed and covered, was unfit "for public access or for anything to be built." Ex. 1702 at 730. In his view, the chemical wastes could be dangerous if disturbed. As a result, the site had to be "carefully controlled." Id. Excavation activities during development of the site might expose buried wastes. Although he felt that houses should not be built in the area surrounding the landfill, Wilkenfeld thought that the surface could safely be used for a playground if it was properly covered. He feared the consequences of subsidence, believing that corrosion of drums and settling would continue. Leakage from the drums increased the danger of human exposure to the wastes; and once ownership of the property was transferred, Hooker would be not be able to control or monitor its use. T. 4307-11, Ex. 1702 at 694-97. He

recalled that other Hooker employees felt that transfer was not a good idea, but did not identify any of these individuals. [24] T. 4306.

> 24 Wilkenfeld summed up his feelings about the planned transfer as follows:
>
> > At that time I think the company should have told the School Board to take us to court if you want that land. We are not going to give it to you. It is not an appropriate place for a school. I have said that before and I will repeat it again, and I still feel that way. I felt that way at that time.
>
> Ex. 1702 at 737.

[**97] Leonard Bryant, who would later become Hooker's Chairman of the Board and Chief Executive Officer, was Plant Superintendent in 1952, reporting to Vice President Hiram Young. See Appendix C. He recalled being told by Young that the School Board had informed Mr. Klaussen that it wanted to acquire Love Canal in order to build a school. Bryant strongly agreed with Klaussen's initial assessment that no part of the property should be transferred. He testified:

> There was a general knowledge that these organic chemical residues that we were disposing of was a mixture of all kinds of things, who knows what, and it was in the ground all mixed together and we just had a general feeling that, by golly, it better stay there and we better keep control of it to be sure it stayed there. That was just a general feeling that we all had.

Ex. 1697 at 246-47; T. 4592.

When Young told Bryant in a later discussion that the Company had decided to give the Canal site to the School Board, making sure the Board understood the hazards and attaching clear language about the hazards in the deed, Bryant remembered expressing his misgivings to Young. He explained that:

> when you lose control of property, [**98] you never know what the new owner will do with it, the foolish things that he will do with it . . . . It's not like a city garbage dump. These are chemicals and some of them last a long time and you would not build a building on it, put footings down into this kind of a landfill, no way . . . . We knew with what was there, the safe thing to do was keep it away from everybody forever.

Ex. 1697 at 250-51. Bryant recalled being surprised at the tone of the April memorandum, in which Klaussen changed his mind about conveying the property. He did not think that the property was suitable for school buildings or even a park. T. 4562.

Despite these misgivings within its ranks, Hooker decided to proceed with the transfer. In a May 1, 1952, memorandum, Wilcox informed Murray that Klaussen

had notified Mr. Small that Hooker "would in all probability be willing to turn over part of the Love Canal property to the School Department." Ex. 120. On October 16, 1952, Klaussen wrote to Small that Hooker was willing to donate the entire site even though the Board had been interested in purchasing only a portion of it, and that "we will be willing to donate the entire strip of property

. . . between [**99] Colvin Boulevard and Frontier Avenue" for the school. Ex. 141. He added that, "with the increasing growth of this area and its present lack of any park facilities, we understand that there is need for [*1025] areas devoted to this purpose." Id., see also T. 4177-78, 4200-01 (Wilkenfeld); T. 5118 (Chambers); T. 6945-47 (Metzler); Ex. 256.

On October 22, 1952, the decision by the Company's officers to donate the property was confirmed at a meeting of its Board of Directors. The Board's minutes of the meeting recounted Chairman E. R. Bartlett's report as follows:

> During the year 1941 the Company purchased for the sum of $ 1500 a tract of land in the City of Niagara Falls, commonly known as the Love Canal, for the purpose of using the same as a dump for chemical residues and other waste materials. He stated that the property consisted of a strip of land 200 feet wide extending south from Colvin Boulevard for a distance of about 3000 feet approximately to the rights-of-way of the New York Central and Erie Railroad Companies and also an extension thereof south of Buffalo Avenue for approximately 1500 feet. He stated that at the time the property was purchased the land surrounding [**100] the same was all vacant and that in recent years residential properties had developed on the easterly and westerly side thereof, and it was, therefore, felt that the portion of the premises between Colvin Boulevard and the rights-of-way of the railroads, which had been used primarily for burying chemical refuses, was no longer suitable for this purpose. He further stated that the Company had been approached by the Board of Education of the City of Niagara Falls and had been advised that the Board had been making a survey of land available for construction of schools and had come to a conclusion that a portion of this property was the most desirable location for a school in this area, and the Board had asked whether the Company would be willing to sell a portion thereof to the Board of Education.
>
> He further stated that the officers had given careful consideration to this proposition; that it had been ascertained that the proposed location of the school would be on a section of the premises on which no chemicals had been buried, and that there would, therefore, be no difficulty in installing proper foundations. He also stated that the officers believed that the only purpose for [**101] which the balance of the premises between Colvin Boulevard and the railroads rights-of-way could be properly used would be for a park or playground purposes, since the existence of chemicals beneath the surface would make it very hazardous to erect any structures thereon. He further stated that the officers were convinced that it was desirable to abandon this property for use in burying chemicals in view of the close proximity of residences which have been recently constructed, and in view of this fact, the officers had advised the Board of Education that the Company would be willing to donate the entire strip of land owned by it between Colvin Boulevard and the railroads rights-of-way with the understanding that a school should be erected on a portion of the property which had not been used for the burying of chemical refuses and that the balance of the property would be maintained as a park.

Ex. 145. The Board approved the transfer. Directors present: Bartlett, Murray, Babcock, Lutkins, Burnham. Id.

Hooker conditioned its willingness to transfer, however, on the School Board's acceptance of special deed provisions limiting the use of the property. Exs. 141, 261, and 7125. [**102] In turn, the School Board voted to accept Hooker's offer and proposed restrictions conditioned on reviewing and approving the actual deed. Ex. 3535, PP 26-27. Wesley Kester, Chairman of the School Board's Building and Grounds Committee, told the Board that Hooker believed the property was suitable for a school and park, but not for the erection of residences, and this was the reason for the special provisions sought by the Company. Ex. 2951. In a note to Hooker, the Board expressed its appreciation for the very generous offer and thanked the Company for helping to meet the City's need for educational facilities. Ex. 2023; 3535 P 26.

On November 20, 1952, the School Board asked the City through the Niagara Falls Planning Board to approve a site encompassing the central section of the Love Canal property and surrounding lots as the location for a new elementary school. Exs. 7125 at [*1026] 262; 3535 at 31. Hooker had told the chairman of the City Planning Board that portions of the Canal property contained buried chemical wastes, and had provided a map showing their location. [25] Exs. 119; 3126 P 18. On December 30, 1952, the City Planning [**103] Board approved the site. Exs. 150; 3626 P 22.

25 The April 1952 Klaussen memorandum (Item 119) indicated that copies of a map were given to both the City and the School Board. However, other than this memo, there is no evidence that the School Board ever received the map described. See Appendix D1-4.

The proposed deed sent to the Board specified that the property could only be used as a park, and that the school would be built near or next to the property but not on it. The deed provided in part: "This conveyance is made subject to the condition that the premises shall be used for park purposes only, in conjunction with a school building to be constructed upon premises in proximity to those above described . . . ." Ex. 256. Hooker created a reverter clause in the proposed deed which allowed the Company to reassume control of the property if it was used for other than "park purposes." Ex. 3535, p.28; T. 1179 (Schultz); Ex. 256. The reverter clause provided that: "Upon the abandonment of said [**104] premises for such purposes, or upon their use for any other purpose, the title to said premises shall revert to the grantor, its successors or assigns." Ex. 256 (emphasis added).

The School Board rejected Hooker's proposed deed, because it was not within the Board's purview to maintain park land. T. 1179 (Schultz); T. 4205 (Wilkenfeld); Ex. 3535 at 29. Hooker responded by removing the reverter clause and the affirmative covenant from the deed requiring the School Board to maintain a park. A new deed was prepared with an alternate paragraph expressly disclosing that the property contained chemical wastes and warning of the hazards. T. 4178 (Wilkenfeld).

By early 1953, the Board had begun to express interest in learning more about the nature of the materials that Hooker had dumped at Love Canal. In an internal memorandum dated February 12, 1953, Klaussen indicated to Bryant that the Company should closely watch any investigation pursued by the Board:

> You are aware that we have offered to convey to the Board of Education of the City of Niagara Falls the Love Canal property between Colvin [Boulevard] and the railroad tracks, a great portion of which we have used for disposing [**105] of chemical residues. In order to protect the Company, the proposed conveyance to the Department of Education sets forth the fact that the property has been used for this purpose.
>
> The School Department has raised certain questions as to the nature of the residues and has stated that they believe they should have tests made in order to ascertain as much information as possible before they accept the deed to the property. They have indicated that they might have the tests made by the Buffalo Testing Laboratory.
>
> We, of course, think it is quite proper for them to make such tests, for in any event they could so do after accepting the conveyance, and it seems to us if the tests are made in advance we might be able to avoid any erroneous conclusions. It would seem, therefore, that if and when these

> tests are to be made, we should have representatives on hand as observers to see what is done and we should also request the right to review the results of the tests before any report is made in order to be sure that they do not go far afield in their conclusions.

Ex. 153. It is not clear whether any further testing was in fact pursued by the Board.

By a deed dated April 28, [**106] 1953, Hooker conveyed the entire Love Canal property to the School Board in exchange for a payment of one dollar. [26] The deed contained the following provision:

> 26 Hooker took a tax deduction for a charitable contribution as a result of the conveyance of the property.

> Prior to the delivery of this instrument of conveyance, the grantee herein has been advised by the grantor that the premises [*1027] above described have been filled, in whole or in part, to the present grade level thereof with waste products resulting from the manufacturing of chemicals by the grantor at its plant in the City of Niagara Falls, New York, and the grantee assumes all risk and liability incident to the use thereof. It is, therefore, understood and agreed that, as a part of the consideration for this conveyance and as a condition thereof, no claim, suit, action or demand of any nature whatsoever shall ever be made by the grantee, its successors or assigns, against the grantor, its successors or assigns, for injury to a person or persons, including [**107] death resulting therefrom, or loss of or damage to property caused by, in connection with or by reason of the presence of said industrial wastes. It is further agreed as a condition hereof that each subsequent conveyance of the aforesaid lands shall be made subject to the foregoing provisions and conditions.

Ex. 159.

The deed was reviewed for the Board by City of Niagara Falls Deputy Corporation Counsel Ralph A. Boniello. In a letter dated May 5, 1953, Boniello warned the Board that it was accepting "the risk and possible liability to persons and/or property injured or damaged as a result thereof arising out of the presence and existence of the waste products and chemicals upon the said lands . . . ." Ex. 162. Boniello also warned the Board of possible liability arising out of Hooker's continued dumping. He recommended a proper liability policy to protect the Board. Id.

As a further condition of the transfer, Hooker reserved the right to continue dumping chemical wastes at Love Canal. In the cover letter to the Board sent along with the proposed deed, Wilcox confirmed that Hooker would continue to dump waste materials in unfilled portions of the property located north of [**108] Reed Avenue and south of Wheatfield Avenue. Hooker also agreed to the Board's request to deposit flyash in the central section. Ex. 160.

Hooker informed the Board by the deed, accompanying letters, and oral communications that corrosive and hazardous materials had been buried at Love Canal. Details of the discussions between Hooker and the Board remain unknown, because none of the negotiators to the transfer were available at trial. Other than a deposition from Mr. Willers, the court was presented with no direct evidence from participants and was forced to rely on the written record and testimony of Hooker employees peripheral to the transaction such as Wilkenfeld, Bryant, and Schultz, who could not supply more than limited information. The Board was warned not to dig into the landfill, but to keep it contained and covered with topsoil and seeded with grass and other vegetation. The Board was also advised that the public should not be exposed to the buried chemicals. T. 4178 (Wilkenfeld); Ex. 1702 at 725, 732-34; Ex. 2951. Wilkenfeld recommended that Hooker tell the Board to maintain good surveillance of the property, to keep sink holes filled in and the surface covered. Ex. 1702 [**109] at 730-31; Tr. 4173.

Hooker did not offer to provide specific technical data or analysis of the chemicals in the landfill. Ex. 1702 at 740-42. As discussed infra in Part VII (Industry Practice), the technology available at that time would have made such an analysis of many of the chemical

residues unreasonably costly and difficult. Wilkenfeld felt that given the conditions and technology at the time, the cautions conveyed were adequate. "At that time this was considered the best information we had. There was no attempt not to inform them as fully as we could of information about the materials and the hazards of the site." *Id. at 735-36*.

Nevertheless, Hooker did know with some precision the composition and dangers of certain chemicals buried in the Canal and could easily have provided explanations of what they looked like, what dangers they presented, and how best to avoid exposure. The best example of such a chemical substance is the BHC (benzene hexachloride) spent cake. As discussed in Part II, Hooker produced enormous quantities of lindane, the pure gamma form of BHC. The residues left after the pure lindane was extracted were largely a mixture of alpha, beta, and delta [**110] [*1028] BHC isomers, with small amounts of lindane still mixed in.

Hooker deposited between 6,000 and 7,000 tons of spent cake at the Canal. The material was readily identifiable as a whitish, chalky, crumbling substance. Based on the degree of subsidence already experienced by Hooker during the disposal operation, it would not have been difficult to predict that this substance would become exposed, as indeed it did after the transfer. Hooker could easily have informed the Board what the spent cake looked like, how it was dangerous, and what warnings should be given to school officials and neighborhood residences who might come in contact with it as well as giving the general suggestion that it be kept covered.

Wilkenfeld knew of no attempt by Hooker to ascertain whether the School Board had the resources, knowledge, and experience to undertake monitoring and maintenance of a chemical waste landfill. Moreover, he did not know whether the Board was aware of the degree of uncertainty Hooker had about the exact location of some of the wastes within Love Canal (*id. at 744, 748-49)*, nor that some people within the Company opposed the transfer for safety reasons. Finally, Wilkenfeld did not [**111] think there was any discussion within the Company about informing the public that the Canal might not be a fit place for a school. *Id. at 921*. He admitted, however, that he was not present at any of the management meetings or privy to communications between Klaussen and the Board at the time of the transfer. And, there is no evidence that the Board ever sought more detailed information about the nature of the chemicals buried in the Canal.

Wilkenfeld returned to the site just prior to the transfer in 1953 and found the cover complete and somewhat raised. The City was disposing of municipal wastes in the remaining unfilled portion of the central section. The parts that had been filed with chemical wastes were fairly level and in safe condition for transfer. There was no sign of leaching of buried materials and no evidence of chemicals seeping into the water in the open portion of the Canal or of subsidence of the cover. He concluded that the cover was in good shape and that transfer could proceed. However, he only did a visual check during this visit, with no sampling of water or any other testing. Ex. 1702 at 711.

The Board hired Hough Soils Engineering Laboratories in early [**112] 1953 to investigate the site. The main purpose of the investigation was to determine the feasibility of construction. Hough's report warned about the potential for instability, but concluded that construction was possible, albeit appearing "to involve somewhat more than ordinary expense." Ex. 161. There was no discussion of chemical waste hazards or the need for maintenance of the cover.

Relying upon its agreement with the Board, Hooker continued to dump chemical wastes and flyash at the site during the initial phase of construction of the school through February, 1954. Ex. 174. When Hooker discontinued use of the site, it did not place topsoil, seed, or vegetation on the cover.

IV.

POST-TRANSFER EVENTS

Between the time Hooker transferred the Love Canal site to the School Board in 1953 and the governmental intervention in 1978, several problems arose. Waste exposure during excavation for the school in 1953 forced relocation of the foundations. There was a series of complaints about subsidence, the eruption of potholes, and chemical wastes and drums rising to the surface. There were also some reports of minor injuries from chemical burns. Approximately 15 of these [**113] incidents were called to Hooker's attention at the time they occurred, but there is no evidence that the Company was informed of many others which were related at trial.

27

27 The locations of many of these events are marked in Appendix A-3, Ex. 1445. See generally State's Proposed Findings 1219 to 1482. The following is a list of proposed findings and the time of the event referred to.

> PP 1302-1313 (May 1955); PP 1219-1221, PP 1314-1342 (June 1219-1221, PP 1314-1342 (June 1958); PP 1225-1233 (September 1961); PP 1239-1248 (April/May 1970); PP 1249-1251 (Spring 1971); PP 1253-1259, PP 1361-1372 (May 1972); PP 1347-1360 (July 1971); PP 1475-1482 (August 1976).

[*1029] The incidents Hooker learned about are examined in detail, because the focus of this discussion is to understand Hooker's attitude toward the possibility of hazard to the community resulting from the chemical landfill. To illustrate the consequences of the Company's alleged recklessness in transferring the site, the State also offered evidence of [**114] occasions when subsidence or a similar event occurred which were not called to Hooker's attention. These latter events are recounted briefly but cannot be given much weight probative of Hooker's intent.

A. INCIDENTS WHICH WERE REPORTED TO HOOKER

A review of the post-transfer evidence presented shows that Hooker offered help or advice for every documented incident of which it received notification, while consistently maintaining that it was under no legal obligation to do so. T. 3185-86 (Cohen). The court was offered no evidence of any occasion during the 25 years after the transfer when the Board, any other party, or any individual demanded that Hooker take further action after it responded to a problem. Hooker was most often called to help with the potholes caused by subsidence. [28] Id. Occasionally, it was asked to identify a chemical that had surfaced and analyze its potential harm or give advice in treating an injury. This assistance was requested both when residents accidently came in contact with chemical residue and when the City and the State were engaged in activities which contributed to the exposure of waste at the Canal. The following is a chronology of these [**115] incidents.

28 Robert Cohen concluded after examining the complete record that between 1953 and 1978, up to 100 potholes erupted in the southern sector and that there were fewer in the central section. T. 3185-86.

1. Chemicals at School Construction Site

Wastes located in the central section began to cause trouble during construction of the 99th Street School even before Hooker stopped dumping at Love Canal. In a letter dated January 21, 1954, Charles Thiele, an architect hired by the School Board, reported to the Chairman of the Board's Building Committee that during excavation for the original proposed site for the school, the contractor hit a "soft spot in the ground" at the southwest corner. Ex. 180. Material in a filled drain trench gave off a strong chemical odor. Upon further investigation, the excavator made contact with a pit filled with chemicals. The general contractor then learned that there were "two dump pits approximately 30 feet wide and 40 feet long and about 20 feet deep . . . filled with [**116] chemical waste, some of which was in 55 gallon drums." Id. Thiele commented that:

> We were informed that no record was kept of the exact location of these pits . . . .
>
> We believe it is poor policy to attempt to build over this soil as it will be a continuous source of odors and until more information is available regarding the material dumped in this area, we must assume that it might be a detriment to the concrete foundations . . . .
>
> A test pit was also dug some 4 feet deep east of the approximate location of the north dump pit to make sure that the building would miss this particular hazard.

Id.

At the Company's direction, Mr. Wilkenfeld went to the site, where the contractor told him that he was concerned about "some black water that they saw around

the foundations that had just been installed for the school building. They were concerned that this might be chemicals and might attack the foundation." T. 4222. Wilkenfeld looked at the black liquid and tested it for acidity or alkalinity by tasting it. It had no taste, and he informed the contractor that, "I didn't think that it was acid or alkaline, and it probably wouldn't attack the foundation. He was [**117] satisfied with that, and I left." T. 4223. Wilkenfeld also described what he found as "black water. It could have been fly ash, it could have been just from the color of the soil, but the water was black and that didn't surprise me." T. 4330. He did not rule out [*1030] the possibility that the water contained chemicals, but he doubted that there were chemicals there because "there was no odor to it and no sign of free organics in it." Id. When questioned about the information he gave to the contractor, Wilkenfeld replied that he merely discussed the pH factor of the material because that was all the contractor asked about. T. 4328-31.

As a result of this discovery, the location of the school was moved approximately 85 feet north of the originally planned location. T. 2901 (Cohen). During closing arguments, OCC agreed that the materials found during the excavation for the school were chemical wastes in pits not shown on any map. OCC concedes that it made a mistake by not finding and including the pits on the map it prepared for the School Board. Truitt, Closing Arguments, January 7, 1992, at p.111. However, OCC claims there is no evidence that the Company knowingly withheld the location [**118] and existence from the Board. Rather, the Company believed there were no chemicals buried where the school was to be built. Nevertheless, the failure of Hooker to inform the Board and the contractor about the location of these wastes is inexcusable. Fortunately, an investigation by the County Health Department in 1976 revealed no evidence of chemicals at the school or on the neighboring surface in the schoolyard, and in 1978 a State investigation came to the same conclusion. Exs. 2102, 487; T. 1268, 1275, 6650.

2. Complaints About Odors: 1955

In early 1955, in response to complaints about odors, Mr. Wilkenfeld and Colonel Arnold Arch, the City of Niagara Falls Pollution Control Department Director, visited the Canal. Colonel Arch, who was deceased at the time of trial, previously had been in charge of the Army Chemical Control Laboratory in Niagara Falls. Wilkenfeld recalled that toward the southern end of the Canal, they noticed odors which were rather general and typical of those present throughout Niagara Falls. He did not notice any subsidence, and the Canal appeared to be covered. Wilkenfeld recommended that topsoil be put on the ground and vegetation planted to [**119] absorb the odors. Tr. 4224-25.

3. Crater in The Playground: 1955

Later in 1955, Mr. Wilkenfeld learned that a large hole exposing chemical wastes had developed in a playground area where a child had been burned by the residues. Wilkenfeld had difficulty recalling the details of this visit, but he agreed with the memorandum dated May 20, 1955, prepared by Colonel Arch describing the incident to the Acting City Manager:

> This report . . . concerns the accident which is reported to have happened at the "Hooker Dump" last night.
>
> The source of my information is Mr. Jerome Wilkenfeld, Assistant Technical Superintendent of the Hooker Electrochemical Company. Approximately 20 yards southwest of the 99th Street School the ground crumbled in an area about 25 feet square, uncovering some drums of chemicals which had been placed in the area when the dump belonged to the Hooker Electrochemical Company. Some of the school children noticing a slight odor began puddling in the material, splashing it in one of the children's eyes. The Principal of the 99th St. School phoned the Hooker Electrochemical Company for advice as to what the material contained. Mrs. Frank Dennis, Supervisor [**120] of the Hooker hospital, and Mr. Wilkenfeld proceeded at once to the school and recommended first-aid treatment for the student. The child has fully recovered.
>
> Mr. Wilkenfeld arranged for approximately ten trucks of fill to cover the exposed area and also sent a bulldozer out to the scene of the cave-in to level and

> grade the area. Mr. Wilkenfeld also recommended that the recommendations given to the Board of Education by him and the writer last year be carried out with the least practicable delay. The recommendations consist of grading and landscaping the whole area with vegetation in order to absorb and decrease any odor level of residual chemicals . . . .

[*1031] Ex. 201. [29]

29 See generally the State's proposed findings at PP 1302-1313.

4. Proposed Sale of Property: 1957

In 1957, the School Board considered a plan to sell a portion of the property to developers for the construction of homes. Upon learning of this development, Hooker sent one of its attorneys, Arthur Chambers, to the Board's [**121] regularly scheduled meeting on November 7, 1957, to advise against such a transfer. Mr. Chambers was deceased at the time of trial, but his deposition was read. T. 5110-41. The record of his meetings with the School Board is set forth in correspondence between the parties, the School Board minutes, the testimony of Mr. Wilkenfeld, who was present at the meetings, and the Chambers deposition.

At the November 7 meeting, Chambers told the Board of Hooker's opinion that the property should not be divided for the purpose of building homes. He told the Board that Hooker felt a moral obligation to warn against a sale of the property for subdivision and home construction. Ex. 253. In his preparatory notes for the meeting, Chambers wrote: "Then if someone is hurt and we, Hooker, escape liability, that does not heal the injured party." Ex. 252.

The official minutes of the Board for its meeting of November 7, 1957, described Chambers' advice:

> Mr. Arthur Chambers appeared as a representative of the Legal Department of Hooker Electrochemical Company . . . . He reminded the Board that, due to chemical waste having been dumped in that area, the land was not suitable for construction where [**122] underground facilities would be necessary. He stated that his company could not prevent the Board from selling the land or from doing anything they wanted to with it but, however, it was their intent that this property be used for a school and for parking. He further stated that they feel the property should not be divided for the purpose of building homes and hoped that no one will be injured.

Ex. 253. Mr. Chambers also told the Board that prior use of the land made it "unsuitable for construction in which basements, water lines, sewers and such underground facilities would be necessary." Id., see also Ex. 255.

Earlier that day, Chambers had called E.C. Jackson, insurance agent for the Hartford Accident and Indemnity Company, to ask about insurance coverage available to Hooker for any potential liability for chemicals buried at Love Canal that "would retain their corrosive and possibly unhealthy properties for a great number of years." Ex. 254. Jackson said that Hooker's policy would provide coverage from claims brought by reason of the dumping of chemicals, but that if any actions were brought, it could affect Hooker's experience rating. Id. Chambers' action [**123] appears to be that of a routine inquiry by corporate counsel.

One week later on November 14, Chambers talked to William Salacuse, the attorney for the Board who had been a member of the Board at the time of transfer. Salacuse asked Chambers about the possibility of selling part of the Canal property to developers, what tests Hooker recommended as a precaution before sale, and whether Hooker would cooperate in the tests. Chambers told Salacuse that Hooker was primarily concerned with preventing injury or property damage; but if the Board was determined to sell, Hooker would cooperate in testing the subsurface areas. In a letter of November 21, 1957, Chambers reviewed his conversation with Salacuse and also sent him a copy of the letter which Wilcox had sent to the Board. Exs. 256, 257. Chambers returned to the Board on November 21 to reemphasize the potentially hazardous conditions that made home construction inadvisable but to explain that because 4 to 5 feet of fill covered the chemicals, use of the land as a park or playground would not be dangerous. Ex. 261.

Ansley Wilcox II, General Counsel for Hooker, wrote to Dr. Charles Brent, President of the Board, on the day of the second [**124] meeting to amplify on Chambers' remarks. Ex. 256. Reviewing the history of the transfer, he noted that when the Board came to Hooker looking for a site to build a school, the Company decided to give the property to [*1032] the Board providing "it would be necessary . . . to incorporate in the deed a recital as to the use of the property and restrict the same to the erection of a school at a particular location which had not been used for the purpose of burying residues and that the balance of the property should be maintained for a park or recreational purposes." Id. The deed restriction which Hooker proposed stated that the conveyance was to be used "for park purposes only, in conjunction with a school building . . . . Upon the abandonment of said premises for such purposes, or upon their use for any other purpose, the title . . . shall revert to the grantor." Id.

Wilcox explained that the Board rejected the deed restriction requiring the reversion to Hooker, because the Board itself had no facilities for maintaining a park and "was reluctant to accept a conveyance containing an affirmative agreement to do so." Id. Since only the City was in the position to carry out this maintenance, [**125] "some agreement would have to be made with the City" to take care of it. Id. [30] Wilcox expressed Hooker's concern that as time passed, possible hazards at the Canal might be overlooked, with the result that people could be hurt. He urged the Board to use the property only for park or recreational purposes. Id.

30 The Board formally requested the City to take over the northern and southern sections of the Canal in 1957. OCC-City Stipulation 29 and 30.

The State describes Wilcox's letter as a lawyerly effort to protect the Company concerning something that was becoming a very controversial issue. Nevertheless, the letter fairly recounted the history of the transfer. Chambers sent a copy of Wilcox's letter to William Salacuse, telling him that Hooker would cooperate with the Board to help locate possible areas of danger and to advise the Board with respect to length and depth of any test trenches to be dug. Ex. 257.

The State emphasizes that in the course of these discussions, Hooker never mentioned the history [**126] of drums corroding and leaking, nor that subsidence would continue to expose drums and chemicals. In the four years since the transfer, Hooker had already been called upon several times to help handle these very problems, yet apparently no one at the meeting raised the possibility that, even if left in the Board's possession, the cover could not be maintained effectively. On November 7, the date of Mr. Chambers' first meeting with the Board, William Beck, a member of the Process Study Group, went to the Canal at Jerome Wilkenfeld's request to determine approximately where Hooker had buried its wastes. He was accompanied by Gilbert Johnson, who was head of the Yard Department, who relied on his memory to help Beck prepare a map, noting the location of various types of waste products. T. 749-57 (Beck); Appendix D-2, Ex. 2044. Yet, there is no evidence that the Board was ever given a copy of this map, which was presumably Hooker's best estimate of where the wastes were located.

The State also calls attention to the remarks of Board member Wesley Kester, which were reported in the Niagara Falls Gazette on November 8, 1957. Ex. 261. After the meeting, he said, "There's something fishy [**127] someplace. Now they tell us it shouldn't be used." His comments are difficult to understand, for he and four other members of the 1957 Board were also on the Board at the time of the transfer in 1953. Hooker officials told Board members Kester, Brent, and Bialecks in 1953 that homes could not be built at the Canal site, that it was filled with chemical wastes and had to be properly maintained. T. 4211-12, 4198, 4523-26 (Wilkenfeld); Ex. 2028. When Chambers told the Board what information Hooker had given the Board in 1953, no one contradicted him.

In 1957, after the School Board graded and filled low spots in the southern sector, Board members inspected it. Ex. 3535, Nos. 84, 85. Erna Runals, one of the Board members, testified that she understood then that the buried wastes should not be disturbed by digging into the ground. Ex. 7138 (Runals Dep.). Hooker officials on their own initiative had gone to the School Board not once, but twice, to remind them of their agreement to maintain the security of the site and strongly advised against selling any portion [*1033] of the property to developers. Moreover, the dumping at Love Canal was observed by various employees and officials of the City. [**128] T. 5011-14, 5018 (Penque); T. 11590 (Ventry).

After the meetings, the Board voted to send a letter to Hooker expressing appreciation for sending a representative to the Board meeting "to explain the

conditions of the soil near the Ninety-Ninth Street School when there was no legal obligation on their part to do so." Exs. 253, Ex. 2048. In spite of the explicit warnings given to the Board by Hooker's lawyers, the Board sold the southern end of the Canal to a private individual a short time later.

5. Problems During Road Construction: 1958

In 1958, Hooker learned of complaints about subsidence and children being burned by exposed chemicals. In June of 1958, Wilkenfeld wrote to R. F. Schultz, then Hooker's Works Manager, that three or four children had been burned by material at the Canal. Wilkenfeld noted that R. Fadel, Inspector for the City Engineering Department, reported he "had been down there inspecting a new road that was being constructed near the 99th Street School and gave Mr. Arch the impression that these children were burned while playing on earth excavated in the construction of this new road." Ex. 264. Despite the warnings Hooker had given earlier to the Board [**129] about the dangers of digging into the ground, the contractor was either not informed about the nature of the chemicals underground or, if warned, took no steps to prevent spreading the waste material in the surrounding area.

Wilkenfeld told Schultz that Beck and Johnson had subsequently visited the area and noticed that just south of the road construction, where dumping had occurred, "the ground had subsided and the ends of some drums which may have been thionyl residue drums were exposed and south of the school there is an area where benzene hexaxhloride [sic] spent cake was exposed." Id. Beck and Johnson told Wilkenfeld that "if children had been burned it was probably by getting in contact with this material." Id. They reported that "the entire area is being used by children as a playground even though it is not officially designated for that purpose," and suggested that these areas be recovered to avoid any further contact. Id.

Mr. Beck said he saw as many as a dozen small pieces of spent cake. T. 773-77. He remembered surmising that the children "picked some of these pieces up and played with them and got some irritation as a result . . . . I think that would be [**130] a natural reaction of children who saw these white chunks, attractive-looking, lying on the ground. I think a tendency would be to pick it up, look at it, maybe play with it for a while, then throw it away." Tr. 806. Wilkenfeld advised the City Air Pollution Control Board that these areas should be covered (T. 4229-31 Exs. 264, 2045, 3626), and similar information was given to the Board. T. 4234. In addition, in July 1958 Wilkenfeld gave another map to the Board showing where wastes were buried. T. 4234; Ex. 2045.

As discussed in Part II, supra, Hooker was fully aware that the spent cake that Mr. Beck found lying on the ground posed a great danger to these children. Ingestion of this material could be fatal. Exs. 1159, 1335 at 50. Although the spent cake only contained small amounts of lindane, the most acutely toxic form of BHC, the beta isomer and the most chronically toxic form of BHC, was present in much greater quantities. It could be absorbed through the skin, stored, and accumulated in the body, eventually damaging the liver and other organs. Id.

Mr. Beck also found thionyl chloride residue drums exposed to the surface. While the methods Hooker used in disposing of [**131] the thionyl residue dissipated most of the toxic liquid (see Part II, Section E, supra), occasionally a barrel which had not been punctured or still contained rework residue with traces of thionyl chloride would continue to react slowly with water and eventually burst, releasing hydrochloric acid (HCL) and sulfur dioxide (SO2) and whatever traces of thionyl chloride or purifiers like toluene were left. T. 157; Item 1021, P 309; T. 1078-79, 1085 (Schultz). The vapors of these chemicals could be irritating to the skin, eyes, nose, [*1034] throat, and respiratory system. T. 572 (Brix); Exs. 1335 at 70; 1141.

The State contends that even though Hooker was well aware of the dangers associated with exposure to these chemicals, it never shared this information with those affected by the wastes. Indeed, Chambers advised Wilkenfeld during the 1958 incident that Hooker "should not do anything unless requested by the School Board." Ex. 264. According to Wilkenfeld, it was the belief of Hooker management that the Company did not have a continuing duty to maintain the property after the transfer. T. 4232, 4238-39; Ex. 286. In fact, Hooker believed that it had no right to correct problems at the site [**132] without permission of the current owners. T. 4232.

However, those who were most affected by the exposure were the children who lived, played, and went to school at the Canal site. Once Hooker was notified that children were playing with the spent cake and had access

to thionyl chloride residues from the drums exposed to the surface, they had at least some responsibility to these children or their parents to make known to them the extent of the danger and the measures which needed to be taken should a child, despite warnings, touch, inhale, or ingest any of these toxic substances. There is no evidence on record that any such effort was considered or carried out.

6. Board Offers Property to the City: 1958 - 1959

By August 1958, the northern and southern sectors had been graded and recovered. There was also some grading behind the school. Ex. 2800; T. 4653, 3052-53. When Mr. Boddecker, a City engineer, inspected the area in late 1958, he found that the property was relatively flat and that there were no exposed drums or waste material. T. 10,046-47.

At some point in 1958, the School Board offered a portion of property to the City in order to "develop ball diamonds and other [**133] play facilities." Ex. 531A. At first, the City refused to take land north of the 99th Street School "because of the tremendous holes being created due to the chemical reaction in the land." Ex. 531. The City considered the area south of the school toward Frontier Avenue to be "in worse shape insofar as 'sink holes' and things [like] that are concerned." Id. T. 2841-43 (Cohen); Ex. 1445, 531. No one asked Hooker to attend to this condition.

However, when the Board offered the land a second time in May 1959, the Council recommended that the City Manager look into the possibility of transfer. Ex. 531A. He requested the Director of Parks to meet with the City Engineering Department to see if the Love Canal property could be used for a playground. After the Manager and his staff, along with Hooker representatives, inspected the property, the City and Board agreed to develop a playground behind the school for use by the school during the school year and by the City during the summer. Ex. 273. The City Manager suggested that the remainder of the property to the north and south of the school be "transferred to the Junior Chamber of Commerce for their long range development of this property [**134] for recreation purposes." Id. In June 1960, the City accepted a deed from the Board for Canal property north of Reed Avenue to be developed as a playground by the Junior Chamber. Ex. 296.

7. Eruption of Thionyl Chloride Container: 1961

In September 1961, the Niagara Falls Fire Department contacted Hooker about an exposure of thionyl chloride residue. When Hooker was asked for advice in disposing of the material, J.E. Dillman, Hooker's supervisor for Technical Control, inspected the area. In a memorandum he reported:

> I found that a buried drum of Thionyl Chloride rework residue had apparently exploded, spewing residue over an area of about 10 [square] yds. The explosion was confirmed by a neighbor as having taken place around 9 a.m. Sunday, September 3. The residue was still fairly intact on Monday morning when inspected by the Fire Department, but by Tuesday it had hydrolysed and decomposed to a yellow stain [*1035] over the soil. The soil was dry and strongly acid.

Ex. 286.

As discussed above, Mr. Wilkenfeld explained at trial that the drum was probably not sufficiently perforated when it was dumped in the disposal pit, so that some thionyl chloride remained. When [**135] enough water leaked in, there "was just an over-pressuring of a drum that was probably weakened and just broke open. It could make noise, it could throw some of the earth in the air a little ways as it released the pressure." T. 4132. Mr. Dillman told the Fire Department to cover the area with clean soil to prevent persons from coming in contact with the contaminated soil. He also informed the fire captain that while Hooker would be available for any further advice, it was no longer legally responsible for the property. [31]

> 31 See also State Proposed Findings at PP 1225-1233.

Interestingly, just prior to this incident, Hooker's Works Manager Maynard L. Parker had received a memorandum from C.M. Olson, Health & Safety Supervisor, chronicling a series of health problems related to this same residue. Ex. 1180. Olson entitled his memo "Thionyl Chloride Residues" and reported that workers had been sprayed on August 2, 6, & 9 from drums that "let go" or were shot out because they were "badly bulged." Id. One man [**136] suffered an eye injury as a result despite the fact that he wore eye

protection. In another case, an entire building was evacuated. Id. Olson concluded that "it would appear to me that safe and final disposal of this problem merits being considered a major project." Id. Apparently, Hooker's concern about the hazard this chemical residue posed was not relayed to the Board.

8. City Excavation at Wheatfield Avenue

At some point during the excavation of Wheatfield Avenue, which took place between 1959 and 1962, the City asked Hooker for assistance. A backhoe digging a ditch on Canal property had run through the drums buried there. T. 120. Mr. Parker went to the excavation site. Upon arrival, Parker saw some construction workers at Wheatfield Avenue in a ditch across the Canal about 5 or 6 feet deep. He recalled: "I saw a bunch of poor fellows down there in hip boots wading around in swill

. . ." T. 123. When he was asked what they could do, he told them to "crib up the sides of this ditch . . . and put some planks down there so you don't need to wade too deep in it, and when you get through, will you please fill it up with clay instead of slag." Id. They had been [**137] using limestone for fill. The liquid in the ditch was black and smelled of chemicals. T. 126, 129 (Parker Dep. at 102-16).

Mr. Parker did not return to the site (T. 129-30), and apparently Hooker gave no further advice to the City regarding this incident. There is no evidence that any further aid was sought. City engineers should have been well aware that a large amount of chemical waste had been buried in this location and must take responsibility for any excavation undertaken without proper precaution.

9. Proposed Sale of the 102d Street Landfill: 1962

On December 4, 1962, Mr. Parker, by then a Production Manager, wrote a confidential internal memorandum opposing the possible sale of the nearby 102nd Street landfill to the City for the enlargement of a park. Ex. 293. He noted that the characteristics of the fill were not conducive to park development, reminding Mr. Coey that Hooker was still plagued with problems at Love Canal in spite of their best efforts to shed responsibility. He said, "Geography in this area is a scarce commodity. Hooker may want this property for its own development in the future." Id. In his testimony at deposition, Mr. Parker explained that [**138] when he said Hooker was "plagued," he was referring to the prior incidents in which children were burned. Parker Dep. at 148-49. He also explained that he had been

> against the use of any landfill for recreational purposes [because] if you're going to have children on a playground or -- we had learned from some past experiences
>
> . . . that it isn't a wise idea to have children [*1036] playing over any place where there's anything buried, "cause they have a tendency to dig."

Id.

10. Problems During Construction of LaSalle Highway: 1968

In 1968, the State began construction of the LaSalle Arterial Highway. As part of the project, the State acquired an approximately 55-foot-wide strip of the southern tip of the Love Canal property in order to relocate Frontier Avenue as requested by the City rather than close the road as originally planned. During the course of the planning for the project, Hooker expressed opposition to certain proposed ramp locations but did not warn the State of any potential dangers associated with excavating on or near its former landfill. Yet, the State never explained why their planning failed to take into account the obvious presence of [**139] the landfill.

On March 15 of that year, State contractors encountered chemical residues during excavation for a storm sewer trench being dug as part of the relocation of Frontier Avenue. Phillip Goodman, the Assistant State Engineer in charge, testified that prior to that date, he had never noticed any exposed chemicals, parts of drums, or odors during excavation. T. 4757. As soon as Goodman asked for assistance, Hooker sent representatives to the site to take samples of the material for analysis. T. 4765; Exs. 331, 1625. Fred Olotka, a Hooker employee, immediately told Mr. Goodman that the material should be covered, because if it dried out it might ignite. T. 4766.

After analyzing the material, Hooker prepared an internal report dated March 21 which described the sample as "an 'oily' like residue that burned like a 4th of

July 'sparkler.'" Ex. 1267. On May 9, apparently after a second request for information was made, Hooker reported to the State that the material was composed of "small amounts of chlorotoluenes, trace benzoyl chlorides and approximately 5% benzoic acid . . . ." However, the State's report did not include the description of oily residue which burned like a sparkler. [**140] Exs. 333, 1289. The State claims this omission was an attempt by Hooker to withhold information. OCC contends that the State reads too much into this transaction, since both the County Health Department and the State were aware that the material should be handled carefully, and the Health Department closely supervised the movement of the material. OCC asserts that the State did not ask for the report until after the County requested it and had no need earlier for a more detailed chemical analysis. Exs. 2074, 2076.

It is important to mention that during construction of the highway, the State's performance was equal to or worse than anything for which it upbraids Hooker. Contractors left many truckloads of excavated wastes unattended at the site for some time. Removal did not happen until after nearby residents and the County DOH complained about the strong odors. Hooker agreed to take the residue at its Hyde Park landfill, but most of these wastes were ultimately dumped at the Nash Road landfill in the Town of Wheatfield. T. 4796, 4811. After moving about 1,000 cubic yards of material, the contractor used permeable material such as broken stone, gravel, excavated street asphalt, [**141] and broken concrete mixed with clay to backfill. T. 4792; T. 4806. [32]

32 See also Proposed State Findings at PP 1518-1538.

The State and County DOH inspected the Nash Road landfill before using it and determined the site was "acceptable" because its soils were "impervious." Exs. 2080, 2082. The soils at the Nash Road site were similar to those at Love Canal. The landfill was never fenced. Many years later, it was discovered that the wastes in the Nash Road landfill were leaking, contaminating the groundwater and threatening residents because of poor cover maintenance. Ironically, the State criticizes Hooker severely for placing waste in what the Company believed was a secure site in 1942; and 25 years later the State itself is caught up in a similar predicament. At the time of trial, the Nash Road site was on the State's list of hazardous waste disposal sites. T. 4815 (Goodman).

[*1037] *11. Report of Children Playing with Chemical Residue: 1970*

In late April or early May 1970, Hooker was notified by the Niagara [**142] County DOH of a complaint that children had been playing with chalk-like residue that had surfaced at Love Canal, and that water at the location was rust-colored. T. 2843 (Cohen). There was no report of an injury. Ex. 351. Two Hooker representatives investigated the complaint with Mr. Pasqualichio of the DOH. At the site, they discovered exposed drums as well as discolored water in an area near 753 97th Street. J. M. Brogard, one of the Hooker employees, took samples from the drums and the water, tested them, and reported to the Health Department that they contained nothing harmful. Id. This apparently satisfied Pasqualichio, for no further inquiry was made. During the trial, Mr. Brogard was employed in the New York office of EPA but not called as a witness.

12. Complaint of Odors: 1971

In the spring of 1971, when a nearby resident complained about odors, several Hooker employees walked the length of the Canal and found exposed drums, fiber containers, and potholes. T. 2844, Ex. 1445. The resident was directed to contact the City.

13. Complaints of Eye Irritation: 1971-72

In July 1971, Hooker learned that a child's eyes had been burned by exposed BHC wastes [**143] on the surface of the northern section near the back lot lines of 97th Street. Hooker employee Fred Olotka talked to the child's mother and went to the area where the incident had occurred. He observed lumps of white powder about the size of a fist on the ground and an exposed fiber drum about two feet in diameter and four feet tall. Olotka was told that the children were touching or throwing the lumps and had received irritation burns. He had several pictures taken which showed exposed chemical residue and the fiber drum, and reported that a landscaper had been working in the area and it appeared that some of the topsoil had been scraped away. Olotka Dep. 23-24, 37; Exs. 368, 1453 PP 273-276. Hooker's attorney notified the Board, and the City suggested that additional soil be placed in the area. Ex. 2087. [33]

33 See proposed State Findings 1347 to 1360.

In May 1972, Debra Gallo, 11 years old, while playing near swings at the school, found some stone-like

material which crumbled into powder. She rubbed her eyes [**144] and was taken to the emergency room for treatment. Ex. 376. Upon investigation Hooker learned that several young girls had burned their eyes and faces after using dry chunks of exposed residues from Love Canal as chalk to write on a sidewalk. Ex. 378. When informed of the Gallo incident by the Fire Department, Mr. Brierly, Hooker's safety supervisor, went to the site and identified wastes found near the south side of the school as benzene hexachloride ("BHC"). He also learned that two young boys had been treated for burns to their face caused by contact with chemicals. All recovered. Ex. 378. The Fire Department hosed the area down. [34]

34 See also State Proposed Findings 1361 to 1372.

14. Aliphatic Acid in Hole Where Children Were Playing: 1976

There was a complaint in 1976 about discolored water in a hole several feet deep and about three feet in diameter which had been dug by neighborhood children. Exs. 2095, 1453. A sample was taken, and it was found to contain aliphatic acids. Ex. 2096. [35] Hooker [**145] told the Niagara County Health Department to have someone fill the hole and tell the children not to play in the area. Ex. 1453. [36]

35 Aliphatic is defined in Webster's Third International Dictionary (1986) as: "relating to, or derived from fat . . . used of a large class of organic compounds characterized by an open chain structure and consisting of the paraffin, olefin, and acetylene hydrocarbons and their derivatives (as the fatty acids)."

36 See generally State's Proposed Findings 1475-82.

[*1038] **B. INCIDENTS NOT REPORTED TO HOOKER**

In addition to the incidents just discussed, the State presented evidence of other problems to demonstrate the conditions in the area. These incidents are only reviewed briefly, because there is no indication that Hooker ever knew of their occurrence or was asked for assistance.

1. Subsidence in the School Play Area: 1956

In October 1956, Mr. Thiele, the architect for the school building, wrote the following letter to one of the contractors about the need [**146] to alter site plans due to the discovery of chemical residues:

> We wish to point out that due to the existing conditions of the subgrading in certain areas, particularly south and south west of the building, certain changes were made to the original plans. These changes were discussed with school authorities prior to doing the work. The Kindergarten play area was moved to parallel the concrete walk south of the south entrance. This was done because a chemical dump occurred at the originally located play area. As these chemical pits are continuously settling, we felt it advisable to raise the finished grade at such areas. The grade of the south west corner of the property was also raised in order to provide adequate cover of the rubbish and fly ash previously deposited.

Ex. 234 (emphasis added). Although this information was given to school authorities, no one called it to Hooker's attention. Evidently, the architect and the school authorities believed they could handle the problem adequately without Hooker's help.

2. Land Collapse in School Parking Lot: 1960

A 1976 issue of the Niagara Gazette printed an interview with the school principal, who reported [**147] that in 1960 the land collapsed in an area near the teachers' parking lot, leaving a hole about two or three feet deep extending over an area about 15 by 30 feet. The principal also reported that a hole two feet in diameter suddenly appeared in the ball field, and part of a metal barrel could be seen. William Howell, who moved to the Canal area in 1956 when he was six years old, also testified that subsidence took place at this ball field where he and his friends were playing. T. 171.

3. Puddling at the School: 1961

In 1960 or 1961 June Wirth, who lived on 99th Street, suggested at a PTA meeting that boards be placed on the ground near the school because chemical-laden water collected in puddles in an area where children who lived on the western side of the school had to wade through the puddles when walking to and from school

during rain storms. This grade school was attended by children as young as six and seven. T. 97-98, 100-01.

4. Chemical Residue Exposure during Street Construction: Early 1960s

William Howell also recalled an incident which occurred while he and a friend were watching workers construct Reed Avenue across the Canal. When they peered into [**148] a trench which was about 15 or 20 feet deep, they saw metal drums, including at least one that had broken. The exposed materials emitted such a powerful stench that he became ill and was confined at home for three days. T. at 173-74.

5. Emission at the Ball Field: 1969

Peter Bulka, a former resident who had been employed briefly at Hooker testified that, while managing a little-league team on a baseball diamond located on the Love Canal property near Colvin Boulevard, a boy came running in from the outfield shouting that there were "volcanoes" on the field. When he went into the outfield to investigate, he found two mounded areas on the ground that were spewing grey fumes. He described the fumes as smelling like thionyl. T. 105-07.

*** * * ***

These events, occurring after Love Canal was taken over by the School Board and prior to 1976, when increasing evidence of chemical exposure and migration began the process which culminated in government action, [*1039] include only relatively minor noticeable injury or property damage. The recurring instances of subsidence did put Hooker on notice that the Board could not prevent all exposure to the chemical wastes buried in the Canal [**149] but, from the record before the court, it is apparent that neither Hooker nor the Board ever believed the Company had a responsibility to ameliorate this problem.

In every documented instance of chemical exposure of which Hooker was notified, it responded with some type of assistance. However, there is no evidence that the Company conveyed its knowledge about the particular dangers of the chemical wastes. The extent of Hooker's knowledge about the chemical residues surfacing at the Canal will be explored in greater detail below. In the recounting of the above series of incidents, it seems clear that at the time neither Hooker nor the Board believed the Company had any legal responsibility to react beyond the scope of what it was asked to do. Nevertheless, considering Hooker's superior knowledge and experience acquired by extensive handling of these chemical residues, the State has a strong argument that, at the very least, the Company should have provided more detailed information to the Board and to residents of the dangers they and their children faced in handling and suffering exposure to the waste materials which surfaced at the Canal after the transfer.

V.

GOVERNMENTAL [**150] **INTERVENTION & OFF-SITE MIGRATION**

A. INVESTIGATIONS BY GOVERNMENT AGENCIES

Complaints about surface exposure to chemical wastes increased during the mid-1970s, eventually accompanied by reports from neighboring residents of chemicals seeping into their homes. These reports led a series of governmental agencies to investigate the site, establish an Interagency Task Force, and decide on a course of remedial action.

In 1973, the Niagara County Health Department ("NCHD") received complaints about odorous conditions at Love Canal and sent George Amery to investigate. Amery, an environmental engineer, had just started with the NCHD that year after retiring from E.I. DuPont deNemours in Niagara Falls. He reported that the undeveloped area between 97th Street and 99th Street, Frontier Avenue and Wheatfield Avenue, had "exposed, odorous [sic] material. . . . An inspection discloses that covering soil has been removed and the area is only about 40% seeded." Ex. 499; T. 6637. At trial, Amery explained that "vegetation was growing on about 40 percent of the area. The balance was mixed with soil and chemical residues that wouldn't support vegetation. I noticed . . . slight ponding, [**151] very shallow ponding of black residues in certain areas." T. 6638-39, 41. Amery determined that the area's cover was inadequate to protect people from the dangers of stepping into the exposed chemicals. Between 1973 and 1976, the NCDH repeatedly attempted without success to contact the current owners of the property to ameliorate the conditions on the surface. T. 6642-44.

In August 1976, one of the inspectors asked Hooker

to analyze a sample of a blackish substance taken from a hole filled with discolored water behind a resident's property because the NCDH could not make the necessary tests. Item 1021, P 338; T. 6644-45 (Amery). An infrared scan showed the substance contained "several different compounds [of] 'aliphatic acid.'" Ex. 2096; T. 6644.

The first official evidence of subsurface chemical release from Love Canal did not appear until November 1976. T. 6647-49, Ex. 2932 (Amery). Amery once again visited the site and found that chemicals were migrating through the subsurface to some Ring I basements, and eventually to the City sewage system. After the City was requested to take action to prevent further discharge (T. 6647-48, 6658), a meeting was held with Hooker, the Board, [**152] the New York State Department of Environmental Conservation ("DEC"), the City, and other interested parties. T. 5226 (Cull); Ex. 2111.

Believing that it no longer had legal responsibility, Hooker agreed nevertheless to assist in addressing the problem (Ex. 2111). [*1040] Meetings were held. A "Love Canal Study Group" was formed, with representation from all interested parties except the State and the federal Environmental Protection Agency ("EPA"). However, both the EPA and the DEC were kept informed of the work of the group, and their representatives attended some of the meetings. The Calspan Corporation, and later Conestoga Rovers & Associates (CRA), were hired to conduct an investigation and to recommend proposals for a remedy. T. 6653-56 (Cull); Exs. 2108, 2110, 2111.

When the EPA suggested in the spring of 1978 that a Study Group meeting be held without Hooker representation, Commissioner Clifford of the NCHD stated that Hooker had given considerable cooperation throughout the planning stages and should be in attendance at the meeting. Ex. 3626. Hooker contributed financially to the investigation, provided machinery to assist CRA, helped dispose of surface liquid, and provided cover for [**153] low spots on the site. T. 5226, 5266 (Cull); 6658 (Amery); 850-51, 881-82 (Wagner); Ex. 3626. In June 1978, CRA submitted a plan suggesting that work be started as soon as possible. The Study Group tentatively approved the plan, and contracts were ready to be signed for work to begin in the summer of 1978. Hooker offered to share the costs of the plan with the City and County. Ex. 3626.

Hooker's response to the County's request for assistance becomes important in light of the subsequent decision to remove it as a player in the clean-up. The State argues that the history of Hooker's efforts are irrelevant, but I believe that what OCC did when the County Commissioner sought help does have a bearing on the Company's intent.

In August 1978, Commissioner Whalen of the New York State Department of Health declared a health emergency at Love Canal (T. 1698-99 (Whalen)), and Governor Carey appointed a Special Love Canal Task Force. New York State Department of Transportation Commissioner Hennessy, head of the new Task Force, called the City Manager and asked the City not to sign agreements which would have authorized construction of the remedial system. Exs. 2179, 3626 P 95. [**154] At a meeting on August 21, 1978, the Study Group was informed that Love Canal was a state problem, that the County Health Commissioner was relieved of his responsibilities in pursuing the remedy plan, and that neither the NCHD nor OCC would be asked to attend subsequent meetings. Exs. 2181; 3626 P 93. The City did not sign the construction contracts. The result of the Governor's order was that neither the County nor Hooker participated in further planning. T. 6664-65 (Amery).

Commissioner Whalen's declaration of a health emergency followed his visit to the site in April 1978, accompanied by staff, including Dr. David Axelrod, who succeeded him as Commissioner in 1979; Commissioner Berle of the DEC; and Commissioner Clifford. Dr. Axelrod, then Director of the Division of Laboratories and Research at DOH, testified that he and Whalen decided a site visit was necessary based on the information they had received from scientists within the Department of Health and the Department of Environmental Conservation. T. 3543.

Shortly before their visit, a rainfall left the area quite muddy. T. 1261 (Whalen). In the southern sector a heavy chemical odor pervaded, and [**155] pools of water containing a black, oily substance rested on the surface. Boards were placed across some of these puddles to permit walking in the area. There was very little vegetation. T. 3545-48 (Axelrod). The surface area around the school "was relatively intact except for a number of drums that appeared to be surfacing through the underlying vegetation." Id. In the center was a baseball diamond.

North of the school was a play area and a shortcut used by the children to get to school. This area had the most vegetation. However, the Commissioner found a white powdery substance on the surface which he suspected was lindane. T. 1213-20. Dr. Axelrod described some cartons which had surfaced containing "large chunks of the yellowish material [which] were breaking off . . . . The road immediately adjacent to these cartons was stained with the same color as the materials . . . ." T. 3546. He expressed disbelief that the area was being used as a [*1041] playground with the extent of surface material present. Commissioner Whalen testified that he observed a total of about 50 pounds of lindane in the area. While he felt this was not an extensive amount (T. 1218), he determined that even this [**156] much exposure was intolerable, perhaps because of the proximity to the school (Axelrod, T. 3549), and directed the NCHD to take measures to eliminate the hazards. T. 1264-68. With the cooperation of the Study Group, including OCC's representatives, the suggestions of Commissioner Whalen were carried out. Exs. 2149, 2249, 3626; T. 1686-89 (Whalen); T. 1934 (Kim).

Investigation did not reveal any chemicals leaching into the bedding surrounding school property or onto the surface of the schoolyard. Moreover, there was nothing unusual about absenteeism at the school which might have suggested that the children were being affected by the chemical release. T. 1268, 1272 (Whalen). However, Commissioner Whalen adopted a cautious approach and asked the Board not to open the school in September 1978, without intending to make it a permanent order. The building became the headquarters for the Love Canal Task Force. T. 1277-79.

Commissioner Whalen stated that he believed that there was danger of possible carcinogenic effect and liver damage when he declared a health emergency on August 2. Finding that there was a risk to pregnant women and children under the age of two, he suggested that these [**157] individuals be relocated temporarily from Ring I homes. T. 1234, 1698-99. Governor Carey's order creating a special Love Canal Agency Task Force followed on August 7. The Love Canal Study Group was disbanded, but much of the CRA remedy plan was later adopted by the State and the EPA. T. 1694-95 (Whalen); Ex. 3626.

As a result of the information gathered by the Study Group and Whalen's staff, a further investigation was ordered. A remedial plan followed, as well as this lawsuit. The details of the studies need only be addressed briefly in our consideration of the punitive damage claim. More detailed analysis may be necessary when issues involving cross- and counter-suits are reached.

B. OFF-SITE MIGRATION

The State offered extensive evidence of off-site chemical migration and argues that Hooker knew or should have known when it began its disposal operation at Love Canal in the 1940s that chemicals would migrate to the surrounding area. As previously noted, Hooker maintains it comported with the best industry practice to determine that the site was secure and could not have foreseen the consequences. To test these arguments, it is necessary to set forth briefly a history [**158] of off-site migration, a review of the investigations conducted to determine the cause and impact of the migration, and an analysis of the competing arguments.

Residents first noticed off-site migration in about 1971. They smelled chemical odors while digging in their backyards. Both the City and the Board received complaints about these odors, but it does not appear that any complaints were made directly to Hooker. The most vivid testimony of chemical invasion was given by Edwin Voorhees and his wife Aileen, who built a house on 99th street in 1958. [37]

> 37 Edwin Voorhees and his wife, Aileen, had a longstanding connection with Love Canal. They moved to 476 99th Street when there were only six homes on the street. In 1951, they built a new home at 482 99th Street. After living in this second home for a few years, they tore down their first house at 476 and built a new home. T. 415-16. By the time they moved back to 476 in 1958, the entire street to the north was built up.

The Voorhees did most of the work themselves [**159] and soon ran into difficulties. As the foundation was dug "black, tarry, thick, smelly stuff" came through the sand and the hard clay mixture, seeping into the basement through the cinder blocks and running down the walls. T. 335-36, 389. The installation of two additional sump pumps did not stop the flow. The seepage continued, and the sump pumps were destroyed. T. 337-39. They were unable to use the basement area because of the seepage and the odor. T. 355. In spite of this, their daughter and son-in-law built a home three

doors away from theirs on [*1042] 99th Street. In 1977, the Voorhees bought the houses located at 401 and 475 99th Street. They continued to live at 476 until they were forced out in 1978.

Although the Voorhees set forth dramatically the extent of the migration into their home, their account does not aid in understanding the attitude of Hooker toward the residents because the Company did not know about the Voorhees' plight until 1978. In fact, the Voorhees did not complain to anyone until then. T. 341-42 (Voorhees). Furthermore, their experience was unique. Although a few other residents had smelled strong odors and had corroded sump pumps in their basements, no one else [**160] described similar ordeals. For example, Peter Bulka, a Niagara Falls Police Officer for twenty years, lived at 753 97th Street from 1965 until 1978. He abandoned the use of the basement as a bedroom because of noxious odors, and his sump pump corroded. After he complained to the County Health Department in about 1975, samples were taken, but he never learned the result of their findings and apparently did not pursue his complaint. T. 98-125.

The investigations initiated by Commissioner Whalen in 1978 revealed that water-insoluble chemicals had leached through the subsurface away from the landfill. Some chemicals had migrated as far as soil around some Ring I homes and into the neighboring sewer system. An air-quality investigation in 1979 confirmed that there was contamination in 8 to 10 homes out of a total of 200 in the Love Canal area. T. 1287, 1675 (Whalen).

C. STRATIGRAPHY

The State urges that evidence of chemicals leaching out of the landfill be considered as at least partial proof of Hooker's knowledge and intent at the time of the deposit of waste. According to the State, Hooker knew or should have known in the 1940s when it was disposing of its wastes that the site [**161] was not secure. As I have indicated previously, OCC's position is that before and during disposal it properly relied on the best available information in forming its belief that the composition of the soil was primarily impermeable clay which would prevent leaching.

To test these competing theories, evidence from geologists, hydrologists, and soil scientists was offered by both sides. One of the most extensive investigations was carried out by Donald Owens, a State witness, in 1978. He made over 1,000 borings along the Love Canal site. Hydrologist Robert Cohen, [38] the State's principal witness, relied on the Owens findings and those of hydrologist George Pinder, as well as on numerous studies referred to in his report (Ex. 718A) to describe the make-up of the soil at the Canal, the movement of chemicals since the time of disposal, and their location at the time of the investigations in 1978. In Mr. Cohen's opinion, Hooker should have known that the soil at Love Canal was not suitable for deposit of wastes.

38 Cohen is a hydrogeologist. He received a Master's Degree in the field in 1982 from Pennsylvania State University and has worked ever since as an investigative consultant on groundwater studies for water development or analysis of contamination. T. 2734-35.

[**162] Mr. Cohen described the stratigraphy at Love Canal in 1978 as divided into several layers. The top layer, which began at the surface and extended down for five or six feet, consisted of surficial fill, or "Lake Tonawanda" silts and sands. The second layer contained about four feet of stiff silty clay with interconnected fractures. The lower few feet of this second layer formed a transition zone which graded into a third soft, silty clay layer. The fractures extended into the transition zone. The third layer, which generally was not fractured, was typically 6 to 14 feet thick, and was underlain by the fourth layer of 2 to 20 feet of glacial till. The glacial till in turn was underlain by the Lockport dolomite or bedrock. The Canal rested directly atop the second fractured, stiff, silty clay layer at some locations, and atop the third soft, silty clay layer at others. Cohen reported that the fractures in the stiff, silty clay layer increased permeability. Ex. 718A, Findings (hereinafter "F.") 13-19; Ex. 718; see also T. 2552-2600 (Owens).

The experts' stratigraphical descriptions are consistent, but some dispute arose in the [*1043] analysis of the permeability of the upper or Tonawanda [**163] layer. Owens reported a consistency of 17 percent clay, 49 percent silt, and 32 percent fine sand. Exs. 798-802, 2864; T. 2552-70, 2601-02, & 2689. OCC witness Frank Williams, a geologist who specializes in subsurface investigations of contaminated sites, described the average content of the topmost layer as a 3-to-6-foot clayey sand and silt layer which roughly averaged 50 percent silt, 18 percent clay, and about 30 percent sand.

T. 5483. Both Williams and Cohen emphasize that the percentage figures are only an average, because the layer is not homogeneous but varied in structure along the length of the Canal. Williams said that below that layer is a reddish, stiff clay layer about 6 feet thick underlain by a grayish, soft clay layer about 5 to 20 feet thick, followed by glacial till and bedrock. T. 5482-85, 8432-33; Ex. 2445 at 2. In the stiff clay layer, he found "vertical fractures or cracks" which extended from the top to the bottom of that layer. T. 5485.

OCC hydrologist Harry LeGrande agreed with Owens and Williams as to the average make-up of the soil at the top level but, unlike the other experts, suggested that a trained hydrologist in the 1940s and 1950s would have concluded [**164] that this layer had low permeability. T. 5049-50, 5052. LeGrande admitted that the top layer was more permeable than the layers below, but insisted that it had "relatively low permeability." T. 5065. He said that as little as 5 to 10 percent clay mixed with silt and sand lowers the permeability of the soil considerably, but admitted that this opinion is based upon his own classification system. He did not agree with the USDA criteria which only labels soil with at least 35 percent clay as "clayey." T. 5069, 5072. LeGrande's analysis is disputed by the State, which claims that for there to be any impermeability, the clay content must be much more than 17 percent.

Mr. LeGrande was well-qualified to testify, because he had worked with the U.S. Geologic Survey from the mid-1930s to 1974 and has since served as a consultant. However, the State is justified in criticizing the quality of his testimony. LeGrande did not visit the site until a few days before trial and did not review in depth the comprehensive study made by Mr. Owens. Mr. LeGrande's opinion about the permeability of the top layers is inconsistent with the testimony of virtually all the other witnesses. For the stratigraphy [**165] of the area, he relied upon a Department of Agriculture Report of 1906 which gave a general description of the soils in Niagara County (Ex. 2785 at 97; T. 5068-69), but ignored a later version completed in 1947. Ex. 1383. The main purpose of the Department of Agriculture reports was to "provide a basis for the best agricultural uses of the land." *Id. at 2*. Although the region's possible use for waste disposal was not discussed, the description of the soils was useful. The 1947 survey describes the topmost soil in the Canal area as a silty loam and very fine sandy loam. Ex. 1383 at 52.

LeGrande also relied upon a 1952 Hough Engineering Report prepared for the Board in anticipation of the construction of the school (Ex. 161, 2861, T. 5047-48), and a 1978 CRA report. Ex. 2862, T. 5051. Although informative, these reports are not as detailed or as thorough as the Owens report and the Cohen Summary.

The Hough report partially supports OCC's version of slight permeability of the upper layer; but as the State suggests, some Hough borings note the presence of "loose, fine sand, firm in organic silt." Ex. 161. The CRA report found silt, sand, and fill near the school site. Ex. 552. See [**166] also Exs. 567, 568, 804, and 809. That report also noted that the top 4 to 5 feet had a permeability much greater than the underlying 30 to 40 feet of clayey silt and loamy till. Ex. 552, p.3. Both the Hough and Conestoga reports talk about particular areas of the landfill. Despite some inconsistencies with Cohen's analysis, they do not contradict his overall description.

Steven P. Larson, another OCC hydrologist, relying upon the exhibits and testimony of other witnesses, including those of Mr. Cohen and Dr. Pinder, said that the subsurface soils were composed predominantly of silt and clay with low permeability, but it is not clear from his report exactly to what level he was referring. T. 6194-6277; T. 6290-6378 (Larson); Ex. 2865. In fact, in another report, he referred to the first layer [*1044] as "generally sand, sandy silt, and/or fill (including disposed waste)." Ex. 2456 at 5. He said that these materials were much more permeable than the underlying clays. The waste fill material was especially permeable. *Id. at 5-6*. According to Mr. Larson, this silty sand and waste fill level was the principal natural drainage layer of groundwater at the Canal. T. 6358. On a practical level, [**167] OCC mentions the observation of John Boddeckker, a City of Niagara Falls civil engineer, who said that during the construction of the six-foot-deep Reed Avenue storm sewer, the soil was basically clay. T. 10049, 10053.

Overall, Robert Cohen's description of the stratigraphy at Love Canal is the best one. Most of the OCC witnesses either agree or do not substantially dispute his analysis. As to permeability, there is a consensus that the top layer is more permeable than those below. Mr. LeGrande disagrees with Owens' assessment of permeability, but even he admits that this layer is more permeable than those below.

D. ANALYSIS OF CHEMICAL MIGRATION

The experts also testified about the rate and extent to which waste material and chemicals moved through the Love Canal soils. The movement was governed by many factors, including the permeability of the soil and the specific gravity and solubility of the chemical wastes. The experts' analysis was complicated and sometimes conflicted. Although it has been known for centuries that water moves extensively below the surface, the testimony and exhibits about chemical submigration concentrated on information developed in the last 15 [**168] years. The knowledge of chemical movement through different types of soil developed slowly and tentatively. For example, descriptions of buried chemicals as aqueous or non-aqueous phase liquid, the concept of chemicals oozing through fissures in clay soil, and the knowledge that denser-than-water, nonaqueous-phase liquid (DNAPL) widened such fissures, were unknown before 1980. Ex. 718A; See generally testimony by Cohen and Kirk Brown. T. 2664-2733.

Approximately 2,100 tons of DNAPL were deposited at the Love Canal landfills in drums. T. 5170-72 (Cull); Ex. 2445 at 3. The testimony indicated that many of the drums were still intact at the time of remediation. Ex. 7137 at 1383; T. 3103 (Cohen); T. 5173 (Cull). No witness made an estimate about the number of drums which disintegrated or the degree of corrosion which occurred. Nevertheless, the State contends that a large amount of DNAPL escaped from corroding drums.

Again, Mr. Cohen's analysis is the most complete.

Ex. 718A, F. 22-43. According to him, the disposal of wastes almost to ground level created a large reservoir of DNAPL. T. 2775. This reservoir, accompanied by a thin cover, corrosion of the drums, subsidence, the [**169] creation of potholes, and the exposure of chemicals, all combined to increase the landfill's recharge. Cohen defined recharge as "the infiltration of . . . any type of precipitation or ponding of fluid at the surface that occurs down to the zone of saturation or down to the water table." T. 2856. Depressions created by subsidence and potholes and lack of vegetation inhibited runoff and increased recharge. T. 2857. The subsidence of cover materials into the corroding drums increased the elevation of non-aqueous phase liquids, or NAPL, which, in turn, promoted the movement of DNAPL, although the drumming of the DNAPL waste slowed its migration. T. 3126 (Cohen).

DNAPL moved outward through the landfill walls under pressure gradients created by its own density. T. 3317 (Cohen). Because a variety of wastes were dumped, the viscosity of DNAPL ranged from the thinness of water to very thick. DNAPL was found from the base of the landfill to the surface. It migrated radially away from the landfill, primarily through the fractured, silty clay layer and, where the NAPL elevation was high enough, through the silts and sands as well. T. 2763-64 (Cohen); T. 3317-18, 24; (Pinder); Ex. 718A; F.30. [**170] Moreover, as DNAPL made contact with the fractured silty clay, it opened the fractures further and thus increased the permeability of the soil materials. T. 2792-93 (Cohen); T. 2688-89 (Brown); Ex. 718A; F.14. DNAPL also [*1045] acts as an impediment to groundwater flow. Thus, the disposal of large quantities of DNAPL promoted the development of a water table mound. F. 41. Light, non-aqueous phase liquid, or LNAPL, being lighter than water, tends to lie above the water table and migrate in the direction of ground water flow. T. 2766 (Cohen).

Love Canal's naturally high water table and flat topography, with its subsoils of low permeability and nearby shallow rivers and streams, all contributed to a drainage problem which left groundwater close to the surface. T. 2794-97, 6213. Poor drainage, combined with Hooker's practice of filling the Canal and covering the wastes above surface level, created a topographic mound which promoted outward chemical migration, especially during high recharge periods. T. 2816, 2867 (Cohen); Ex. 1450. Hooker's use of excavated soil from the landfill as cover and failure to make this cover uniform accentuated the water table mound. Puddles formed and increased infiltration [**171] and recharge. Ex. 718A, F.38-39; T. 2857, 3332-33. During periods of great precipitation, the recharge brought the chemicals to the surface and caused overland flow.

The low-permeability dams that Hooker constructed across the original Canal inhibited the north-south subsurface flow of groundwater along the length of the landfill and increased the east-west flow of groundwater to surrounding properties. Cohen said that the construction of sewers and homes with basement drains caused an hydraulic gradient, which also promoted outward flow from the landfill. T. 2946. The Wheatfield Avenue sanitary sewer, the drain at the school, and the road base underneath Reed Avenue all contributed to outward migration. T. 3127-30; (Cohen); Ex. 1444. The

construction of the Frontier Avenue storm sewer permitted NAPL to enter the bedding materials and migrate off-site. T. 3079 (Cohen). Dr. Pinder, a State expert on hydrology, and Mr. Kolmer, an OCC expert on waste disposal practice, both agreed with Mr. Cohen that the creation of a large reservoir of DNAPL in clay soil rather than the construction of homes, sewers, and streets initiated the movement of DNAPL off-site, but neither addressed the effect [**172] on NAPL movement. T. 3326-28 (Pinder); Ex. 883; T. 8547-48 (Kolmer); Ex. 2445.

Property owners who removed soil, and grading operations during construction of a baseball diamond, contributed to the loss of cover in certain areas. T. 2972-73 (Cohen). In 1954, the School Board removed several thousand cubic yards of soil from Love Canal to use as fill at the 93rd Street School. Although Cohen thought that the soil was taken from the original mounds along the side of the landfill. He was not aware of grading activities conducted by the School Board in the mid-1950s. T. 3075-76 (Cohen).

Because no monitoring wells were in place before 1977, the history of hydraulic gradients and velocity of movement of chemicals in the area cannot be known with certainty. Cohen said that the flow from the landfill may have occurred:

> (1) at a relatively continuous and slow rate between the period of disposal and the 1970's, (2) at a slow rate for a period of years followed by a faster rate during high recharge periods, or (3) at a slow rate except for seasonal high water table periods.

F. 42. In his opinion, significantly less than 5 percent of the disposed material moved off-site. T. 3085.

At [**173] the time Hooker was contemplating the use of Love Canal, the Company did not carry out an extensive soil analysis. Mr. Cohen testified that Hooker should have been aware of a number of studies available in the 1940s which indicated that an investigation of groundwater flow was needed before the landfilling occurred. Ex. 718A; see especially F. 45. Hooker apparently did not take into account the studies and experiments referred to by Mr. Cohen. The State relies primarily on Cohen's testimony to argue that the Company was remiss in failing to consult these studies and make more a scientific investigation of the site prior to using it as a chemical landfill. Thus, Cohen's analysis must be evaluated to determine whether it sufficiently supports the State's argument.

[*1046] Mr. Cohen first visited the site in 1978. He was not familiar with industry practice relating to disposal of waste materials in the 1940s and 1950s. Although he had wide experience in the field of geology, his analysis necessarily depended upon a review of a limited number of Hooker documents, a review of articles which appeared in learned journals, and reports of on-site investigations made after 1978. Ex. 718 A, F. [**174] 45. He concluded that Hooker was aware or should have been aware before 1954 that "infiltrating precipitation and flowing groundwater will leach buried wastes resulting in the generation of potentially noxious leachate that may flow with groundwater away from the burial location." F. 45. In support of this position, he appended a list of about 80 articles and publications and 7 references to depositions. Of these, only about 20 publications were available before 1940. [39] Even if relevant, information published in the late 1940s could not have aided Hooker in its initial decisions regarding the location of a landfill and the manner of waste disposal.

> 39 All but 3 of other articles were published in the period between 1940 to 1954: 13 before 1945, 30 between 1946 and 1950, and 16 between 1950 and 1954.

To assess the weight and the relevancy to be given to these materials, I have attempted to review them from a common- sense point of view as a juror would. Many were easily understood, although a few were quite technical [**175] because they related to laboratory studies of water movement. Most did not deal with landfills, and those that did usually discussed construction and maintenance of garbage disposal sites and the control of vermin and of noxious odors. Ex. 571-74. One which discussed garbage disposal but not landfilling suggested that garbage could be used to fill in low or swampy areas. Ex. 528.

Other publications dealt with irrigation problems, such as the movement of large volumes of water in an irrigation system or in deep underground aquifers (Exs. 715, 1359, 1363, and 1381), soil problems in other states or countries with conditions much different from those

found at Love Canal (Ex. 496; 563; 565; 1368), and the pollution of streams and lakes by dumping wastes (Ex. 509, 1372). Some included advice on locating a water well to avoid pollution. Ex. 712, 1343. One article suggested that pollutants should be pumped to the ocean. Ex. 711.

Two publications dealt with the hazard of gas and oil percolation through the soil. Exs. 498, 700. A 1952 American Waterworks Journal article explained the hazard of oil and gas well waste brine polluting well water by seepage through porous soil; but the consensus [**176] was that if soils were heavy, seepage was not a problem. Ex. 498; T. 2740-41 (Cohen).

The articles lend support to Dwight Metzler's opinion that in the 1940s and 1950s, the emphasis of government regulators and industry was on stream, lake, and air pollution and not on landfilling. See Part VI, infra. None of the articles mentioned DNAPL, NAPL, the phenomenon of the groundwater mound, or the fact that chemicals of high specific gravity and density could force their way through fractures in clay soils. As I have already noted, Mr. Cohen reported that no one was aware of this phenomenon until about 1980.

Kirk Brown, a State expert witness, testified at length about the impact of organic chemicals in clay soil in order to explain how the DNAPL could have migrated off-site, even through clay. T. 2664-2731. However, none of this was known during the 1940s and 1950s. Cohen testified that he was not aware of Dr. Brown's work until about 1984, and had no reason to believe that Hooker was aware of it before then. T. 3086-88. In general, the articles referenced by Mr. Cohen confirmed the practical knowledge which Hooker relied on--that silts and sands were permeable and clay soils [**177] were not.

Some of the conclusions reached by Mr. Cohen appear elementary and obvious today. According to him, Hooker knew that there was a potential at Love Canal for surface subsidence of cover. T. 2738-39. The presence of the silt and sand layer near the surface was known to Hooker employees during disposal operations. It was obvious that the site had a high water table, that groundwater flowed through silt and sand, and that flow increased during periods of high precipitation. [*1047] Hooker knew that organic chemicals dissolve in water to varying concentrations, depending upon the chemical and other factors. The Company should have been aware that wastes had to be buried above the water table to prevent leaching, and that dissolved chemical wastes could be carried off-site if wastes were buried near the surface. Ex. 718A, F. 45. Many of the referenced articles emphasized the belief that clay was impermeable and that wastes should be buried in clay or other impervious material. OCC argues that Hooker followed this belief and buried its wastes in clay.

During his testimony, Cohen also highlighted several Hooker documents referenced in Finding 45. One report discussed a 1948 meeting of the [**178] Manufacturing Chemists Association ("MCA") attended by several Hooker representatives which dealt with lagooning problems. T. 2923-26, 2929-30 (Cohen); Ex. 70. Lagooning is the discharge of liquid wastes into a holding basin to permit wastes to seep into the ground, evaporate, or drain into a stream. If the lagooning operation includes seepage, the soil must be porous; and if evaporation is the intended effect, the lagoon must remain uncovered. The report stated that the chief hazards of this method were pollution caused by the seepage and obnoxious odors emanating from the surface. Ex. 70; T. 2924. Cohen conceded that Hooker's disposal practice at Love Canal was not lagooning, because water was never used as a means to bury or dispose of the waste materials. T. 2926. However, he believed that the common aspects of lagooning and Hooker's practice of reacting chemicals in water and placing waste in excavations which contained water at the site made this information pertinent to a discussion of Hooker's knowledge. T. 2744, 2925-27. He also referred to several Hooker memoranda written between 1946 and 1950, which described DDM rising to the surface and which noted observations of oily [**179] globules on the surface of the Canal ponds. Exs. 34, 46, 96. However, none of the documents discusses the potential for off-site migration through the soil.

Taking into account all of Mr. Cohen's testimony and reports, I conclude that Hooker did not become aware of the potential for subsurface migration of NAPL chemicals until at least 1976, although Hooker knew that the top layer was more permeable than the lower layers. Personnel believed that for the most part, the materials were buried in a clay subsurface, which was quite impermeable, and the materials would not leach through the underground surface. Throughout the disposal period and afterward, Hooker was aware of subsidence, the creation of potholes, and the movement of some chemicals and drums to the surface, but was not made aware of the off-site migration of chemicals to basements

or homes. Complaints were made to the City and perhaps to the Board, but not to the Company. Although Hooker should have known that there was a potential for off-site migration of wastes placed close to the surface in the water table, no studies available prior to 1980 showed that DNAPL could invade through fissures in the clay. The first indication [**180] of liquid waste migration through the fracture network did not occur until the CRA investigation in 1978 (T. 3096 (Cohen); Ex. 552). Cohen estimated that less than 5 percent of the wastes migrated off-site, and he was unable to determine the range and extent of the movement. T. 3085. Nor did he address the effect of other influences, such as the sewer lines, on off-site migration.

The State contends that Hooker should have anticipated the subsurface migration of wastes and that its failure to analyze the stratigraphy at Love Canal prior to its use reveals the Company's recklessness.

OCC insists that evidence culled from current knowledge and present methodology of soil testing is irrelevant to our analysis. It says that the focus should be on the knowledge of stratigraphy and established practice in the 1940s, because the science of soil studies was still in its infancy then and a good, practical evaluation of the area was sufficient to meet the 1940 standards.

In the following section on industry practice, the type of information which was generally used by companies such as Hooker in the 1940s to prepare waste disposal sites is discussed in much greater detail. See [**181] Part VI, infra. At this juncture, it is important to keep in mind the ever-changing nature of soil [*1048] science and geology. Much has been learned since 1940 about the movement of leachate through the soils. Attitudes and opinions held in the early 1940s by many conversant in the field have changed considerably because of new learning. **VI.**

INDUSTRY PRACTICE

A. APPLICABILITY OF STATE-OF-PRACTICE EVIDENCE

OCC contends that state-of-practice evidence is relevant as a factor in assessing appropriate conduct. [HN3] In negligence law, an understanding of what the industry was doing at the time helps determine whether a particular defendant exercised due care. OCC asserts that compliance of state-of-practice, while not necessarily sufficient to defeat liability for negligence, should weigh strongly against an award of punitive damages, which requires a showing of more culpable conduct. See *Maxey v. Freightliner Corp., 665 F.2d 1367 (5th Cir. 1982)*. OCC acknowledges that if the prevailing industry practice was unreasonable, the court is not bound to measure Hooker's action by that standard. See *The T.J. Hooper, 60 F.2d 737* [**182] (2d Cir.), cert. denied, *287 U.S. 662 (1932)*. It claims that the methods used by the chemical industry to dispose of waste products at the time of the Love Canal landfill operation were reasonable in the light of the limited knowledge of the dangers of chemical migration and indirect exposure to residues. Therefore, OCC argues that the court, in judging Hooker's intent, should take into account whether the Company exceeded industry standards by burying wastes in the Love Canal.

The State contends that industry practice cannot be given any weight unless widespread use confirms it is a custom. In order to show a custom existed, there must be uniform, recurring circumstances. *McDonald v. Acker, Merrall & Condit. Co., 192 A.D. 123, 182 N.Y.S. 607 (2d Dept. 1920)*; *T.J. Hooper, 60 F.2d 737*. The State argues that the few isolated cases pointed to by OCC, such as a school built near buried chemical wastes, were too few and factually distinct to give rise to the necessary showing of custom. Moreover, even if the defendant can show a practice existed, if that practice is demonstrably [**183] hazardous, the defendant is nonetheless liable for injury. *Saglimbeni v. West End Brewing Co., 274 A.D. 201, 80 N.Y.S.2d 635 (3d Dept. 1948)*, aff'd, *298 N.Y. 875, 84 N.E.2d 638 (1949)*. [HN4] The trier of fact must weigh the probability of harm, its severity, defendant's knowledge, and other circumstances. While there is no formula for assigning relative weights for each factor, when the harm is likely to be severe, the weight assigned to conformity is greatly diminished. *Trembley v. Coca-Cola Bottling Co., 285 A.D. 539, 138 N.Y.S.2d 332 (3d Dept. 1955)*. And where the defendant knew the serious hazard to be "a particular and known condition," the custom defense is defeated. *Texas & Pac. Ry. Co. v. Behymer, 189 U.S. 468, 47 L. Ed. 905, 23 S. Ct. 622 (1903)*.

[HN5] Evidence of industry practice of warnings where exposure to extremely hazardous chemicals may occur may be so devoid of probative value as to be inadmissible. *Maize v. Atlantic Refining Co., 352 Pa. 51, 41 A.2d 850 (1945)*. [**184] These principles apply with

equal force to determination of reckless conduct. *Maxey, 665 F.2d 1367*. The State contends that even a universal failure to warn cannot save a practice from being deemed reckless conduct.

While it is clear that Hooker's defense of its action could not rest solely on the state of industry practice, those practices can inform a trier of fact about what would have constituted reasonable or, conversely, reckless conduct at the time. The State correctly points out that there must be a sufficient number of instances to constitute a custom. One must first determine whether or not standards and practices existed by examining the evidence. Only then can an informed decision be made about what weight to give Hooker's conformance or lack of conformance. Therefore, I have decided to consider the testimony of the expert witnesses provided by OCC despite the objections of the State.

B. THE STATE OF KNOWLEDGE AND INDUSTRY PRACTICE IN THE 1940S

AND 1950s

OCC presented three well-qualified witnesses to describe industry practice in landfill [*1049] waste disposal in the 1940s and 1950s: Wesley E. Gilbertson, Eugene Fowinkle, and Dwight Metzler.

[**185] Each individual offered a description of industry practice and its application to Hooker's conduct at Love Canal from a different point of view. Mr. Gilbertson discussed the development of public policy of solid waste disposal from the 1940s until the 1970s. Ex. 2410; T. 3822-3971. Although he had reviewed the testimony of Cohen and Wilkenfeld and some other witnesses, he did not make an extensive review of Hooker documents, nor was he aware of the nature of the chemical wastes at the site. His focus "was primarily on national and state public policies and, as such, dealt with these broader issues." T. 3831, 3902.

Gilbertson had over 40 years' experience in environmental problems, much of which was concerned with solid waste management and disposal. He had been with the Public Health Service for many years but had little involvement with landfills before 1951. T. 3888, 3883, Ex. 287. He was serving as Chief of the Office of Solid Waste when the Solid Waste Disposal Act was enacted in 1965. Upon his retirement in 1967, he became Director of the Bureau of Environmental Health in Pennsylvania. He was well-qualified to explain how governmental control of solid waste evolved and the reasons [**186] for the relatively slow advance in know-how and in legislation.

1. Scientific Knowledge and Public Awareness

Gilbertson explained that scientific knowledge, public concern, and governmental regulation of land disposal practices lagged far behind the control of the more obvious stream, water, and air pollution. From the early years of the century to the present, there has been a slow but substantial increase in scientific discovery, public understanding, and acceptance of the problem of pollution. Large industrial plants were tacitly encouraged in the 1930s and 1940s to dispose of their wastes on company property to avoid burdens on public facilities. Plant sites were out of the professional and public eye and therefore did not get attention from public health professionals or the community at large. Unlike air and water pollution, there was no public funding or interest in disposing of toxic wastes. As a result, there was minimal control over landfills during this period. Ex. 2410.

While public health concern in the 1940s and 1950s focused mainly on bacterial contamination of drinking water from sewage, municipal dumps received some attention as well. Municipal dumps in [**187] this period were often open and caused many problems, noticeable to the public and investigators, such as attracting insects and vermin and emitting foul odors. T. 3887, 3899-3900. While a landfill may have triggered concern over public health if its underlying soil was fissured or cracked, a dump located in a tight soil was perceived as safe. T. 3841.

Companies disposed of industrial waste either on the plant site or, if off-site, away from public view. T. 3897-3901. Regulations controlled garbage disposal methods, but disposed industrial waste was not monitored unless it was placed in municipally owned landfills. T. 3848-49, 3854-56, 6748. No distinction was made between industrial and municipal wastes, unless the industrial wastes were highly inflammable or explosive. T. 3899, 3902. The U.S. Public Health Service recommended that all refuse--household, commercial, and industrial--be deposited in one place. Unless seepage to neighboring sites occurred, public health officials did not act. T. 3841, 3854-56.

Industrial or chemical landfills were not regulated

more stringently than municipally owned landfills, even in the late 1950s, because no one considered solid wastes, including [**188] radioactive and toxic chemicals deposited in "tight soils," to present environmental problems. T. 6830. Until the mid-1960s, industrial wastes were often dumped into sewers and waterways, on the banks of rivers and streams, and in swamps and marshes. Many in government and industry thought that dumping in low-lying areas with high water tables was a good practice, because the filled land could be reclaimed and used for park or recreation purposes. In recent years, public attitudes and policies have changed, driven by an increase in knowledge [*1050] and acknowledgement that land disposal of waste creates severe problems.

Industrial waste areas were often exposed and not covered. As late as 1964, over 96 percent of the 1,600 municipal and industrial land disposal sites in the State of New York were open dumps. Ex. 2481 at 7-9 (Gowan). Groundwater-monitoring wells were not used until the 1970s. T. 3858.

When Hooker began to use Love Canal for waste disposal, the usual industry practice did not call for engineers, geologists, and other scientists to site, design, or operate the landfill. Ex. 2474, at 5-7. Public health authorities paid little attention to industrial waste disposal and would [**189] rarely recommend consultation with a geologist before waste disposal began. T. 6773, 6852-53. It was unusual for landfills to be fenced. T. 3857, 6733, 6852-53.

After World War II, environmental concerns about water and air pollution increased. This interest, however, was spotty, often short-lived, and of limited national effect. Considerable debate over whether there should be federal or state responsibility and control and other policy considerations slowed passage of legislation.

Gilbertson explained that the increased emphasis by governments on water and air pollution put greater pressures upon industry to use landfilling methods to dispose of wastes. Incineration was not an efficient response, because good design and materials were not available, and the capacity of incinerators in use was too small to cope with the large volume of waste generated by war production. T. 3851. Thus, the pressure to dispose of solid wastes on land increased.

2. Legislative History of Pollution Control

Gilbertson reviewed the legislative history of government control of pollution to support his conclusion that Hooker's activities not only complied with the laws in effect at the time of [**190] action, but often represented a more enlightened approach to environmental safety than government or similar industry practice. He referred to a timeline which set forth in simple but dramatic fashion the very slow progress of government control of solid waste disposal. [40] Exs. 2410, 2761. The early emphasis of government control was on water and air pollution, especially the protection of public drinking water sources, rather than solid waste disposal. The first federal Water Pollution Control Act [41] was enacted in 1948. The State of New York followed in 1949, with an amendment to the public health law providing for water pollution control. [42] These early statutes did not address ground water pollution directly, but focused on problems connected with providing clean drinking water, sewage disposal, and pollution of coastal waters, lakes, and streams rather than landfilling. The Act had limited effect because it applied only to interstate waters and consent of the state in which the pollution originated had to be obtained before the federal government could act. The principal aim of the legislation was to increase research, training, and demonstrations. The emphasis on cleaning [**191] public waters resulted in more uncontrolled waste disposal in landfills.

40 **ENVIRONMENTAL STATUTE TIMELINE**

1948 Federal Water Pollution Control Act (PL 80-845)

1949 New York State Chap. 666, Amendment to

Public Health Law, Water Pollution Control

1955 Federal Air Pollution Control Act

(PL 84-159)

1957 New York Chap. 931, Air Pollution Control

1965 Federal Solid Waste Disposal Act

(PL 89-272)

1966 New York State Public Health Law, Article 13,

Sections 1360-1364

1973 New York State Chap. 339, Solid Waste

Management Facilities

1976 Federal Resource Conservation and Recovery Act (RCRA)

1980 Federal Comprehensive Environmental Response,

Compensation and Liability Act (CERCLA or

Superfund)

41 Pub. L. No. 80-845, ch. 758, 62 Stat. 1155 (1948).

42 Water Pollution Act, ch. 666, 1949 N.Y. Laws 1509. Gilbertson first testified that the 1949 New York State Act only applied to surface water. Upon further examination, he admitted that the Act could also be construed to apply to underground waters and to prohibit the seepage of pollution into groundwaters. Ex. 23; T. 3835, 3920, 3922-23.

[**192] [*1051] Several air pollution disasters turned public and Congressional attention to air quality control, but enactment of legislation was slow. [43] Air pollution control did not begin until 1955, when the federal Air Pollution Control Act [44] was passed, providing for research and training but without enforcement provisions. In 1957, New York State also enacted a law relating to air pollution control, but it called only for a "reasonable degree" of air purity. [45]

43 For example, air pollution from a steel mill in Donora, Pennsylvania, resulted in a number of deaths in 1944. Smog was and continued to be a serious problem.

44 Pub. L. 84-159, ch. 360, 69 Stat. 322 (1955).

45 Air Pollution Control Act, ch. 931, 1957 N.Y. Laws 2009. Gilbertson noted that the City of Niagara Falls enacted an air pollution control ordinance in 1947. Niagara Falls, N.Y. Ordinances, ch. XI; Ex. 2499, T. 3848. He found it interesting, but not surprising, that Niagara Falls placed emphasis upon air pollution control rather than landfills, because that was the common practice at the time.

[**193] As an example of the public's lack of interest in solid waste pollution, Gilbertson noted that during Congressional hearings on environmental problems in 1960, a number of witnesses were called, including the Commissioner of Health for the State of New York. Although many problems relating to pollution were addressed, industrial solid waste disposal was never mentioned as a concern, even though at that time New York was considered to have one of the nation's most advanced environmental programs. Ex. 2757; T. 3845.

The increase in solid waste disposal in landfills resulted in a need for solid waste control. Books like Rachel Carson's Silent Spring (1962) helped bring public attention to bear upon environmental issues. The Solid Waste Disposal Act [46] was passed in 1965, authorizing the public health service to conduct research, training, and technical assistance programs, but affording no federal regulatory or enforcement authority. According to Gilbertson, the major thrust of this act was to stimulate action at the state level. The focus was on health agency work--to cover open dumps, to control insects and rodents, and to prevent air pollution caused by fires at open dumps. New [**194] York State passed similar legislation in 1966. However, a 1966 National Academy of Sciences Report on Waste Management and Control found that legislation at all government levels for solid waste disposal was inadequate. Funding of research and enforcement, staffing, and training programs were all insufficient. Ex. 2759 at 16.

46 Pub. L. 89-272, 799 Stat. 992 (1965). In 1965, Gilbertson, in his capacity as chief of the Office Waste Management, testified before Congress during its consideration of the solid waste legislation.

The National Environmental Policy Act [47] became law in 1970. It established the Council on Environmental Quality and brought into existence the concept of "environmental impact statements." An executive order was issued which required federal agencies to clean up air and water pollution at their installations, but the order said nothing about solid waste.

47 Pub. L. 91-190, 83 Stat. 852 (1970).

[**195] A 1970 report of the President's Council

showed that 110 million tons of toxic industrial wastes were produced annually. It recommended the enactment of a Toxic Substance Act, but Congress did not respond until 1976 when the Resource Conservation and Recovery Act [48] ("RCRA") became law. This legislation provided for "hazardous waste management" which mandated a separate classification of solid wastes as "hazardous." It limited severely the option of land disposal, but continued the federal policy of depending on state agencies for implementation. The Act had special requirements for the tracking and permitting of hazardous wastes sites. T. 3869. In 1973, the Solid Waste Management Facilities Act [49] was passed in New York State. However, serious attention was not paid to industrial landfill waste problems until [*1052] 1980, when CERCLA was enacted. [50] This brought about many dramatic changes, including provisions which permit the enforcer to reach back and place liability on the owner of the site or disposer of waste whether or not there was fault.

48 Pub. L. No. 94-580, 90 Stat. 2795 (1976). The Council repeated the request for legislation in each year from 1972 until 1976, when Congress finally acted. Gilbertson testified at the hearings in behalf of the National Governors Conference. T. 3868.

[**196]

49 Ch. 399, 1973 N.Y. Laws 1474.

50 Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub. L. No. 96-510, 94 Stat. 2767 (1980).

In conclusion, Gilbertson's testimony and report support OCC's assertion that disposal practices of Hooker at Love Canal were in advance of industry and government concern about the environment. Gilbertson emphasized that the acts of any disposer of waste material should be judged by the policy in effect at the time and the information that the industry had about the hazard when the action was taken. It would be unfair to use current standards to judge the activities of a company in the 1940s. He stated that this did not mean he believed a company should wait for the enactment of a statute to begin acting on industry knowledge. A company which is aware of a pollution problem has a responsibility to address it in a sensible fashion. T. 3917-18, 3934-35.

3. Solid Waste Disposal

OCC's second expert witness on industry practice was Dwight Metzler, who had many years of experience in public health. He was with the Public Health Service [**197] in the 1940s and then worked for the Kansas State Board of Health. In 1964, he became Executive Secretary of the Kansas State Water Resources Board. He was made Deputy Commissioner of the New York State Department of Health in 1966 and finally Deputy Commissioner of the New York State Department of Environmental Conservation in 1970. Before retiring in 1984, he was appointed Secretary of Health and Environment in Kansas and Chief of Water Systems Development.

A civil and sanitary engineer by profession, Mr. Metzler had wide experience in environmental problems, especially those concerning water pollution. Mr. Metzler was particularly well-qualified to testify because of his intimate knowledge of the history of landfill operations in New York State acquired as Deputy Commissioner between 1966 and 1974. His position included supervisory responsibility for statewide solid waste studies and programs. In 1972, he supervised the publication of the "Comprehensive Solid Waste Study---Erie and Niagara Counties" (Camp, Dresser, McKee, June 1972).

Mr. Metzler prepared his report (Ex. 2481) and his testimony by reviewing the evidence given by a number of witnesses, including Fowinkle, Gilbertson, [**198] Gowan, Brix, Wagner and others, and the exhibits they had discussed. T. 6734. He first related the history of solid waste disposal in New York between 1940 and 1960, including the use of industrial off-site waste facilities and government and industry approaches to the problem of control of toxic waste material. Even though the State Department of Health acted upon information it acquired about the problems of industrial solid waste disposal, no regulations were adopted until 1963. The earliest legislation merely required approval of new sites by the local health officer. In 1966, the State legislature finally recognized that solid waste disposal was a major problem and enacted legislation requiring planning studies, but the emphasis was placed on municipal rather than industrial sites. [51] In 1968, New York completed a statewide inventory of solid waste practice, which found a prevalence of open, unsanitary dumps. [52] Ex. 2556, T. 6765.

51 In The Pollution Fighters (1973), which traces the history of environmental engineering in

New York, Metzler has an extensive discussion of the state of pollution control in New York to that time. He makes only glancing reference to industrial waste disposal. The emphasis is on efforts to control municipal garbage disposal. There is no discussion of movement of chemicals through soils or any of the other developments of soil study which followed in the 1980s. Ex. 2560.

[**199]

52 Joseph Salvado, who was in charge of the solid waste program for the New York State Department of Health in 1969, reported that there were about 1,600 open dumps in New York State in 1962. By 1969, the number was reduced to 920, with 54 considered as sanitary landfills. Ex. 2556; T. 6765.

Metzler next discussed the disposal difficulties Hooker faced in 1940. In preparation [*1053] for World War II, the U.S. government pressured the chemical industry to search for new products and to increase production, creating an urgent need to build and expand plants. These pressures demanded a concomitant response in appropriate waste disposal.

Prior to 1940, especially in states like New York where water was plentiful, pollutants were diverted into streams and rivers because dilution was considered an adequate response. The increase in production heralded the expansion of landfilling, usually done on-site or into municipal dumps or lagoons where wastes were permitted to seep into the soil. T. 6744-45. During the war years, it became common practice for companies like Hooker to find off-plant sites. A Congressional [**200] survey revealed that out of 50 chemical companies, 21 had disposal sites away from their plants. Ex. 914C; T. 6759. In Niagara County as of 1990, 40 percent of the sites were off-premises. [53] Ex. 2573.

53 Considering the extent of the disposal in the areas surrounding the Hooker plant, one would have expected frequent complaints from those living and working nearby. However, Hooker was never cited during the relevant period for a violation by federal, state, or local authorities. T. 6769.

Considering the practices in the industry, the knowledge of movement of chemicals through soil, and Hooker's knowledge and experience at that time, Metzler concluded that the choice of Love Canal as a disposal site was proper. He examined a series of photographs of the area taken in 1941, and saw nothing in the area which would prevent using the site. There were few houses nearby and the Canal was not far from the plant, so it was not necessary to truck materials for long distances on busy streets. T. 6758-59.

Relying upon the testimony [**201] of Wagner and others, Metzler also approved Hooker's practices in moving waste materials to the site, dumping them, and covering and compacting them. T. 6764. It was a good practice to mix fly ash with waste, because that kept down the fumes and helped to keep the liquids in place. In Metzler's opinion, a waste disposal operation in which the operator would dig, bury, cover the waste, and prevent drainage from the site from getting into streams would have been considered a suitable sanitary landfill as recently as the late 1960s, not only in Western New York but nationwide. [54] T. 6747, 6767-68. Metzler's research revealed that the earliest New York State suggested standards for landfilling of soluble industrial waste was not published until 1971. Like Gilbertson, Metzler emphasized that until the mid-1960s, the concern of health authorities in the State and nationwide was with water and air pollution. Research on the problem of leakage through clay liners did not begin in earnest until the late 1970s. If solid waste or leachate did not dribble into streams, it was not perceived as a problem.

54 During cross-examination of Robert Cohen, OCC offered evidence that Hooker's disposal strategy was much better in many respects than some of the recommended practices of the time. The MCA, a well-recognized trade association in the chemical industry, made recommendations which threatened the environment. The MCA recommended that perchloroethylene be poured on dry sand; that phenol be put in a pit and allowed to seep into the ground; that orthodichlorobenzene be poured into an a earthen dike and allowed to evaporate, or drenched with large quantities of water and washed into ditches, streams, and sewers; and that benzene be poured on dry sand and ignited. T. 2933-40 (Cohen); Exs. 2680, 2682. Looking at the same exhibits, Jerome Wilkenfeld concluded that the MCA suggestions were inferior to Hooker's practice of burying and covering chemical wastes T. 4093-94, 4097.

[**202] In reaching his conclusion that the Hooker

disposal operation was appropriate for its time, Metzler explained that he made certain assumptions from the record. For example, based on a drawing of the proposed site prepared in December of 1941 (Ex. 2002), he assumed that Hooker had done some thinking and planning about the disposal operation even though no memorandum setting forth detailed plans was called to his attention. T. 6841-42. The engineering drawing showed the physical layout, the elevations, the cross-section of the Canal, and included a fence around the perimeter. He admitted that it would have been a good idea to fence the landfill even though fences were not usually erected.

[*1054] He also admitted that it would have been preferable to have a sanitary engineer design the landfill from the beginning even though that was not the practice at the time. T. 6842. However, he insisted that in the early 1940s, a geologist would not have been retained to make a study of a proposed waste disposal site. T. 6845. At the time he made his report, Metzler was unaware of the testimony of witnesses who described the top layer of the soil as sandy loam or soil more permeable than the clay below. [**203] He also felt that if the Company was aware that the children were swimming in polluted water, it should have taken some action to prevent them from doing so.

Metzler was next asked to respond from the perspective of a sanitary engineer of the period to the toxicological information contained in the Brix report about the chemicals Hooker was using and burying at Love Canal in the 1940s and 50s. See Part II, Section E, supra and Appendix B, infra. He concluded that the information it contained "would not have altered the engineering response of public health officials in dealing with Hooker waste disposal practices or in evaluating exposed waste events after the site was transferred to the School Board." Ex. 2481, p.14; T. 6814. He pointed out that the report touched "only slightly on the wastes which were generated by Hooker manufacturing processes and how they were disposed. . . . The hazard information . . . was the kind that was available to and known by the New York State Department of Health at the time Love Canal was being filled." Id. He said that it was well known that these wastes were toxic to both humans and animals and needed to be contained. He further [**204] asserted that the New York State Health Department, with its sophisticated laboratory and able toxicologists and epidemiologists, had ample knowledge not only about the hazards of chemical manufacture and use in general, but also about the specific use and disposal of chemicals employed by Hooker. He referred to the International Joint Commission report of a 1949 study made by Canadian and United States authorities about water pollution in the Niagara Frontier, principally in the Niagara River (Ex. 2524, T. 6751-56, 6780-82), and several industrial waste surveys (Ex. 2508, 2510) to illustrate that knowledge. [55]

> 55 OCC argues unpersuasively that the Commission's report evinced its detailed understanding of the Love Canal disposal practice. The Commission's main concern was water pollution. Since no water pollution was found at Love Canal, the Commission took no great interest in it. The Commission's report, however, does support the assertions by Mr. Metzler that scientific attention, knowledge, and governmental concern were directed to water pollution but not to solid waste disposal.

[**205] To summarize, Mr. Metzler found that Hooker's practices, although not perfect, were more than adequate for the times. By attempting to put the materials into a secure, covered place, Hooker did much more than other companies did to control solid waste disposal. Burial was preferable to untreated discharge into the Niagara River or lagooning. The method Hooker used to handle wastes sufficiently prevented contact with people and animals.

4. Public Health Analysis of the Love Canal Landfill Operation

OCC's final witness, Dr. Eugene W. Fowinkle, discussed Hooker's disposal operation, the transfer of the property to the School Board, and post-transfer activity from a public health perspective. He is a physician specializing in public health, but not an engineer. He had served as Commissioner of the Tennessee Department of Public Health from 1969 until 1983. Since that time, he has served as Associate Vice Chancellor for Health Affairs at Vanderbilt University. Waste disposal problems in Tennessee were similar to those in New York, for while Tennessee had 42 chemical companies and 104 land disposal sites, at the same time New York had 59 chemical companies and 160 disposal sites. [**206] His experience in Tennessee gave him insight into the difficulties facing Hooker at Love Canal.

Dr. Fowinkle's testimony tracked his detailed written report (Ex. 2948), in which he reviewed the literature and exhibits which were introduced into evidence. He started with an assumption that Hooker executives believed that the soils at Love Canal were [*1055] clay and sufficient to withstand leaking of chemicals from the site. In addition to making general comments about the practice at Love Canal, he was asked to review Dr. Brix's report from a public health standpoint, discussing: 1) Hooker's disposal practice; 2) the transfer to the Board; and 3) post-transfer problems.

Dr. Fowinkle labored under certain difficulties in preparing his report. He was not at the Canal during disposal, transfer, or post-transfer periods, nor was he able to interview those who participated in these endeavors. Further, he did not review most of the trial testimony nor some documents which are arguably relevant. He is not a toxicologist; and if required to make a decision in that field as Commissioner, he would have sought advice from a specialist. Within the strictures of these limitations, Dr. Fowinkle testified [**207] that based on the evidence he reviewed describing the Love Canal property and its usage in the period before its transfer to the School Board in 1954, as well as the information set forth in Dr. Brix's report, he would have approved of Hooker's disposal operations from a public health perspective.

Fowinkle explained that until the 1970s, neither the chemical industry nor public health officials had reason to believe that chemical wastes which were buried in clay soils and not disturbed would result in exposure causing health problems. The documents referenced by Dr. Brix demonstrate that from the 1940s through the 1970s, Hooker and other industry and health officials were primarily concerned with direct, high-level exposure to potentially toxic chemical agents by plant workers or users rather than the possibility of low-level exposure to chemical wastes which had been buried. The documents cited by Brix do not address waste disposal by burial. Public health officials at the time would have had no reason to be concerned about adverse effects of residues of toxic chemicals which were thought to be securely buried.

For the same reason, Dr. Fowinkle found nothing in the Brix report [**208] which would have given public health officials reason to oppose the decision to locate a school near the landfill. He considered that the Board was informed that chemicals were buried in the Canal and that the site was approved by the City Planning Board and the School Board. [56]

56 In making this evaluation, Fowinkle assumed ten test holes were dug along the sides of the disposal area without finding any migration of chemicals, and this information was conveyed to the Planning Board and the School Board. As discussed previously, there is a dispute as to the number of holes which were dug and exactly what information was sent to the Board. See Part III, supra.

In Fowinkle's opinion, the maintenance standards which Hooker recommended to the Board and to the City were not difficult to comply with. Such maintenance required no specialized expertise. The State has argued that the Company should have given a specific list of chemicals to the School Board before the transfer. However, Fowinkle said that this type [**209] of disclosure was not necessary because Hooker told the Board that the materials were toxic and had to be treated with care and kept covered. A list of the particular chemicals would not have been helpful. T. 6414. From a public health standpoint, the important question was whether the materials were toxic; if so, they must all be treated with care regardless of their chemical name (T. 6440).

In support of his assessment that the transfer was appropriate for its time, Fowinkle noted that several other schools had been located next to chemical disposal sites. T. 6406-10; see Exs. 2564-69, 2572, & 2575. A New York State Department of Environmental Conservation Inactive Hazardous Waste Disposal Report (undated) discussed a site owned by the State Department of Health adjacent to a school at which spent solvents were poured down a pipe into a disposal pit over a period of years. Even though the soil was considered "very dense," high levels of solvents were discovered in a monitoring well located on the school property. Ex. 2565. [57] [*1056] Evidently, when the Health Department began disposal in about 1950, it believed that the solvents could be disposed of safely in this tight soil. In [**210] 1971, the State found that it had made a mistake because some solvents had seeped out of the well. The comparison with what occurred at Love Canal is striking.

57 The report stated:

> State owned research lab. Spent solvents were poured into drywell on site. The solvents were burned periodically in the well over a period of 15 years. The pit was then filled with rocks and covered with a vertical pipe extending into the fill. The solvents were poured down the pipe over a period of 15 more years until the practice was discontinued in 1976. Approximately 7000 gallons of solvents were disposed of over the lifetime of the site.
>
> A Phase II investigation has been completed. The Phase II report has revealed high levels of solvents in soil samples taken from the disposal pit and in one monitoring well located on the adjacent Christian Brothers Academy property.

The report continues:

> ASSESSMENT OF ENVIRONMENTAL PROBLEMS:
>
> Groundwater contamination has been confirmed at this site. Remediation is necessary at this site.
>
> ASSESSMENT OF HEALTH PROBLEMS:
>
> This site is fenced and patroled. All waste is under ground and there is little potential for direct contact. The groundwater is not used for drinking since the area is served by public water. The soil in the area is very dense, and contaminant migration is not likely. Migration through sewer lines and utility line bedding will be evaluated in the remedial investigation.

Ex. 2565.

[**211] From this and other reports, [58] it is apparent that at the time Hooker transferred Love Canal to the School Board, at least a few other schools in the State were also situated near chemical waste landfills without complaint by the Department of Health or local authorities. These instances support the view that there was slow progress in determining how chemicals migrated through underground soils and a lack of awareness of possible hazard to the community. They also buttress OCC's contention that, at least at that time, the general belief was that there was nothing inherently wrong with locating a school next to a chemical waste facility.

> 58 The other exhibits described industrial waste disposal sites near schools in Johnstown (Ex. 2566), Rochester (Exs. 2568 and 2569), and Middleport (Ex. 2569).

Because the Company offered assistance and advice upon request or on its own initiative, Fowinkle also found Hooker's reactions to post-transfer events responsible and appropriate. He noted that on at least two occasions, [**212] local officials praised Hooker for offering assistance. He could not recall any cases in which the former owner of a landfill was required to assume responsibility for problems which subsequently developed when the property's prior use had been disclosed. Fowinkle would not have expected a former owner to assume management of a previously owned property. Further, local officials stated several times that Hooker had no post-transfer responsibility. The Company repeatedly stated this position without governmental objection.

5. State's Rebuttal to OCC Expert Testimony

To rebut the testimony of Drs. Gilbertson, Fowinkle, and Metzler about the appropriateness of Hooker's disposal practices at Love Canal, the State offered testimony of Clarence Klassen. After graduating from engineering school in 1925, Mr. Klassen began service with the State of Illinois as a Sanitary Engineer, He became Chief Sanitary Engineer in 1935. During World War II, he left his employment to provide the military with supervision of supply, sanitation, and waste disposal sites. After the war, he returned to his former position, remaining there until he retired in 1971.

During his direct testimony at trial, [**213] Mr. Klassen briefly restated, without explanation, the general conclusions set forth in his cursory written report as follows:

> 1. The abandonment of a dumpsite filled with chemical residues for a school facility or other similar public use was contrary to prevailing practices, even in the 1940's and 1950's;
>
> 2. It was known in the 1940s and 1950s that dumping chemical wastes into the ground created the potential for their migration;
>
> 3. The failure to dispose of liquid and solid chemical residue on-site was a departure from prevailing practices.

Ex. 1333.

Klassen's brief report, divided into three sections, reviewed the testimony and reports [*1057] of the OCC experts. Based on this review, he determined in the pre-transfer period that: 1) Hooker failed to design and operate the landfill properly; 2) Hooker's practices failed to prevent potential hazards to the public; 3) Site selection was inadequate because it was too close to nearby residences; 4) Failure to make a geological assessment was improper whether or not there were wells in the area; and 5) Failure to fence was defective. T. 7697-99. Regarding the propriety of the transfer, Mr. Klassen faulted Hooker for [**214] failing to discuss the volume, character, and toxic nature of the waste with the Board. He said that Hooker's response to incidents after transfer were insufficient, believing that the Company should have made periodic inspections of the site. He concluded that:

> Hooker stood out as an exception to the general rule that toxic chemical residues were normally disposed of on factory site, isolated from the public . . . . Hooker's objectionable behavior was compounded by its failure to take definitive actions in the 1950's, 1960's and 1970's to protect school children and other neighboring residents from exposure to these wastes as chemicals and barrels surfaced. This was more than a mere violation of Hooker's good neighbor policy: it was instead an open disregard for the public's safety.

Ex. 1333.

Cross-examination of Mr. Klassen and a comparison of his report to the testimony and reports of the other witnesses revealed numerous contradictions and mistakes. His findings were contradicted by independent evidence and reports, by evidence at trial, and by actions he took during his own career in environmental work. His assertions that Hooker's actions were an exception to industry [**215] standard were rendered questionable when cross-examination revealed that many deplorable environmental conditions were pervasive during his tenure as Chief in Illinois. [59] His opinion that failure to dispose of the waste on-site was a departure from prevailing practices is contradicted by a Congressional Report which found that in Illinois in 1955, 11 of the 38 disposal sites surveyed were off-site. T. 7718.

> 59 For example, Klassen informed the Mayor of DeKalb that there was very little danger of leachate from a proposed gravel pit traveling underground for a 400-foot distance and approved the plan without a geological study, although he did suggest that there be a monitoring program. Ex. 7019; T. 7824. He failed to object to siting a school next to a landfill, saying that it would not pose a public nuisance. Ex. 7017; T. 7831.
>
> He granted a permit to the Monsanto company to dispose of chemical wastes into a creek which ran through a residential area, and finally to the Mississippi River. The ditch was unfenced, unsupervised, and unguarded. T. 7836-48; Ex. 2996. During his tenure, he permitted landfills containing hazardous industrial wastes near residential areas. Exs. 2972, 2984, 2997.

[**216] The International Joint Commission ("IJC") investigation of water pollution found that many industrial plants on the Niagara Frontier used off-site landfills during the 1940s and 1950s. T. 6737-38, 6769-70 (Metzler); Exs. 2520, 2524, 2573. Moreover, studies of sanitary landfilling by other Western New York companies in the late 1940s through the mid-1950s show that Hooker's methods compare favorably. [60] T. 6747-48 (Metzler); Tr. 5217-18 (Cull); Exs. 1216A,

2005-07, 2009-10, 2013-16, 2025. Klassen's opinion that other companies including Dow chemical were relying extensively on incineration to dispose of wastes during the 1940s is substantially contradicted. See Part II, supra.

60 In the 1940s, the federal government also engaged in land disposal of hazardous wastes in Western New York. At the Haist property near the Grand Island Bridge, the United States dumped on open ground hundreds of truckloads of uranium processing residues in a pile three to six feet deep spread over several acres. Ex. 6605, pp. 79-81 (Anderson Dep.). The government dumped uranium tailings on the ground at the Lake Ontario Ordinance Works in Lewiston. Ex. 6605, p.88 (Anderson Dep.). Also, the federal government's Linde Plant in Tonawanda discharged liquids from purifying uranium to storm sewers and later to wells. Ex. 6605, pp. 84-5 (Anderson Dep.).

[**217] *** * * ***

The overwhelming weight of evidence given by experts in the field of solid waste disposal during the relevant time period shows that Hooker comported with and often exceeded the standards demanded by statute, proposed by health and other government [*1058] officials, or followed by others in the industry. The concept of sanitary landfilling by periodic covering of buried wastes was still in a formative stage in Western New York in the 1940s. Many companies were still discharging industrial wastes into lakes and streams. Others used open dumps, many located off-site, without any attempt to dig, bury, and cover. Although knowledge of chemical toxicity and the dangers of exposure was growing rapidly, virtually nothing was known about the ability of these chemical to migrate, nor their hazardous potential after burial of residues. When Hooker's activities are regarded in the light of contemporaneous industry practice of solid waste disposal, the existing regulations and recommendations made by governmental agencies, and the state of knowledge of the dangers of chemical landfills, they do not appear reckless. VII.

DISCUSSION

[HN6] Punitive damages in New York State may be assessed against [**218] a wrongdoer for conduct which shows "reckless or wanton disregard of safety or rights." *Sharapata v. Town of Islip, 56 N.Y.2d 332, 437 N.E.2d 1104, 452 N.Y.S.2d 347, 349 (1982)*. This is the same standard elucidated in Roginsky by the Second Circuit and most other circuit courts in the nation. *378 F.2d 832*; See Part I, supra. The State claims that OCC is liable for punitive damages for its activities and omissions regarding the method of waste disposal at Love Canal, for transferring the site to the School Board in 1953, and for failing to respond adequately to the problems and potential hazards which arose once it had relinquished control over the waste area. The State asserts that OCC had a duty based in both contemporary property law and products liability law to prevent the creation of a public nuisance and to protect the community around Love Canal from the potential of danger before, during, and after the transfer. It maintains that OCC's alleged failure to fulfill its duty in "reckless and wanton disregard" for public safety warrants a finding of punitive damages as a matter of law.

In [**219] ascertaining OCC's liability for punitive damages, the court will keep in mind the difficulties presented by this case which were discussed in the Introduction (Part I). The record is devoid of testimony from many of the principal participants due to death or infirmity and contains a wealth of documents prepared by individuals who could not be questioned or cross-examined. The legal and scientific standards by which OCC's conduct must be measured have changed considerably since these events occurred and were difficult to reconstruct. Furthermore, there is a dearth of legal authority for the State's argument that punitive damages can be awarded. Despite extensive legislative activity in the field of environmental regulation in recent years, neither the federal nor any state government has provided for statutory punitive damages. The State's claim will be examined in light of these limitations.

A. THE APPROPRIATE LEGAL STANDARD

1. Property Law

The prevailing doctrine in property law at the time of the transfer of Love Canal to the School Board was caveat emptor. [HN7] The New York caveat emptor doctrine of the day imposed no general duty on a seller's part to disclose. Rather, [**220] the buyer had to satisfy himself as to the quality of the property. *Kilmer v. White, 254 N.Y. 64, 171 N.E. 908 (1930)*. This doctrine remains law today. *Westwood Pharmaceuticals, Inc. v. National Fuel Gas Distrib. Corp., 737 F. Supp. 1272, 1282 (W.D.N.Y. 1990)*, aff'd. *964 F.2d 85 (2d Cir. 1992)*.

[HN8] The exception to this general rule as applied to nuisance claims in the early 1950s required sellers to disclose latent, dangerous conditions about which they had knowledge. *McCabe v. Cohen, 294 N.Y. 522, 63 N.E.2d 88 (1945)*; see also Restatement of Torts § 353. The seller could not prevent purchasers from examining the property or other relevant information. Conversely, purchasers could not claim fraudulent conveyance where, at the time of sale, they were aware of the relevant problem or capable of ascertaining it. See, e.g., *Danann Realty Corp. v. Harris, 5 N.Y.2d 317, 184 N.Y.S.2d 599, 157 N.E.2d* [*1059] *597 (1959)*. This rule applied equally to transfers for value and to gifts [**221] of property. Restatement of Torts § 354 (1934 & 1965). The State argues, however, that donees may have less reason to satisfy themselves about the quality of the bargain than do purchasers for value. Item 1269 at 19.

In the early 1950s, a seller of real property had no post-transfer duty to warn or to remedy dangerous conditions except to disclose latent defects or material information about which it had superior knowledge. Even for latent defects, the seller's duty terminated when a new owner discovered or should reasonably have discovered and had a reasonable opportunity to abate the condition. *Kilmer v. White, 254 N.Y. at 64 (1930)*; Rest. Torts § 366 (1934). However, a lessor could be held liable for a third party's personal injury even after the control of the property had been transferred if the lessor had failed to disclose a dangerous condition at the time of the transfer. Judge Cardozo found that a failure to disclose made the owner liable, especially if he knew the intended use of the property was public. *Junkermann v. Tilyou Realty Co., 213 N.Y. 404, 108 N.E. 190 (1915)*. See also [**222] *Barrett v. Lake Ontario Beach Improvement Co., 174 N.Y. 310, 66 N.E. 968 (1903)*.

OCC agrees that a seller's liability may have extended beyond the time of transfer in property law in 1953 when the cause of action concerned off-site nuisances arising from on-site conditions. [HN9] While a former landowner's liability in nuisance for off-site property damage terminated when the buyer had a reasonable time to discover and abate the condition, a 1926 New York Court of Appeals decision held that a former landowner could be found liable for off-site personal injury if it had created the nuisance that caused the injury. *Wilks v. New York Tel. Co., 243 N.Y. 351, 153 N.E. 444 (1926)*. Wilks was still the law in 1975. *State v. Ole Olsen, Ltd., 35 N.Y.2d 979, 365 N.Y.S.2d 528, 324 N.E.2d 886 (1975)*.

[HN10] Moreover, under landlord-tenant law, when a landlord was required to abate a nuisance, the fact that the nuisance was on land he no longer possessed did not remove his duty to abate it. The landlord was also liable to third parties for injuries [**223] resulting from a public nuisance from the time he knew of the dangerous condition, even after he had let the premises. *Steefel v. Rothschild, 179 N.Y. 273, 72 N.E. 112 (1904)*. In Steefel, the landlord who constructed a dangerous building not only was required to abate the nuisance by making the building safe, but was also found liable to his tenant for actual damages caused by the landlord's failure to abate because the landlord had failed to disclose the danger and the tenant could not have ascertained it upon reasonable inspection.

While it is fairly clear that the property law of the period required some type of disclosure at the time of the transfer when latent defects existed, it is more difficult to ascertain to what extent the duty to disclose continued after the transfer. To the extent that the dangers at Love Canal were latent and not reasonably ascertainable by the School Board, Hooker retained the obligation to disclose, especially since the land was used by the public. However, it would appear based on 1953 property law that Hooker would have had little duty to update the information provided to the Board and subsequent [**224] users of the site as its knowledge of the potential dangers of the chemicals and their capacity to move through the ground increased, unless the disclosures made at the time of the transfer were inadequate or misrepresented the condition of the property. In fact, the duty appears so limited as to preclude the necessity for disclosure of any type of toxic condition which might only surface years after the transfer unless the seller knew of and failed to warn the buyer of the dangers at the time the property was transferred and the hazards were such that new owner could not reasonably learn about them prior to their causing damage.

2. Products Liability

The State urges the court to apply products liability law by analogy to evaluate the Company's responsibilities in this case. It argues that, unlike the usual real property transfer, a relationship was maintained between Hooker and the School Board subsequent to the donation of the site. The School [*1060] Board naturally relied on the Company, a recognized expert in the field, for advice and

assistance in maintaining the surface cover, testing chemical residues which became exposed, and determining whether human contact with these [**225] residues could cause further problems. The State argues that this reliance created a continuing duty to inform as Hooker's knowledge increased about the dangers of exposure to the chemicals buried at Love Canal. OCC asserts that it is inappropriate for the court to look at products liability law to determine Hooker's duties because the courts of New York did not apply products liability duty-to-warn concepts to the transfer of unimproved real property at the time of the Love Canal transfer, nor do they do so today. Item 1267 at 35. OCC argues that, unlike the retail purchaser of a product, the School Board as the real estate purchaser was in actual privity with Hooker and had actual opportunity to inspect the property before purchase. Moreover, the School Board assumed the risk of potential liabilities for injuries caused by the buried waste in the deed.

[HN11] Products liability law creates a higher standard for post-transfer disclosure and remedy of defects for a product sold to the public than does property law, because the assumption is that the producer not only has superior knowledge at the time of transfer but continually increases that knowledge in efforts to improve the product. [**226] In the products liability realm, the duty to warn encompasses an obligation to advise foreseeable users of the nature and mechanism of the injury which is known to be associated with product use, along with appropriate precautions. Products liability law of the 1950s held a producer accountable for a dangerous product if no notice was given of the danger and the danger could not be discovered by reasonable inspection. Genesee *County Patrons Fire Relief Assn v. L. Sonneborn Sons, Inc., 263 N.Y. 463, 189 N.E. 551 (1934)*; *Restatement (Second) of Torts § 388* (1965). A manufacturer was liable for injuries to remote users of an inherently dangerous product that is defectively made, "irrespective of contract." *MacPherson v. Buick Motor Co., 217 N.Y. 382, 389, 111 N.E. 1050 (1916)*. The seller's duty to warn was commensurate with the risks posed by the product and the limitation of the foreseeable user, including his lack of experience with and his foreseeable inattention to the risk. *Henry v. Crook, 202 A.D. 19, 195 N.Y.S. 642 (3rd Dept. 1922)*. Superior [**227] technical knowledge was a significant factor in determining negligence for failure to warn. *Rosenbusch v. Ambrosia Milk Corp., 181 A.D. 97, 168 N.Y.S. 505 (1st Dept. 1917)*. Furthermore, the purchaser's duty to inquire may have been irrelevant to the seller's duty to warn if the danger was not generally known to purchasers. *Rosebrock v. General Electric Co., 236 N.Y. 227, 140 N.E. 571 (1923)*. In *Orr v. Shell Oil Co., 352 Mo. 288, 177 S.W.2d 608 (1943)*, the court held that the manufacturer of a pesticide ingredient owed to a worker in another company's plant a duty to warn of toxic hazards. See also *De Vito v. United Air Lines, 98 F. Supp. 88 (E.D.N.Y. 1951)*. Finally, if the product is so inherently dangerous that no amount of warning could make it safe, punitive damages could be warranted merely for placing it on the market. *Sturm, Ruger & Co. v. Day, 594 P.2d 38* (Alaska, 1979) cert. denied, *454 U.S. 894, 70 L. Ed. 2d 209, 102 S. Ct. 391 (1981)*. [**228]

The State argues that products liability law should also be applied to Hooker's conduct after transfer. In 1969, the Second Circuit held that a manufacturer of a product with dangerous defects has a duty to warn of a defect of which it learns after the sale. *Braniff Airways, Inc. v. Curtiss-Wright Corp., 411 F.2d 451 (2d Cir. 1969)*, cert. denied, *396 U.S. 959, 24 L. Ed. 2d 423, 90 S. Ct. 431 (1969)*. The court in Braniff did not require remedial action, but in some other cases, courts found that mere warnings were inadequate and obliged the manufacturers to take remedial action as well. *Noel v. United Aircraft Corp., 342 F.2d 232 (3d Cir. 1964)*; *Gracyalny v. Westinghouse Electric Corp., 723 F.2d 1311 (7th Cir. 1983)*. Punitive damages have been awarded when a manufacturer failed to warn past and present purchasers of a serious danger of which the manufacturer had received growing confirmation over [*1061] the years. *Gillham v. Admiral Corp., 523 F.2d 102 (6th Cir. 1975)*; *Lewy v. Remington Arms Co., 836 F.2d 1104 (8th Cir. 1988)* [**229] (failure to recall).

The State agrees with OCC's assertion that sellers had no post-transfer duty to warn about a defect only discovered after sale under 1953 products liability law because this obligation was not imposed upon manufacturers in New York until 1984. *Cover v. Cohen, 61 N.Y.2d 261, 473 N.Y.S.2d 378, 461 N.E.2d 864 (1984)*. Nevertheless, the State argues that application of products liability law to Hooker's post-transfer duty is appropriate, because the ongoing relationship between the School Board and Hooker over maintenance of the property when problems occurred is analogous to the feedback a manufacturer receives about its product from further development and research as well as consumer communications. The State attempts to distinguish this transfer from most real estate

transfers because most transfers are usually single transactions, at which point the seller-buyer relationship terminates. The State argues that in both cases, members of the public were placed at risk by Hooker's transfer of ownership. Just as products liability law recognizes that consumers must be protected from dangerous products, the [**230] public at Love Canal should have been protected by the party that created the dangerous conditions. Item 1269 at 49-50. The State asserts that the School Board would not be considered a knowledgeable user because its members were not professionally experienced with the product--in this case, a toxic waste landfill. *Billiar v. Minnesota Mining & Mfg. Co., 623 F.2d 240 (2d Cir. 1980)*; *Rosebrock, 236 N.Y. 227, 140 N.E. 571 (1923)*.

Although the State draws an interesting parallel between the producer-consumer relationship under products liability law and the relationship between Hooker and the Board in this case, it could not provide any New York case law to support its argument that products liability can be applied here by analogy. Almost all of the cases the State does cite were decided long after the 1950s and have questionable bearing here. Most deal only with negligence. Those which included punitive damages almost all have substantial factual differences. For example, in Gillham v. Admiral Corp., 91 serious fires had been called to the defendant's attention before plaintiff's injury. *523 F.2d 102 (6th Cir. 1975)*. [**231] In Noel v. United Aircraft Corp., there were 27 accidents in which the propeller had malfunctioned and a number of planes had crashed before the accident in which the court found that punitive damages were warranted. *342 F.2d 232 (3d Cir 1964)*.

Moreover, in the products liability cases, the producer is usually dealing with many customers who must rely upon the design or representations made by the manufacturer and do not have the opportunity to investigate the representations. The negotiations are not held face-to-face, but rather occur in the general marketplace. In contrast, negotiations between Hooker and the Board stretched over a long period of time, with many opportunities for the Board to become as fully informed as it desired. Hooker was not bound by contract to continue servicing the site; indeed, the agreement was to the contrary, and the Company made clear on many occasions that it was not required to give assistance. The fact that Hooker responded with help when requested did not create a continuing or additional obligation. Most of the problems associated with the site -- potentially dangerous chemical wastes, subsidence, potholes, and foul [**232] odors -- were obvious or known to the Board. Indeed, it is mysterious that the Board did not ask additional questions.

The relationship between Hooker and the Board was unique, but not so unique to require products liability formulas to be applied to the relationship. Therefore, to find that punitive damages are an appropriate remedy under the Roginsky standard, the court must look solely to the Hooker's duty as established by the property law of the period. The law did necessitate disclosure by the seller at the time of the transfer if latent defects existed. If Hooker's conduct shows a reckless disregard for the safety of others in making a transfer, it could be liable for punitive damages. A failure to warn of latent defective conditions that were not reasonably [*1062] ascertainable by the School Board may indicate reckless behavior.

The post-transfer duties of Hooker as defined by contemporaneous property law were very limited. They depend on the extent of disclosure at the time of transfer and the opportunity and ability of the School Board to learn about the problems associated with the chemical wastes during and after the transfer.

Although there is no legal authority by which [**233] to measure Hooker's responsibility for Love Canal over time, the School Board's continued reliance on Hooker's expertise after the transfer will be taken into account, along with the Company's consistent denial of responsibility and evidence that the Board failed to seek or ignored Hooker's advice.

B. PRE-TRANSFER ACTIVITIES

Although the State devoted considerable effort to describing Hooker's disposal operation, the use of the Love Canal site as a recreation area, and the problems that arose from exposure to chemicals prior to the transfer of the area to the School Board, it concedes that none of these activities in themselves would raise the issue of punitive damages liability. Rather, the State presented this evidence in an attempt to show a pattern of carelessness regarding the safety of those who lived in the area, a policy of negligence which it claims continued with the transfer and subsequent occurrences.

There was evidence of negligence on the Company's

part during the period in which the waste disposal occurred. Hooker knew that the area was used habitually by nearby residents for recreation. Children and adults not only played in the Canal, but also went swimming [**234] and fishing there. Yet, despite a plan and several suggestions by internal observers that a fence be erected around the perimeter to keep out unauthorized people once the dumping started, if a fence was ever put up in the northern section, it was not operational for most of the disposal period. No fence was ever erected in the southern and central sections, neither were signs posted or other warnings given to residents of the neighboring homes that fishing or swimming might prove harmful. Hooker was also negligent in its careless method of piling barrels above the clay level where chemicals could and did seep through the soil, exposing the tops of the barrels and even the chemical residues themselves whenever subsidence occurred. OCC argues that the barrels were only exposed temporarily, when subsidence occurred or while dumping was in progress at a particular pit. A review of the literature on solid waste and chemical disposal techniques of the 1940s and 1950s reveals that Hooker was justified in believing that the chemicals could not get through the clay soil if the area remained properly covered. However, no such belief could be maintained regarding the chemicals buried too shallowly [**235] to sit securely inside the "clay bathtub." The State asserts that Hooker should have asked a geologist to survey the site before beginning its disposal operations. However, no expert was needed to point out that the barrels had to be buried deeply enough to avoid exposure from subsidence. Common sense should have informed Hooker that allowing the barrels to rest within 1 1/2 feet from the surface was potentially dangerous.

However, these instances of negligent behavior in and of themselves do not amount to a reckless or wanton disregard for human welfare. Hooker's chemical waste disposal operations comported with the knowledge and practice of the time. Measured by industry practice of the time, Hooker's procedures at Love Canal met or exceeded the standards in most particulars. Moreover, the disposal practices were designed to limit the exposure of those who worked daily at the site. Although the "helter-skelter" dumping of barrels looked untidy, this method was safer than forcing workers to climb into the pits to align the barrels.

Hooker owned all the land in which it was burying its waste products. At the time Hooker acquired the site and throughout most of the disposal period, [**236] few families lived in the area. Although the Company was aware of the Canal's use as a recreation area and should have provided some warning to residents of the potential dangers of the site once the dumping began, it violated no zoning or pollution regulations by using it as a [*1063] dump or failing to erect a fence to keep people out. [61]

61 The State placed too much emphasis on the lack of a fence. It should be noted that when the State dumped the material unearthed during construction of La Salle Highway in 1968 at the Nash Road site, it did not erect a fence either.

Hooker also responded to the immediate problems arising from the disposal site. When it received complaints about fires, subsidence, exposed barrels, or someone being splashed, Hooker personnel were sent to take care of the trouble. For example, the Company acted quickly to ameliorate the DDM problem. It continued to attempt to improve its manufacturing processes, especially for DDM and thionyl chloride, to lessen the amounts of chemical wastes which had [**237] to be buried. Also, there were no problems with migration through the upper silty layer of soil during the pre-transfer period.

However, the incidence of subsidence, exposed barrels, potholes, and similar problems should have called to Hooker's attention the need for greater care. Hooker's negligence is disturbing in light of the knowledge it possessed concerning the effects of exposure. While most of the Company's internal documents as well as the scientific articles of that time discussed hazardous chemicals primarily in terms of dangers to those handling the chemicals in pure form, Hooker was well aware even during the disposal period that the wastes from lindane production and several other chemical processes were highly toxic. Even if some temporary surface exposure during the disposal operation was unavoidable, there is no excuse for the Company's failure to guard against the recurrence of surfacing chemicals by burying more deeply and maintaining an adequate cover.

However, the State agrees that the practice of shallow dumping and leaving exposed drums and chemicals on the surface would not give rise to a claim for punitive damages without the subsequent transfer to a less [**238] knowledgeable buyer. Therefore, we cannot look at the pre-transfer events in isolation but

must consider them in the context of the transfer.

C. THE TRANSFER

The State first argues that Hooker's conveyance of the property to the School Board was in itself a reckless act, without regard to the adequacy of warnings given. It claims that Hooker should have known that the chemicals buried in the Love Canal landfill would pose a danger to the public for the foreseeable future, that children or even adults might not exercise the punctilious care necessary to avoid exposure to wastes near or on the surface, and that the Board could not possibly provide the adequate maintenance to prevent injury. From this knowledge, Hooker should have realized that the site was an inappropriate location for an elementary school and recreational area. Therefore, the State asserts, Hooker displayed a wanton disregard for public safety and health in transferring the Canal.

To support this argument, the State relies on a series of products liability cases in which the courts found the product to be so inherently dangerous that no amount of warning could prevent its hazardous use. See Item 1269 at 25-26. [**239] The court has already determined that in the present case, the analogy to products liability law is too weak to be applied. The relationship between the Board and Hooker before, during, and after negotiations for the transfer of the Canal obviated the need for some of the safeguards erected by products liability law. The face-to-face negotiations between members of the Board and Hooker personnel, the ability of the Board to make an independent assessment of the property, and the continuing relationship between the Company and the Board as a representative of the community also mitigate against a finding that the transfer to the Board would have been a reckless act even with full disclosure.

In the alternative, the State argues that OCC is liable for punitive damages because it transferred a hazardous waste to the Board for public use without providing the disclosure necessary to insure that adequate preventive measures would be taken. While Hooker cautioned against digging into the waste and said that chemical residues were buried at the site, it remained silent as to the [*1064] known probability and consequences of subsidence; it failed to talk about the consequences of exposure and failed [**240] to warn residents and children as to the dangers. Item 1269 at 32.

The extent of Hooker's obligation to disclose when the property was given to the School Board cannot be determined simply by reference to a legal standard. Whether Hooker had an obligation to identify the specific chemicals buried in the site, their possible short- and long-term deleterious effects, and/or the precise means for effective maintenance of the site to prevent contact is necessarily a fact-based determination, as is the question of whether Hooker fulfilled this duty. To measure Hooker's behavior in this regard, it is more fruitful to examine the contemporaneous knowledge and practice of the industry as well as the actual information Hooker had at the time of transfer.

Despite the fact that Hooker's use of Love Canal as a chemical dumpsite was public knowledge, the way in which the property was defective was latent. A reasonable inspection of the site alerted the Board to the facts of subsidence, potholes, and the knowledge that substantial quantities of chemicals were buried there. Hooker warned the Board about the danger of digging or construction in the site. But Hooker's knowledge about the [**241] contents of the landfill, the potential problems associated with coming into contact with the residues, and the best methods for containing the danger was far superior to that of even very well-informed School Board members.

As a recognized expert in chemical manufacture, Hooker had information about the chemicals it produced, the byproducts it created, and the dangers of both direct and indirect exposure. Dr. Brix's detailed analysis recounts the Company's considerable knowledge about potential toxic effects of many of the chemicals in pure form. Her analysis also made clear that with the passing of each year, the Company's knowledge concerning the chemicals increased in all aspects, including their hazardous nature.

Because no one actively involved in the transfer testified and relatively few documents survived, it is difficult to tell exactly what information Hooker gave to the Board and what questions the Board asked in the negotiation stage. But the evidence does not indicate that Hooker deliberately withheld knowledge about the dangers of specific chemicals during the negotiations for transfer. It did not hide from the Board that chemicals were buried at the site which would [**242] cause injury if they were dug into. It was public knowledge in the City of Niagara Falls that some of these chemicals were very toxic.

While the exact nature of Hooker's disclosure cannot be ascertained, it appears that the Board was provided with very little explicit information about what had been deposited. At one point, the Board was misleadingly told the site was used for "plant refuse containing some chemicals." Apparently, the School Board never asked for more detailed information, but this does not necessarily relieve OCC of further responsibility. Although the School Board members were intelligent, educated people, they were not chemists or toxicologists. They could have brought in independent specialists to verify the information given to them, but apparently chose to rely on Hooker's specialized knowledge. The Board reasonably expected Hooker to disclose what was needed to maintain the site safely because the Company remained very active in the community.

OCC argues that the Board would probably not have benefited from more detailed information. Eugene Fowinkle, a public health specialist, testified that such disclosure would not have been necessary or helpful at the time. [**243] Public health officials treated all chemical residues labeled toxic with the same caution. T. 6414, 6440. Moreover, Hooker could be and was called upon to investigate and advise about any chemical which caused problems as the need arose.

However, had Hooker been more forthcoming, the Board may have taken further precautions. The Company could easily have supplied a list of specific chemicals manufactured at the Niagara Falls plant during the years in which wastes were dumped in the Canal, along with the approximate amounts, the general nature of the residues created, [*1065] and the type of injury which might result from exposure. The Board could then have consulted with the Health Department or others in the City about insuring the integrity of the site and warning the public, and accepted responsibility for transfer with a fuller understanding of the undertaking.

Events after transfer indicate that the warnings Hooker gave the Board concerning the need to keep the site covered apparently did not adequately convey the amount of work entailed nor the potential risks involved in failing to maintain a cover. However, the Board was notified that such work would be necessary. Hooker suggested [**244] strongly that a covenant for such continued maintenance be included in the deed, and the Board's attorney warned the Board before transfer that it was accepting the risk and possible liability to persons who may be injured as a result of the existence of chemicals upon the land. The Hough report commissioned by the Board in preparation for construction of the school echoed these same warnings and noted that this would mean greater than usual maintenance work. These warnings mitigate any "reckless disregard for human safety" which might be read into the Company's failure to give the Board adequate information before the transfer.

For some purposes, further disclosure would not have been helpful. Hooker was not negligent in failing to predict that the water-soluble chemicals buried at the site would eventually migrate through the soil to adjoining residences. Despite some scattered scientific investigations which indicated that subsurface migration was possible, the state of knowledge of stratigraphy and secure toxic waste disposal methods was not advanced to the point that Hooker could reasonably have been expected to inform the Board at the time of the transfer that chemicals might [**245] leach through the soil. Hooker could honestly have believed that the clay several feet below the surface was impermeable and that if kept covered, the chemical wastes would stay put. There was no attempt to mislead the Board in this regard.

However, Hooker's failure to disclose to the Board that it had disposed of chemicals so close to the surface and that portions of the central section contained chemical residues was inexcusable. Barrels and wastes were deposited above the clay level where they rested in a mixture of silty sand and clay, with minimum cover in many locations. Chemical wastes filled two pits at the original proposed school site. Hooker's omissions in these instances increased the chances of human exposure to potential dangerous substances.

The issue of where the chemicals were buried is also problematic. The original site for the 99th Street Elementary School was, according to Hooker, filled only with flyash. But the School Board's general contractor soon discovered that Hooker had dumped chemical wastes into two large pits in that area, requiring a change in the school's location. It is not clear whether these pits were dug and filled before or after the property [**246] was transferred to the School Board.

However, there is no evidence that the Company deliberately intended to mislead the Board. From our present viewpoint, Hooker's disclosures to the Board were inadequate, but the sparsity of the record about the

nature and extent of these disclosures at the time of transfer makes it difficult to conclude that Hooker's actions at the time showed a reckless and willful disregard of the health and safety of others.

D. POST-TRANSFER EVENTS

OCC asserts that during negotiations for the transfer, Hooker made clear and consistent representation to the Board that the Company would have no further legal responsibility over what happened at the site once Love Canal was under the Board's control. This understanding was included in the deed and accepted by the Board as a condition of the transfer. Despite this absolution of responsibility, the Board called on Hooker to lend its advice and assistance when problems arose that the Board could not handle, from identifying the chemicals that surfaced to recovering the area and advising people who came in contact with the chemicals about the best treatment. Although not explicit anywhere in the record, it [**247] is likely that the Board's reliance on the Company was discussed, [*1066] acknowledged, and encouraged by Hooker at the time of transfer negotiations, or shortly thereafter, when the problem with siting the school arose. Thereafter, the record does not show any occasion in which the Company refused to respond to requests for assistance, each time asserting that the help was voluntary rather than obligatory.

The State claims that the Company's disclaimers were self-serving and that the response was inadequate on several occasions. [62] It argues that incidents of subsidence, foul odors, pothole eruption, and, most seriously, several occasions in which young children coming in contact with chemical wastes served as ample notice to Hooker that post-transfer responses failed to prevent exposure to Love Canal's hazards.

> 62 As an example, the State emphasizes the incident involving the building of the highway in which Hooker tarried in providing the contractor with an analysis of the chemical and then gave an incomplete report. No direct evidence was given to explain the delayed report or the omission of the fact that the residue burned "like a 4th of July sparkler." Ex. 1267. Although such an omission could be construed as a misrepresentation, there is no proof of any intent to mislead, nor would there be a motive to do so, since Hooker had no legal obligation and the workers in question were State contractors who clearly knew or should have known in 1968 that they were digging into a chemical dumpsite. The County Health Department supervised the movement of the material and asked Hooker to identify the substance, but neither the State nor the Health Department ever asked for further analysis or reported any further problem with the residue.

[**248] The most disturbing allegation by the State is that Hooker became increasingly knowledgeable about the potential for harm from buried wastes after relinquishing control, but never attempted to offer the Board or anyone else additional information which might have helped protect the site's users. The most striking concern is Hooker's handling of BHC disposal. The Company knew that it had deposited over 6,000 tons of highly toxic, concentrated BHC residues. While the exact composition of most of the other waste materials were unknown, Hooker was well aware that "spent cake" was almost 100 percent pure BHC. At the time of transfer, the Company knew that BHC was toxic and posed great danger if handled. See Part II, Section D. After the transfer, the Company's knowledge increased, yet apparently no effort was made to particularize the warnings given to the Board as more information became available.

Although Hooker believed that the wastes had been placed in a secure clay vault, it became apparent by the early 1950s that some toxic materials were rising to the surface. It also became evident that the Board was not heeding the instructions to keep the area covered and to avoid excavation. [**249] The explicit warnings given to the Board by Mr. Chambers in 1957 against digging into the subsurface, keeping the site covered, and maintaining ownership and control of the area rather than selling it were ignored. Hooker should have perceived that if the Board did not heed its many warnings, speculators or developers who bought the property would most likely ignore the dangers as well. Yet, other than reiterating the same warnings, Hooker did nothing to prevent the sale or the construction projects. It was fortunate indeed that the eventual purchaser did not develop the area.

A year after the Board meeting attended by Mr. Chambers, the problem of continuing exposure was highlighted further. Road construction crews uncovered spent cake and a child was burned. The investigation of Mr. Beck confirmed that BHC spent cake was the cause

of the injury, which fortunately did not appear to be serious. Common sense dictates that Hooker should have done more than simply repeat former warnings. Hooker should have revealed in detail the serious danger of the BHC deposit to the Board, if not at an earlier time, then certainly once it had been notified of these events. Hooker's excuse that the [**250] Board did not ask for this information is without merit. By this time it was evident that the Board either did not know how or did not care to ask the right questions. Disastrous results could have followed because of Hooker's lack of candor. The company was well aware of the danger, and it was apparent that the Board would not heed its advice unless stronger measures were taken. A meeting with the Board, with a straight-forward explanation of the grave [*1067] hazards of the lindane isomers, was required. If that had been done, a plan could have easily been formulated to prevent further exposure. [63] There is no excuse whatsoever for Hooker's silence. Under the circumstances, Hooker's lack of action was clearly negligent.

63 When the enormous quantity of BHC deposited is considered, Hooker was fortunate that there were not many more incidents similar to the one in 1958. BHC exposure was reported by Olatka in 1971, Brierly in 1972, and Dr. Axelrod and Commissioner Whalen in 1978, see Part IV, Section A, supra and Part V, Section A, supra. Not all of the blame for this exposure can be attributed to Hooker. By 1978, almost 25 years had passed since the Company's last deposit of waste materials. In the meantime, grading, occasional removal of soil, road and sewer construction, the sale of the southern portion, and failure to keep the area covered considerably influenced the condition of the area and exposure of BHC. These intervening factors cannot be charged to Hooker.

However, it is important to note that children were burned on other occasions than the ones listed above. See Part IV, supra. Although BHC was not necessarily identified as causing the injuries, the type of injury and the description of the offending material should have called to Hooker's attention and concern the fact that the Board's upkeep efforts were lacking and more was required.

[**251] Although not as serious as the BHC problem, there were several instances in which thionyl chloride barrels exploded or, as OCC preferred to say, "burst." Usually, Hooker's disposal method for this material worked well, but if there was not a sufficient reaction with water at the time of initial disposal, chemical reaction in the sealed barrel resulted in the sudden and unexpected "bursting." Because of experience at the plant, Hooker was aware that this could occur and should have known that some barrels were near the surface. It also knew that liquid or gaseous residues of thionyl chloride could have prolonged, cumulative ill effects, especially in children. Again, the Company did not share this knowledge with the Board or the community. Again, there is no evidence of serious injury or that anyone ever approached Hooker for more specific information about the danger of these chemicals.

Given the amount of dangerous chemicals buried at the Canal and the failure to maintain an adequate cover or warn the community about the hazards of exposure, it was sheer good luck that no one suffered any immediate, severe injury. Had more serious injury occurred, perhaps the Board would have inquired [**252] further and demanded more of Hooker. Further, the evidence shows no instance in which either the Board or the City complained to Hooker that its assistance was inadequate or unavailing.

From Hooker's perspective as well, the lack of serious injury meant that the Company was not ignoring an obvious problem in reckless disregard for the safety of others. Although potholes and subsidence developed, there is also considerable evidence that in some respects the landfill cover held up well. Between 1954 and 1978, there were relatively few reports of BHC exposure, potholes, and subsidence. In addition, individuals such as Mr. Goodman, an experienced engineer who looked over the site before he started road and sewer construction at the southern end of the landfill in 1958, testified that they did not notice any evidence of waste disposal or chemical odors. The subsequent exposure of chemical wastes at that time during construction cannot be attributed to Hooker.

The scientific knowledge available to Hooker was theoretically available to others as well. However, the superior nature of Hooker's knowledge, combined with the Board's continued reliance on the Company for advice and assistance, [**253] created a common-sense

duty on the part of Hooker to amplify on the hazards posed by these chemicals. It is questionable whether the law at that time would require Hooker to be more open and candid about giving advice to the Board; but when its knowledge of the chemicals is considered and the danger to residents from the chemicals, hindsight tells us that the Company should have done more.

CONCLUSION

Upon detailed consideration of the entire record, the court finds that while the State documented many specific instances of Hooker's negligence, it has failed to prove by a preponderance of the evidence that Hooker's actions and omissions in operating the [*1068] Love Canal landfill or transferring it to the City of Niagara Falls School Board for use as school and park grounds displayed a reckless disregard for the safety of others. Hooker's decision to landfill its chemical wastes, its choice and maintenance of the site, and its method of disposal operation all comported with the available knowledge and industry practice of the time. While the Company should have made greater efforts to keep local residents off the property, it violated no ordinance or legal obligation in failing to [**254] do so. It responded to complaints about odors, fires, and exposures to chemicals whenever notified, and there was no evidence of injury during the disposal operations that would have signaled a compelling need to provide more protection.

Hooker agreed to transfer the property to the School Board, despite the misgivings of some of its managers, when it became convinced that the rapid population growth in the surrounding area both created the need for a school and ended the site's usefulness as a landfill. The Company disclosed to the Board that many dangerous chemicals were buried at the site, and the ground would have to be maintained properly and not excavated. Hooker did not disclose the composition and amounts of chemical residues buried. While it is likely that this type of disclosure would have given the Board a better understanding of the responsibility they accepted, there is no indication that this information was either sought or deliberately withheld. The sparse record of the negotiations which led up to the transfer makes it difficult for the court to fix blame at this juncture.

Although Hooker's activities after the transfer were clearly unacceptable by present standards [**255] and at times violative of common sense, in general, given the state of scientific knowledge and the legal principles of that time, they did not exhibit the degree of recklessness which would warrant a punitive damages award. The Company's failure to respond adequately to the likelihood of serious harm once it learned that children were playing with and being injured by the waste materials argues strongly that Hooker disregarded a threat to public safety. The Company was clearly negligent in failing to warn the Board that chemicals had been dumped in the central section at the proposed site of the school and to inform the Board that many of the chemical-laden barrels were so shallowly buried that subsidence would inevitably expose them and their contents. However, after the transfer, the Company responded to calls for assistance in dealing with incidents of exposure and no immediate, serious injury or damage was reported. By contemporaneous property law precepts, Hooker's legal duties as a seller were very limited. The Company asserted clearly and consistently that the transfer removed its legal responsibility for the site.

Nevertheless, Hooker had superior knowledge about the health [**256] hazards of exposure to such substances as lindane wastes which it never disclosed to either the Board or the community. Even though there was a general awareness that dangerous chemicals were buried in the ground, the threat to the children's health was at least partially latent, because the current users of the property did not know what the residues were nor the type of ill effects they could cause. Incidents of exposure should have put the Company on notice that exposure would most likely continue and result in serious illness. At that point, Hooker should have provided more detailed information and sounded an alarm. The history of Hooker's failure to come forward makes for a strong argument that it showed a wanton disregard for the health and safety of others.

However, it is necessary to consider the many factors which have been previously discussed. Noted again is the very slim support for the State's position that the common law gives a governmental entity the right to sue for punitive damage. Since 1950, both state and federal legislatures have enacted many environmental laws but have chosen to punish by criminal statutes and fines rather than civil punitive damages, in spite [**257] of extensive discussion and legislation. Furthermore, actual awards of punitive damage are rare in the absence of conclusive evidence of serious injury or deliberate flaunting of regulatory standards. There is no evidence of either in this record. Additional evidence of damage and

wrongdoing may yet be produced [*1069] in Phase II, but the court must make a decision on the present record, which the passage of time left woefully incomplete for many of the crucial events by which intent could be inferred.

Considering all of these circumstances, the court finds that the State has failed to prove by a preponderance of the evidence that Hooker's conduct at Love Canal met the Roginsky standard necessary for an award of punitive damages. The court emphasizes that this verdict does not signify approval of Hooker's conduct. Hooker was negligent on a number of occasions as the court has already noted. But a finding of outrageous conduct and reckless or wanton disregard of the safety of others requires more. And the conduct must be judged by the law in force at the time of action or inaction. There are further proceedings in this case. Hooker's conduct as set forth in this decision will be considered [**258] a part of that future record, if appropriate.

So ordered.

JOHN T. CURTIN

United States District Judge

Dated: March 17, 1994

[*1070] [SEE DIAGRAM IN ORIGINAL]. [*1071] EXECUTIVE SUMMARY

A. ANTIMONY TRICHLORIDE (ANT)

Hooker recognized the severe toxicity of antimony trichloride as early as 1941. ANT was corrosive to the skin, eyes, nose and throat. It combined with water vapor in the air or on the skin to form hydrochloric acid. It could cause severe burns that were slow to heal. Even the vapors could cause dermatitis and blisters. Inhalation of vapors could burn the interior of the nose, which lead to frequent nosebleeds and septal erosion. In addition, ANT could cause severe irritation to the respiratory system, including, pulmonary edema. Hooker recognized that persons who have chronic diseases of the nose or respiratory tract should not have exposure to ANT. These diseases include bronchial asthma, bronchitis, bronchiectasis and chronic sinusitis.

B. ARSENIC TRICHLORIDE (ART)

Hooker recognized the severe toxicity of arsenic trichloride by 1934. They summarized the symptoms of arsenic poisoning and [**259] required several industrial hygiene procedures. Arsenic poisoning could result from inhalation of the vapors or skin absorption. ART reacted with water vapor in the air or on the skin to form hydrochloric acid. It caused deep-seated skin burns, which healed slowly with difficulty. Several Hooker employees developed skin burns, ulcers, dermatitis or nosebleeds because of ART exposure. The symptoms of chronic arsenic poisoning included: digestive disorders, vomiting, inflammation, irritation and reddening of the skin, hair loss, and numbness or tingling of the toes and fingers. Hooker recognized the special susceptibility of individuals with a history of kidney or liver disease to the toxic effects of ART. Hooker consulted the medical literature on arsenic compounds and relied upon information obtained from the National Safety Council.

C. BENZENE

Hooker was aware of the highly toxic properties of benzene as early as 1946. This volatile, and potentially explosive, chemical had caused documented fatalities due to inhalation or skin absorption prior to 1946. Acute exposure to elevated air concentrations caused an anaesthetic effect on the central nervous system, which induced [**260] dizziness, headache, excitement and euphoria, and ultimately stupor, loss of consciousness and death due to paralysis of the respiratory center. Chronic exposures to low levels caused bone marrow toxicity, inducing anemia, decreased white blood cells, decreased platelets and increased immature forms of blood cells. In severe cases, this bone marrow toxicity was irreversible and could lead to death.

The importance of variations in individual susceptibilities and pre-existing disease conditions in determining the toxicity of benzene was recognized in 1946.

D. CARBON TETRACHLORIDE (CT)

Hooker received the results of toxicity tests on CT as early as 1944. Human fatalities were reported as early as the 1930's due to inhalation or ingestion. Deaths from kidney or liver damage were well-described by the 1950's. Chronic lower-level exposure could lead to "headache, mental confusion, depression, nausea, vomiting, loss of coordination and sense of balance, and visual disturbances." Dangerous air concentrations could arise without adequate warning properties of odor.

Hooker decisionmakers themselves discussed the wisdom of the marketing of a product as dangerous at CT. Hooker was [**261] aware of individual variability in the susceptibility to CT as well as a synergistic interaction between CT and alcohol.

E. CHLORINATED BENZENES

Chlorinated benzenes could cause irritation to the skin, eyes, mucous membranes, and upper respiratory tract. Orthodichlorobenzene, for example, could cause serious chemical burns to the eyes and skin. Inhalation of this class of chemical could cause symptoms of central nervous system depression and narcosis. Chronic skin exposure to these compounds could cause dermatitis. Chronic inhalation exposure to all of these chemicals could cause damage to the liver, and for some of these chemicals, damage to the lungs and kidneys, as well. All of these chemicals were a significant hazard when heated, because toxic decomposition products were emitted, [*1072] such as phosgene or hydrogen chloride gas.

E. 1. MONOCHLOROBENZENE (MCB)

Hooker recognized that MCB was irritating to the skin, eyes, nose, throat and upper respiratory tract as early as 1943. Hooker required safety labeling of its MCB product and several safety precautions for its employees. Hooker recognized the acute and chronic effects of central nervous system depression due to MCB [**262] including the potential for death due to anesthesia. Symptoms of chronic MCB poisoning included "headache, dizziness, stupor and urine difficulties" and possible "damage to lungs, liver and kidneys". Hooker was aware that persons with liver or kidney dysfunction or alcoholism should not be exposed to MCB.

E. 2. ORTHODICHLOROBENZENE (ODCB)

Hooker Chemical Company had already recognized the toxicity of orthodichlorobenzene by 1942. They were consulted by other chemical manufacturers about the toxicity of ODCB. ODCB was irritating to the mucous membranes and upper respiratory tract. It was a severe eye irritant, and it was an acute skin irritant, which could even lead to blistering. Vapor inhalation could lead to central nervous system depression and narcosis. Chronic skin exposure could cause dermatitis and cracking. There were reports of jaundice and weight loss in exposed individuals. Chronic inhalation could lead to injury to the liver, lungs and kidneys. Hooker corresponded with other chemical companies and physicians about the toxicity of ODCB. Hooker was familiar with and relied upon the current periodical toxicology literature and toxicology reference texts. In [**263] addition, Hooker recognized racial and genetic factors which contributed to variations in individual susceptibility in the development of chloracne due to ODCB exposure.

E. 3. TRICHLOROBENZENE (TCB)

Hooker Chemical Company had already recognized the toxicity of trichlorobenzene by 1947, at which time they required a precautionary label on their product which listed several safety recommendations. Hooker was consulted by other chemical manufacturers about the toxicity of TCB. TCB was irritating to the eyes, skin, mucous membrane and upper respiratory tract. Hooker expressed concern over skin contact, which could lead to dermatitis and possible systemic absorption. Chronic inhalation of TCB could result in liver damage. Chronic exposure to TCB "carried the same toxicity rating" as chronic exposure to biphenyl (PCBs). When heated, TCB could emit toxic fumes of chlorides. Hooker accepted the premise that the effects caused by administration of TCB subcutaneously could also be caused by inhalation or ingestion of TCB.

E. 4. TETRACHLOROBENZENE

Hooker Chemical Company was aware of the toxicity of tetrachlorobenzene by 1953. They were consulted by another chemical company [**264] regarding dermatitis caused by tetrachlorobenzene. Hooker issued a Material Safety Data sheet on this chemical. This chemical could cause definite irritation to the eyes, skin, and upper respiratory tract, as well as an anaesthetic effect on the central nervous system. Chronic exposure to it could cause liver injury. Heating it yielded toxic hydrogen chloride gas and methyl and ethyl chlorocarbons.

F. CHLORINATED NAPHTHALENES (CN)

Hooker was aware of the highly toxic effects of chlorinated naphthalenes by 1937, even before they began to manufacture them. Inhalation and skin contact could result in chloracne and systemic absorption, leading to liver damage. Fatalities in employees of another corporation were investigated by Harvard University. In 1937, Hooker discussed the necessity of an industrial

hygiene program, if they began to make CN. Hooker also realized that exposure to a mixture of chlorinated chemicals, including CN, could produce synergistic toxic effects. Also, Hooker recognized that persons with a history of alcoholism should not be exposed to CN. Several Hooker employees developed [*1073] dermatitis when they were exposed to chloronaphtalenes.

G. HEXACHLOROBUTADIENE [**265] (C-46)

Hooker possessed information which demonstrated the extreme toxicity of C-46, as early as 1944. Very small doses were fatal to several species, through ingestion, inhalation or epidermal application. It caused serious damage to multiple organ systems, in particular, the kidneys and liver. Hooker required several safety precautions for its employees. Hooker was aware that toxic effects could appear long after the onset of exposure. C-46 was toxic enough to warrant consideration as a potential chemical warfare agent by the Army Chemical Corps. These documents demonstrate that Hooker contracted with outside experts to perform toxicity testing on C-46, and that Hooker exchanged toxicity information on C-46 with their customers and various government agencies.

H. HEXACHLOROCYCLOHEXANE ISOMERS (HCH) - INCLUDING LINDANE

Hooker Chemical Company recognized the toxicity of HCH isomers as early as 1945. HCH isomers were demonstrated to be very toxic to several rodent species, through oral, skin and subcutaneous administration. HCH isomers caused central nervous system excitation, convulsions and death, with pathological changes in multiple organs on autopsy. Early toxicity [**266] tests showed that the gamma isomer was the most toxic in a single oral dose, but the beta isomer was the most toxic in multi-dose subchronic testing. The beta isomer caused hypertrophy and rapid cell division of the liver. There were sex- and age- related differences in the storage of these isomers in experimental animals.

Human exposure to HCH isomers caused headache and irritation to the eyes, nose, pharynx, and skin. In 1948, the estimated fatal oral dose of lindane was about 0.5 ounce for humans. Fatal poisonings due to gamma-HCH were reported as early as 1951. Poisonings could occur through ingestion or skin absorption. Symptoms of acute poisonings could include loss of consciousness and grand mal convulsions. As early as 1953, chronic poisonings were reported, which included symptoms due to severe anemia and easy bleeding (probably due to decreased platelets). Hooker exchanged information on the toxicity of HCH isomers with other companies; kept apprised of the toxicologic literature; was familiar with research at academic institutions; recommended several safety precautions for its employees exposed to HCH isomers; and closely followed the concern of regulatory agencies [**267] in gamma-HCH.

I. HEXACHLOROCYCLOPENTADIENE (C-56)

Hooker had documented knowledge that hexachlorocyclopentadiene (C-56) was toxic as early as 1950. Extremely low doses were fatal to four species of rodents, through the oral, epidermal and inhalation routes. Each of these routes caused similar pathological changes in multiple organ systems; the most severely damaged organs were the liver, kidneys and lungs. Although most chemicals are more toxic when given orally than when applied upon the skin, the minimum lethal dosage for rabbits was about the same for C-56, by these two routes, thus indicating the exceptional dermal absorption of C-56.

The extreme chemical reactivity of C-56 caused it to be corrosive to the skin, eyes, nose and throat. It caused skin burns and blisters upon contact, and even wearing contaminated clothing or shoes could result in painful second and third degree burns. In 1955, Treon et. al. stated that 0.15 ppm C-56 was too high an air concentration to be permissible for worker exposure; this concentration approximated the odor threshold. Hooker mandated that workers must not be exposed to air levels above the odor threshold.

In 1955, Hooker recognized [**268] that C-56 was more toxic than phosgene, and much more toxic than carbon tetrachloride. Hooker required many safety procedures for its employees, which were designed to minimize skin and inhalation exposure. Hooker was familiar with toxicity research performed by universities and other corporations. In addition, Hooker was aware of government studies of C-56, and government regulations. C-56 [*1074] was regulated as a Class B poison by the U.S. Department of Transportation.

J. MERCAPTANS

Hooker Chemical Company knew that mercaptans

were toxic as early as 1944. These chemicals are corrosive in the presence of water, and can irritate the mucous membranes and burn the skin. They could cause central nervous sytem depression similar to hydrogen sulfide, including loss of control over skeletal muscles, convulsions, and death due to paralysis of the respiratory center. The recommended treatment for mercaptan poisoning was the same as for hydrogen sulfide. At lower concentrations, mercaptans could induce nausea, vomiting, diarrhea and kidney damage.

Hooker recommended either enclosure of chemical processes which involved mercaptans or the use of supplied-air respirators. This indicated [**269] that Hooker believed that inhalation of even very low concentratons of mercaptans could be injurious. They also required personal protective equipment to prevent skin contact. Hooker communicated with other corporations on the toxicity of mercaptans. Hooker recognized that there were serious long-term hazards of burying the manufacturing byproducts of mercaptans at the Love Canal dumpsite, as early as 1945.

K. PERCHLOROETHYLENE (PC)

Hooker Chemical Company recognized the toxicity of perchloroethylene by 1945. PC could be absorbed through the lungs, skin and gastro-intestinal tract. It was irritating to the skin, eyes, nose, throat and upper respiratory tract. Eye exposures resulted in lacrimation, burning and inflammation. Impermeable gloves and aprons were recommended to prevent skin contact. PC could cause symptoms and signs of central nervous system depression, upon acute or chronic exposure; including loss of consciousness and death. Chronic skin exposure could cause dermatitis, including cracking and blistering. Chronic exposure could cause damage to the central nervous system, liver or kidneys. Special susceptibilities were recognized: alcoholics, and those markedly [**270] overweight or underweight; and people with chronic diseases of the central nervous system, liver, kidneys or skin were not supposed to be exposed to PC.

Very detailed safety procedures were published for PC in 1948. These included procedures for: 1) product labeling; 2) employee education; and 3) symptoms and treatment of overexposure. Hooker and other manufacturers and users of PC were aware of governmental concern about the effects of overexposure to PC.

L. THIONYL CHLORIDE (TC)

As early as 1943, Hooker recognized that TC was a very toxic chemical, which was very irritating to the skin, eyes, nose and upper respiratory tract. It caused burning and blistering of skin upon contact, and the odor was "suffocating". Inhalation could lead to pulmonary edema. It was highly reactive with water, producing toxic vapors of SO2 and HCL. This lead to concern over disposal methods of TC which would allow contact with water. Hooker also stated concern over TC exposure to inhabitants of a building on the plant site and neighboring homes.

M. TRICHLOROPHENOL (TCP) - INCLUDING DIOXIN

Hooker Chemical Company was aware of toxicity problems with their trichlorophenol processes as early [**271] as 1941. Many exposed employees developed severe chloracne that necessitated treatment, sick leave and job transfers, which in turn led to high labor turnover. These cases of chloracne were very slow to heal, even after removal from exposure. As early as 1941, Hooker suspected that the chloracne-inducing agents might be manufacturing by-products, such as chlor diphenyl oxides, rather than the TCP itself. Hooker consulted with other corporations, physicians, and governmental scientists about TCP-related dermatitis in 1941 and 1942. Toxicity testing (specifically, patch testing of animals with the various chemical by-products of the TCP process) was recommended in 1950. Hooker was consulted by several other companies about dermatitis problems due to the TCP process or similar chemical manufacturing processes.

[*1075] Dioxins and dibenzofurans were identified by several German researchers as the likeliest sources of the chloracne by 1957. These chemicals were extremely toxic when applied to the skin of rabbits and they could cause chloracne-like changes within a few days, as well as death from liver damage, at extremely low dosages. The German researchers suggested several manufacturing [**272] process changes that could reduce the production of dioxins in 1957. As late as 1971, Hooker appeared not to have made these recommended changes. In 1965, Hooker TCP residues were tested for dioxin content and were demonstrated to contain about 300 ppm of dioxin.

[*1076] [SEE DIAGRAM IN ORIGINAL.]

[*1077] [SEE DIAGRAM IN ORIGINAL.]

[*1078] [SEE DIAGRAM IN ORIGINAL]

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