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STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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In the Matter of Alleged Violations of
Sections 17-0501, 17-0511 and 11-0503
of the Environmental Conservation Law
of the State of New York by:

INTERIM OPINION
AND ORDER

File No. 2833

GENERAL ELECTRIC COMPANY,

Respondent.

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SOFAER, A. D., Hearing Officer:

This proceeding was commenced on September 8, 1975 by the Department of Environmental Conservation ("Department") to enforce against the General Electric Company ("GE") sections 17-0501¹, 17-0511² and 11-0503³ of the Environmental Conservation Law of the State of New York ("ECL") and of water

1. ECL 17-0501 General prohibition against pollution

- 1) It shall be unlawful for any person, directly or indirectly, to throw, drain, run or otherwise discharge into such waters organic or inorganic matter that shall cause or contribute to a condition in contravention of the standards adopted by the department pursuant to section 17-0301.

2. ECL 17-0511 Restrictions on discharge of sewage, industrial waste or other wastes

The use of existing or new outlets or point sources, which discharge sewage, industrial waste or other wastes into waters of this state is prohibited unless such use is in compliance with all standards, criteria, limitations, rules and regulations promulgated or applied by the department pursuant to this article.

3. ECL 11-0503 Polluting streams prohibited

- 1) No dyestuffs, coal tar, refuse from a gas house, cheese factory, creamery, condensary or canning factory, sawdust, shavings, tan bark, lime, acid, oil or other deleterious or poisonous substance shall be thrown or allowed to run into any water either private or public, in quantities injurious to fish life, protected wildlife or waterfowl inhabiting those waters or injurious to the propagation of fish, protected wildlife or waterfowl therein.

quality and purity standards promulgated pursuant to ECL 17-0301. The complaint alleges that GE is polluting the waters of the Hudson River by directly and indirectly discharging a toxic substance, polychlorinated biphenyls ("PCBs"), into the river from the Company's facilities at Hudson Falls and Fort Edward (ECL 17-0501, 17-0511), and that the discharged PCBs are injurious to fishlife of the Hudson River (ECL 11-0503.1). The Department seeks far-reaching relief, including: an order that GE cease its discharge of PCBs from all point and non-point sources⁴; that GE restore the health of the Hudson River and other natural resources to the extent its PCB discharges have despoiled them; and that these objectives be attained through a procedure under Department's supervision, including a requirement that GE file a surety bond of \$2,000,000 to guarantee its compliance.

GE answers that its discharges do not violate the ECL and raises as an affirmative defense compliance with its permit under the National Pollutant Discharge Elimination System (NPDES), now a State Pollutant Discharge Elimination Permit (SPDES), issued originally by the U.S. Environmental

4. ECL 17-0105(16):

"Point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation or vessel or other floating stock from which pollutants are or may be discharged.

Protection Agency (EPA). GE argues that no basis exists for the imposition of any remedy. At the same time, the Company represents that "it is going forward voluntarily with a program to achieve maximum treatment and containment." Reply Brief, p. 1 (Jan. 12, 1976). At the hearing, its Manager of Engineering and Product Development, Dr. Michael Modan, testified that GE was in the process of reducing its discharge of PCBs from a claimed daily average of about two pounds, to a maximum daily amount of one hundred grams by the end of 1976. Tr. 1322. These amounts are in sharp contrast to the combined daily discharge level of thirty pounds from the plants at Fort Edward and Hudson Falls described in GE's SPDES permit.

The hearing commenced on October 6, 1975, when petitions to intervene were made by the New York State Department of Commerce ("Commerce") and the Natural Resource Defense Council ("NRDC") in behalf of itself and others.⁵ After oral and written argument, the petitions to intervene were granted on certain conditions, as outlined in an opinion filed on November 19, 1975.⁶ The parties engaged

5. The others are the Hudson River Fishermen's Association, Inc., the Hudson River Sloop Restoration, Inc., and the Federated Conservationists of Westchester County, Inc. In addition a statement by the United Electrical Workers was made without objection from the parties.

6. The opinion and other papers and documents in this litigation are on file with the New York State Department of Environmental Conservation, Office of the General Counsel, 50 Wolf Road, Albany, New York.

in extensive discovery, after which nine additional days of hearings were held. All witnesses were available for cross-examination, and the parties offered direct as well as rebuttal testimony. A substantial record has been compiled, consisting of several thousands of pages of transcript, prefiled testimony, reports, studies, articles and miscellaneous other exhibits.

The filing of this enforcement action necessitated findings and conclusions on whether GE has violated any or all the statutes invoked. On the other hand, it became clear to all those involved that a hearing and judgment concerning the remedies that should be imposed would become necessary only if GE was found to have acted unlawfully. The parties therefore agreed to defer the complicated remedial issues in this case until violations of law were found.⁷

In summary, the record in this case overwhelmingly demonstrates violations of ECL 17-0501 and 17-0511, within the applicable statutory period. PCBs are toxic substances, capable in sufficient quantities of causing skin lesions, destroying cells in vital body organs, adversely affecting reproduction, and inducing cancer and death. GE has discharged PCBs in quantities that have breached applicable

7. The Department objected when the Hearing Officer noted that any opinion and findings filed prior to a determination of the relief to be afforded would be tentative and interim. Tr. 1949-1950. The objection was overruled since final and appealable findings and conclusions will and should be filed with the Commissioner only after the proceeding is complete.

standards of water quality. The PCBs have injured fish, and have destroyed the viability of recreational fishing in various parts of the Hudson River by rendering its fish dangerous to consume. Fish analyses in evidence present a grim picture in which PCB contamination reaches over 100 times the temporary tolerance level established by the U.S. Food and Drug Administration ("FDA") in 1971.

These unlawful consequences are the product of both corporate abuse and regulatory failure: corporate abuse in that GE caused the PCBs to be discharged without exercising sufficient precaution and concern; regulatory failure in that GE informed the responsible federal and state agencies of its activities, and they too exercised insufficient caution and concern until this action was instituted by New York's present Commissioner of Environmental Conservation.

GE is responsible for its conduct and must be compelled to abide by the law. It will at a minimum be ordered drastically to limit its discharges, as it claims itself willing and able to do; to consider and use substitute products wherever feasible; to take other steps that may be appropriate to prevent intentional and non-intentional future discharges; and to rectify the effects of its prior violations where lawfully proper, and economically and environmentally practicable. The public must not be made to

pay a continuing price for past bureaucratic insufficiency. But neither should the legislature and public be deceived by this focus on GE's activities into assuming that government has otherwise dealt in a meaningful, institutional fashion with PCBs, or with other hazardous substances being discharged into our environment.⁸ Effective regulatory surveillance would have prevented much of the harm that GE has inflicted. The remedial order ultimately imposed in this case will therefore be constructed with a full and fair appreciation of the fact that, while the damage must cease and be rectified, GE has operated openly and negligently rather than in secret or in disregard of PCB discharge limits set in its permits. For this reason, among others, the charge under ECL 11-0503 is dismissed.

8. New York enacted in 1973 a toxic substances control bill which gives the Department authority to promulgate within "not less" than one year rules and regulations to control the discharge and storage of substances determined to be hazardous to the environment. L. 1973, C. 400, ECL 37-0101 et seq. No official Department action has yet been taken.

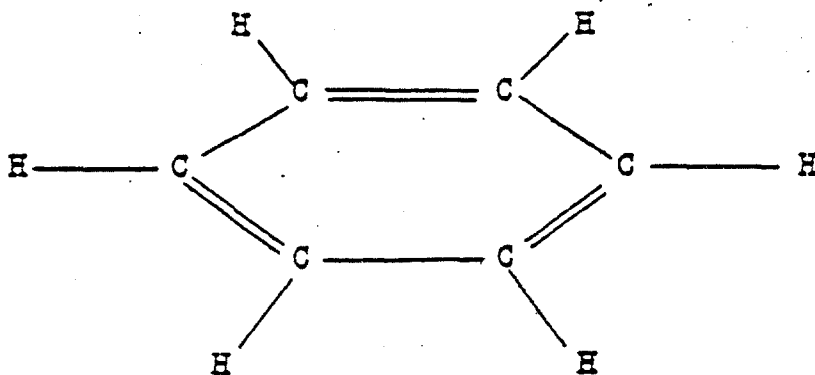
EPA, pursuant to the 1972 Amendments of the FWPCA, is responsible for setting effluent standards for toxic pollutants. FWPCA §307(a)(1), 33 U.S.C. 1317(a). An initial list of pollutants, proposed in 1973, included PCBs. 38 FR 18044 (July 6, 1973). The Act mandates that the Administrator focus on these "most serious hazards to man and other organisms inhabiting or consuming water"; NRDC sued EPA in 1973 to require it to promulgate Section 307(a) standards. EPA then proposed standards and hearings were held in 1974. See Tr. 1145. No effluent standards have as yet been promulgated.

I. PCBs and the Hudson River

A. Composition and Properties of PCBs.

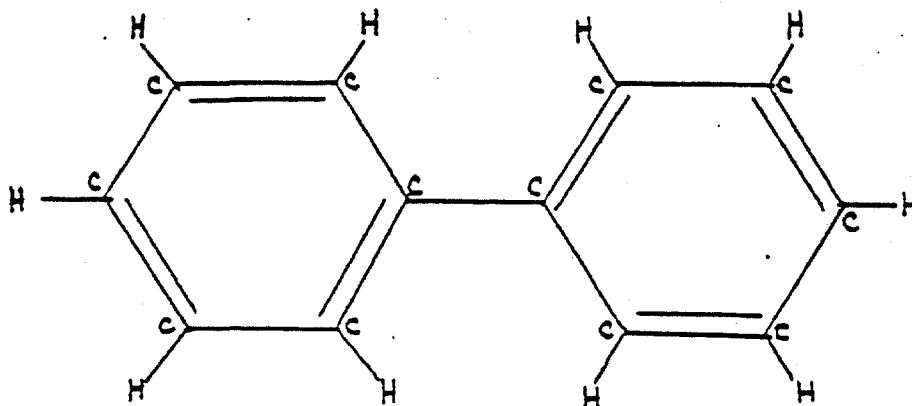
PCB is the abbreviation for a group of chemicals known as polychlorinated biphenyls. Their composition is based on the "biphenyl", a substance made by heating benzene under appropriate conditions. The biphenyl consists of two phenyl molecules, each having six carbon atoms attached in a chain with its two ends hooked together to form a ring, and each with six hydrogen atoms attached to its six carbon atoms.⁹ A biphenyl ring is formed by breaking the links between one carbon and hydrogen atom on each of two phenyl molecules and making instead a new carbon-to-carbon bond. The result is a compound empirically described

9. Each carbon atom has the ability to form four links, or bonds, with other atoms. One way in which six carbon atoms combine, is for each to have one bond with the carbon on one side of it, and a double bond with the carbon on its other side. This configuration leaves each carbon with one unused link, which in the phenyl molecule is occupied by a hydrogen atom. The results can be described as C_6H_6 or by the following structural diagram:



See Dep't Exhibit 15, p. 2. The description of PCBs is drawn from the testimony of Dr. Gilman D. Veith, Dep't Exhibit 14 and Dr. Edward L. Simons, Tr. 1118-26.

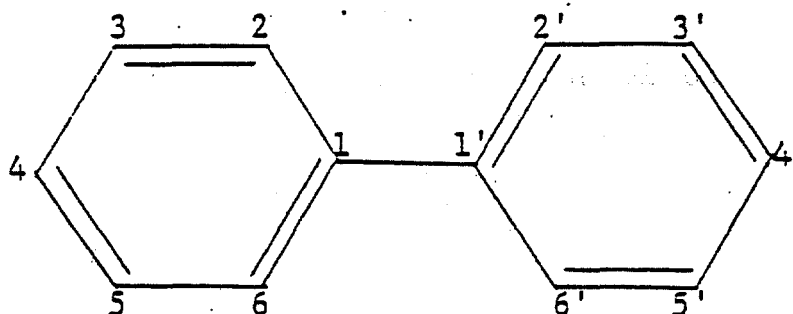
as $C_{12}H_{10}$, or by the following structural diagram:



To chlorinate a biphenyl one must replace its hydrogen atoms with chlorine. When only one chlorine atom is added in place of a hydrogen atom, the resulting compound is called a monochlor-biphenyl. When more than one chlorine atom is added, a polychlorinated biphenyl is formed. Since each biphenyl has ten hydrogen atoms, PCBs may have any number of chlorine atoms up to ten, and PCBs with anywhere from one to ten chlorine atoms are called homologs of each other. In manufacturing PCBs, it is generally not possible exclusively to create molecules with a specific number of chlorine atoms. Instead, when chlorine gas and biphenyls are mixed, many homologs of PCBs are formed, and the average number of chlorine atoms with each biphenyl varies with the temperature.

PCB mixtures not only contain different homologs, they also consist of different "isomers". Each biphenyl has

several possible sites for chlorine atoms, and the different arrangements of atoms are called isomers of each other. For example, dichlorobiphenyl (two chlorine atoms added) has twelve possible isomers, each with the chlorine atoms at different places on the two phenyl rings. The empirical formula $C_{12}H_8Cl_2$ would apply to all these isomers, but structurally they would be different. Chemists express these differences either diagrammatically or more succinctly by describing the location of the chlorine atoms in accordance with the following position numbering system:



Thus, for example, if the chlorine atoms in a tetrachlorobiphenyl (4Cl-PCB) were located at the "2" and "5" positions of each phenyl molecule, the resulting compound could be described as 2, 5, 2¹, 5¹ tetrachlorobiphenyl.

The sole manufacturer of PCBs in the United States is the Monsanto Chemical Company. Domestic sales of all PCBs by Monsanto have ranged from 26,061,000 pounds in 1958 to 73,061,000 pounds in 1970; in 1974, sales totalled 34,406,000 pounds. GE Exhibit 19. Until 1971, PCBs were

sold for numerous commercial purposes. Monsanto limited PCB sales in 1972, however, to so-called closed applications. The sole application for which PCBs have been used in recent years, according to Monsanto data, are transformers and capacitors. The GE plants at Hudson Falls and Fort Edward manufacture transformers and capacitors, and use PCBs in their preparation. Since 1966, GE has purchased 82,213,000 pounds of PCBs of all types from Monsanto for use in its products. Dep't Exhibit 6.

PCBs, especially mixtures with relatively high percentages of chlorine, have useful physical properties. They are essentially non-flammable. Tr. 1136-37 (Dr. Simons). They are extremely stable; for example, a mixture with an average of five chlorines released only traces of degradation when treated with concentrated sulfuric acid for 255 hours or boiling 10 percent sulfuric acid for 150 hours. Dep't Exhibit 14, p. 7 (Dr. Veith). Finally, electric current can pass through PCBs without affecting or being affected by them.

These properties have made PCBs desirable for use in capacitors and transformers. Transformers are used to change one type of current into another, and consequently dispense with the need to create generating and transmission capacity in all useful forms of current. Capacitors

also save considerable electrical energy. Many motors and other electrical devices have parts that must be magnetized to operate; when such a motor draws current, only part of the current is used in rotating the shaft, the rest is required simply to maintain the magnetic field. Without a capacitor, electricity would flow back and forth from the generating station and the motor, as it does in other applications. With a capacitor hooked across a motor's terminals, however, the magnetizing current is captured, rather than sent back to the generating source, and returned to the motor during the next electrical cycle. The net saving of power by using capacitors was estimated without rebuttal as thirty percent; or, to run three air conditioners with capacitors would require the same electrical power required to run two such air conditioners without capacitors. Tr. 1127-35 (Dr. Simons).

Monsanto has sold, and GE has used, PCBs with a variety of chlorine percentages. These mixtures have been merchandized under the trade name "Aroclor", followed by a numerical designation such as Aroclor 1254. The "12" represents the twelve carbon atoms in the biphenyl ring, and the last two digits, "54" for example, indicate the average percent chlorine of the particular mixture. Aroclor 1254 ("A-1254"), therefore, would have an average of five chlorine atoms for

each biphenyl ring, though the mixture will contain PCBs with anywhere from 3 to 7 chlorines. Dep't Exhibit No. 14, p. 6 (Dr. Veith). Until 1971, Monsanto sold large quantities of various Aroclors, especially 1242, 1254 and 1260. In 1971, the company introduced a new mixture, which it designated Aroclor 1016 ("A-1016"). Since then, A-1016 has accounted for an increasing proportion of PCB sales, until in 1975, A-1016 sales are running at a greater rate than the sales of all other Aroclors combined. GE Exhibit 19, p. 3. GE purchases of PCBs from 1965 to 1975 indicate an almost total shift from A-1242 and 1254 to A-1016, and to a minor extent A-1221. Dep't Exhibit 6.

Aroclor "1016" is a deceptive numerical designation for that compound. The chemical has 12 carbons, not 10, and contains over 41 percent chlorine, not 16. Monsanto's Manager of Product Acceptability testified that there was no scientific reason for the designation "1016", and conceded that "following the old nomenclature it should be called Aroclor '1241 plus'." Tr. 1232-33. There is a difference between A-1016 and 1242, but it is not in the percent of chlorine. Rather, it is in their homolog composition; Monsanto specifications show a maximum of .4% of homologs with five or more chlorines in A-1016, whereas the typical A-1242 mixture contains 6 to 7% of such homologs.

Dep't Exhibit 19(2) (Letter of W.B. Papageorge, Monsanto, to Dr. David L. Stalling, U.S. Dep't of Interior, Oct. 17, 1973). The extent to which this difference has any bearing on toxicity is discussed below.

B. Presence of PCBs in the Hudson River.

The Hudson River is some 305 miles long, from its source at Lake Tear of the Clouds to the George Washington Bridge at New York City. This case deals primarily with that part of the river near and downstream of the GE plants at Hudson Falls and Fort Edward. The plants are only about one mile apart.

To determine the amount and type of PCBs in a body of water, or in any other matter, is no easy task. All the evidence produced at this hearing was derived through gas chromatography, the science of separating chemicals by heating them to the points that they become vapors.¹⁰ The parties recognize that this method is not perfect.

10. Chemicals introduced in a gas chromatograph will move at different rates, depending on their respective boiling points, and will separate from the chromatograph at different times. Each separation is recorded by a detector, which then draws a peak on a chart paper recorder, resulting eventually in a "gas chromatogram". The intensity of peaks on the chart recorder is proportional to the quantity of the particular chemical escaping from the chromatograph. By comparing a chromatogram of an unknown mixture with those of mixtures whose contents were known, an analyst is able to identify the types and amounts of chemicals in the unknown mixture with those of mixtures whose contents were known, an analyst is able to identify the types and amounts of chemicals in the unknown mixture. See generally Dep't Exhibit 14, pp. 8-13 (Dr. Veith).

Furthermore, the fact that analyzed material is found to contain a particular PCB configuration, for example A-1242, does not necessarily mean that the material originally discharged was A-1242, since PCB homologs have different rates of bioaccumulation and degradation. Further, chromatograms of mixtures with similar chlorine content tend strongly to resemble each other, a circumstance particularly true of A-1242 and 1016. But none of the parties objects to chromatography as a scientifically adequate way of measuring for PCBs.

The record contains substantial evidence of PCBs in the water, sediment, organisms and fish of the Hudson River. During August 1974, employees of the U.S. Environmental Protection Agency ("EPA") conducted an investigation of PCB contamination in the Hudson. They found a concentration in water at the outfall from GE's Fort Edward facility of 2800 ppb (parts per billion or ug/l) A-1016. Sediment at the same sampling station yielded 6700 ppm (parts per million or mg/kg) A-1016, indicating the absorptive capacity and constant exposure of the sediments nearest the outfall. At another station, one-half mile downstream, sediments contained 2980 ppm A-1016, or an accumulation 10^3 times greater than the recorded outfall concentration. Dep't Exhibit 28, R. J. Nadeau & R. P. Davis, Investigation of Polychlorinated Biphenyls in the Hudson River, p. 9.

Composites of snails found below the GE discharges were found to contain up to 45 ppm of a PCB analyzed as either A-1242 or 1016. G. D. Veith to R. J. Nadeau, Oct. 23, 1974, in Dep't Exhibit 28, appendix. Shiner minnows had 78 ppm, and a rock bass set what was then regarded as "a new record for PCB contamination of fresh water fish", with 350 ppm. Id. 14, 18.

The Department has for several years been aware of the presence of PCBs in New York's waters, including the Hudson. An analysis of fish in 1972 indicated a concentration of PCBs in largemouth bass of 0.66 to 14.62 ppm; in white perch of 0.38 to 15.81 ppm; and in striped bass of 3.70 to 49.63 ppm. Data compiled in 1973 on striped bass indicated that most fish tested contained more than 10 ppm PCBs, ranging up to 49.63 ppm in one sample. Fish from other waters also had high concentrations. GE Exhibit 11, appendices. Beginning on December 4, 1974, the Department's Division of Pure Waters initiated, in conjunction with EPA, a more systematic monitoring program of PCBs in the Upper Hudson River Basin, an area including GE's plants. Water and sediment samples were taken from several sampling stations. Special precautions were taken to assure quality analysis, including a series of interlaboratory comparison studies. A-1016 was found in water below the GE plants at a rate of

3 ppb during mid-winter 1974-75, indicating a river load of that PCB of about 94-97 lbs per day.¹¹ By late August 1975, when the study terminated, sampling at the same station reflected 0.06 ppb A-1016 in the river, indicating a river load of less than 14 lbs per day. Sediment and core samples¹² below the GE plants showed concentrations of A-1016 ranging as high as 100 ppm, 201 ppm and 1850 ppm, as well as high concentrations of A-1221 and 1254. Dep't Exhibit 9, pp. 6-7 (R. Mt. Pleasant). This water and sediment monitoring study included no collection and analysis of fish and other organisms. On the basis of the water concentrations observed (not including the effects of sediment, runoff or other sources of PCBs), however, the report predicted that fish flesh concentrations of 3 ppm to 150 ppm of A-1016 would result. Dep't Exhibit 5, pp. 25-26. The Department's contemporaneous study of Hudson River fish overwhelmingly confirmed this anticipated result.

11. The river load of PCBs is the total amount of PCBs from all discharge points that enter the river daily. This figure is derived by measuring the total PCBs suspended in the water column from daily samplings, multiplying this total by the daily volume of river flow which is expressed in cubic feet/second, and then multiplying by 86,400, the number of seconds in a day.
12. Sediment samples are obtained from the top level of the river sediment. The Department set this depth at five centimeters for their program. The sediment is scooped up, with suitable equipment, labeled and later analyzed for PCB content. Dep't Exhibit 5, p. 3. Core samples are taken with equipment which can penetrate the surface of river sediment or land formation. Those core samples taken by the Department ranged from three to eleven inches in depth. The core samples were analyzed for PCB content in one inch sub-samples cut from the originally extracted core. Id. App. C, figure 6.

The Department initiated a statewide fish sampling program in August 1975 to ascertain the extent of PCB concentration. Numerous samples were taken from the Hudson River, prepared and analyzed; once again, precautions were taken for quality assurance. Fish captured at stations below the GE plants contained higher amounts of PCBs than previously found. Concentrations of over 20 ppm A-1242/1016 were found common. A composite of ten Yellow Perch had 236.42 ppm A-1242/1016, as well as 62.88 A-1254, a total of 299.30 ppm PCBs. An American eel, captured at Stillwater, was found to contain 403.38 ppm A-1242/1016 and 155.87 ppm A-1254, totaling 559.25 ppm PCBs. Dep't Exhibit 13, Monitoring of PCB's in Fish Taken from the Hudson River (Oct. 1975). This figure is over 100 times greater than the temporary tolerance limit set by the FDA in 1971 for PCBs in the edible portion of fish.

GE does not challenge these data. During the hearing, the Company sought to introduce evidence gathered by Ecological Analysts, Inc., a firm that engages for profit in preparing testimony for corporations in environmental litigation. Tr. 1426-1427. The evidence gathered was analyzed by the Woodson-Tenent Laboratories of Memphis, Tennessee, and some initial results were placed in the

record through the testimony of Dr. Gerald J. Lauer, Vice President of Ecological Analysts, Inc. These results showed in thirteen fish samples, several of which were taken below the GE plants, not a single sample with over 5 ppm PCBs in the edible flesh. After cross-examination, it became apparent that these data were unreliable. GE ultimately terminated its effort to introduce the material and agreed to request the laboratory involved to prepare a complete analysis of all its Hudson River samples.¹³ The new findings, based in

13. During cross-examination of Dr. Lauer, NRDC requested the complete results of the sampling program conducted by Ecological Analysts, Inc. This included data from the Upper Hudson, Lower Hudson, Long Island Sound and Chesapeake Bay. GE objected on various grounds. Initially its objection was that the request was for the "furnishing of additional substantive evidence" and therefore not proper within the scope of proceedings where the government has the burden of proof. Tr. 1583. More particularly GE argued it had presented no evidence with respect to whole fish in the Upper Hudson nor any evidence "whatsoever...with respect to any type of investigation concerning PCBs in fish elsewhere." Tr. 1593. GE also claimed the material was privileged, even though it had originally sought to introduce the results of the investigation.

The Hearing Officer ruled that the material requested for Chesapeake Bay and Long Island Sound samples was outside the scope of the issues raised by the complaint, but directed GE to produce all evidence relating to fish in the Hudson River. Tr. 1660-61. Respondent requested a 48-hour stay of the order to allow "a determination as to whether a review of what amounts to a subpoena order should be taken at this time." A stay was granted, Tr. 1664, but on the following day GE withdrew its objections.

part upon reanalysis of the same samples earlier analyzed, are consistent with the Department's conclusions. Several fish had concentrations of A-1016/1242 over 100 ppm in their edible flesh. Concentrations in what GE termed "non-edible" tissue ranged as high as 1178 ppm. NRDC Exhibit 1.

C. GE's Responsibility for PCBs in the Upper Hudson

GE "has not contested that it has been a source of certain PCBs in the Upper Hudson River in the vicinity of its discharges." GE Reply Brief, p. 11. But it claims that "the evidence does not permit..., by the legal standards which exclude conjecture as a basis for penalties, a finding that the high levels of PCB's reported in these fish are attributable to Respondent's discharges." In particular, the company asserts there is "no evidence" excluding other PCB sources earlier than September 1975, "no evidence" relating downstream fish concentrations to Respondent's discharges, and "no evidence" as to when the accumulations occurred. Id.

The Department has the burden of proof in this proceeding. ECL 17-0905(6). The burden involved is that normally applied in civil and administrative proceedings to prove the alleged violations by a preponderance of the evidence.¹⁴ It may be

14. McCormick, Evidence §§339, 355 (1972). The authorities cited by GE for a more exacting burden are inapposite. For example, Beckett v. Pfaeffle, 157 N.Y.S. 247 (1st Dep't 1916), indicates that statutes "penal in nature" require stricter proof, but it dealt with a statute that punished its violation with fines and imprisonment. Professor Jaffe's article likewise discusses cases where serious, personal consequences are imposed, such as deportation of long-time resident aliens. L. Jaffe, Administrative Law: Burden of Proof and Scope of Review, 79 Harv. L. Rev. 914, 919 (1966).

that, in order to obtain some especially onerous and punitive remedy the Department would be required to meet a higher standard of proof.¹⁵ But GE's argument that, merely because this is an enforcement proceeding, the Department has to prove its case on the merits by clear and convincing evidence, is untenable.

In any event, the Department has in fact carried its burden on this issue beyond any reasonable doubt. The evidence that GE is responsible for the high concentrations of PCBs in the Upper Hudson's water, sediment, organisms and fish is overwhelming. To begin with, GE has until recently been discharging very large amounts of PCBs into the Upper Hudson. GE applied for a discharge permit on December 18, 1972, stating that it was directly discharging an average of 30 pounds per day of "chlorinated hydrocarbons" (measured using the test for PCBs), and a maximum of 47.6 pounds per day from its two plants. Dep't Exhibit 4, p. 3. GE's Manager of Environmental Operations, Dr. Simons, testified that these figures represented what he believed to have been the actual discharge from the plants. Tr. 1166. At the time, GE was purchasing about 7,900,000 pounds of PCBs each year from

15. The test for a penal statute in New York is whether the remedy chosen is "imposed for punishment or for redress of injury...." Sicolo v. Prudential Savings Bank of Bklyn, 5 N.Y. 2d 254, 258, 184 N.Y.S. 2d 100, 103 (1959). Even a recovery that exceeds actual loss may not amount to a penal sanction. But the courts have held that an arbitrary exaction, unrelated to actual loss, is a penal sanction. E.g., Verona Central Cheese Co. v. Murtaugh, 50 N.Y. 314 (1872). These standards make clear that the remedies sought against GE are non-penal. The only violation charged that could justify any sanction that could be characterized as penal is ECL 11-0503, discussed below, which has been dismissed.

Monsanto. Dep't Exhibit 6. Purchases of even greater quantities had occurred at least as far back as 1966. Since the record indicates that GE's discharges have decreased rather than increased in recent years, it is reasonable to assume that it discharged PCBs in 30 lb. per day quantities throughout the 1966-1972 period.¹⁶ In any event, GE obtained the permit it sought, and makes no contention that it significantly altered its discharge levels until early 1975.¹⁷

In March 1975, Clark, Dietz Associates, an engineering firm retained by GE, performed a wastewater monitoring program at GE's plants, and reported total average daily discharge levels of between 5.06 and 7.81 lbs. of PCBs. Dep't Exhibit 8. During late August 1975, both GE and the Department (with EPA) measured the discharge levels, and found a further reduction: GE's data indicate an average discharge from the two most important discharge sources of 5.54 lbs., a figure that includes days in which exceptionally high discharges were recorded; the Department's data are roughly equivalent. Dep't Exhibit 7B(15); Dep't Exhibits 4, 29, 31 and 32. These findings

16. 30 lbs. per day would mean over 84,000 lbs. between 1966 and 1973.

17. On February 7, 1974, a GE engineer estimated then current average PCB discharges at 21.4 lbs. per day, and maximum discharge at 65 lbs. per day. Dep't Exhibit 16, A. Pozefsky to Dr. Simons. On May 8, 1974, Dr. Simons testified under oath at EPA hearings on Proposed Standards for Toxic Substances that GE was discharging 25-30 lbs. per day PCBs from its two plants. Tr. 1165-66. Monsanto sampled the two largest of several discharges at GE's plants on December 12, 1974, and reported a combined total of 18.2 lbs. per day. Dep't Exhibit 7(b)(12).

show substantial reductions in PCB discharges as compared to earlier periods. Yet, the amounts are still significant especially when considered as supplementing the large quantities already released, and the totals probably understate total discharges because some sources were not measured, and discharges caused by run-off and percolation were not measured.¹⁸

After this action was commenced, GE made further measurements of its discharges. These indicate a combined average of 3.46 lbs. per day directly discharged from its two plants, through the two main discharges (discounting an unusually high discharge of 116 lbs. on September 13-14; Tr. 1245-48). In addition, however, data collected by GE indicate average discharges of 1.42 pounds PCBs per day into the Hudson Falls Village Sewage Treatment Plant, which in turn discharges into the Hudson. The total daily discharge during the hearing in this case, then, is roughly 4.88 lbs.

Not only has GE been shown to have discharged large quantities of PCB's into the Hudson over long periods of time, the Department has established that other sources contribute negligible amounts of PCBs to the river. During

¹⁸. See Dep't Exhibit 4, p. 8; Dep't Exhibit 7A and 7B; Tr. 1279-83. A GE witness testified that run-off discharge through sources other than those monitored was unlikely, but this was based on a cursory visual examination, and was not at all addressed to possible discharge by percolation. See Tr. 1242. Compare Tr. 334-35; 1310-11, 1316-17, and the strong evidence that PCBs in the soil around GE's plants find their way into the river during heavy rains. See, e.g., Dep't Exhibit 5, Table 6.

September 1975, as part of its water and sediment study, the Department tested effluent from 28 municipal and industrial discharges in the Upper Hudson. The Hudson Falls Village Treatment Plant showed a discharge of 2.45 lbs. PCBs per day, which has been shown to be attributable to GE. Four other sources had amounts of 0.005, 0.001, 0.22 and 0.095 lbs. per day (of which the 0.22 figure may be overstated, see Tr. 355-56). All the remaining sources indicate no recordable amounts of PCBs. In striking contrast is the study's finding that GE effluent for a virtually contemporaneous period averages a gross discharge of 2.12 lbs. per day of A-1016. GE protests that this study shows only that it was the major source of PCBs during August and September 1975. But it makes no effort to prove that other sources of PCBs exist than those studied by the Department, or that those companies that use PCBs used them in greater quantities in past years.

The strongest evidence of GE's responsibility for existing PCB levels is in the contrasting results obtained, in all the studies in evidence, of PCB concentrations upstream as opposed to downstream of GE plants. Thus, in the EPA study during August 1974, a reading of 2800 ppb PCBs in water was taken at the junction of GE's Fort Edward Plant's discharge and the Hudson River. The concentration at a station one-half mile above Bakers Falls, upstream of the GE

plants, was less than 1 ppb. The concentrations at stations located .25, .5 and .75 miles downstream of the Fort Edward discharge were 2.2, 3 and less than 1 ppb respectively. Dep't Exhibit 28, p. 17. The Department's water and sediment monitoring project, from December 1974 to August 1975, developed similar results. Water concentrations of PCBs upstream of the GE plants were uniformly (with one anomalous exception, see Dep't Exhibit 5, pp. 17-18) less than 0.1 ppb; below the plants, concentrations declined to from 3 ppb to 1.5 ppb, but were much higher throughout than upstream concentrations. Id. Appendix C, Table 1.

Sediment samples taken above the GE plants also had concentrations of PCBs that were much lower than those below the plants. At the nine upstream stations, PCBs were found in quantities below 3 ppm with one exception at the Glens Falls landfill, where 14.9 ppm A-1221 was recorded. Sediment taken 1500 feet above GE Hudson Falls plant contained 0.6, 2.0 and 2.2 ppm A-1016, 1221 and 1254 respectively. Some of these upstream concentrations cannot be regarded as insignificant, in that they should cause concern for fish and other living things in the river. But the five downstream stations revealed PCBs in much higher quantities, that render the upstream concentrations insignificant by comparison. A sample taken in the vicinity of the Fort Edward discharge contained 100, 6 and 8 ppm A-1016, 1221 and

1254 respectively; a sample from near the Thompson Island Dam, about 13 miles downstream of the Fort Edward discharge, revealed 1850, 1720 and 137.2 ppm of the same Aroclors. Dep't Exhibit 9, pp. 5-8 (R. Mt. Pleasant); Dep't Exhibit 5, Appendix C, Figure 6.

Plentiful evidence gathered concerning PCB concentrations in fish also shows that GE's plants are the only important sources of PCB contamination in that area. The August 1974, EPA study showed PCB concentration above the GE plants (but below the Hudson Falls sewage treatment plant) of 17.0, 7.0 and 1.9 ppm PCBs (A-1016/1242, 1248 and 1254) in samples of Yellow Perch, Shiner Minnows and snails respectively. Stations below the GE plants turned up the rock bass earlier referred to with 350 ppm A-1242/1016, as well as Shiner Minnow and two Snail samples of 78, 45 and 27 ppm respectively. Dep't Exhibit 28, p. 18. The Department's study during 1975 revealed that, in 29 samples taken from upstream stations (above the Hudson Falls sewage plant), all contained less than 1 ppm PCBs. In contrast, the average concentration for the numerous fish sampled at Fort Edward was 176.83 ppm PCBs for the whole fish, and other, very high concentrations were found at most downstream stations. Dep't Exhibit 12, appendix B-1. An experiment was conducted during October 1975 by the Department in which fish in "live cars" were placed upstream and downstream of the GE plants.

After 14 days of exposure, the fish upstream accumulated at most only trace amounts of A-1016 (less than 0.1 ppm) while those downstream accumulated from 1.66 to 3.76 ppm A-1016. Dep't Exhibit 12 (J. Spagnoli). GE's data are no less supportive in proving its responsibility. All fish taken at upstream stations contained less than 5 ppm in both their edible flesh and "non-edible" parts; fish taken below the GE plants had an average PCB content in their edible flesh of 94.66 ppm, with much higher amounts in their "non-edible" portions (ranging to 658 ppm in one Common Sucker sample). See NRDC Exhibit 1 and Dep't Exhibit 52.

By any reasonable standard, then, GE has been shown to be responsible for the PCB contamination of the Upper Hudson. If others have contributed to that contamination, their contributions are inconsequential by comparison, and they in any case might also be held legally answerable for their actions. The Department cannot be required to prove that specific PCB molecules, discharged by GE, reached specific fish or parts of the river. Compare GE Reply Brief, p. 12. Given the natural flow of rivers, and the nature of the issues, the evidence of GE's responsibility is more than sufficient.

II. Legal Consequences of GE's PCB Discharges

A. The Violations Charged

The State of New York, and our federal government, have drastically revised common law doctrine that allowed pollution of rivers subject only to the rights of other users and the limited notion of public nuisance. As early as 1881, New York prohibited the discharge of any "noxious, offensive or poisonous substance into any public waters...." Penal Code, section 390 (1881). In 1892, the prohibition was expanded to private waters, but limited to "quantities destructive of the life of, or disturbing the habits of fish inhabiting the same." Laws of 1892, c. 488, section 100. The "habits" apparently in mind during that more decorous time became clear in 1912, when the phrase was changed to "propagation of fish." L.1912, c. 318, section 247. In addition, a 1903 statute prohibited discharges injurious to human health, aiming particularly at sewage control. Public Health Law, section 76 (McKinney 1943).

Major reform was initiated when the legislature in 1946, by concurrent resolution, established a Special Committee of Pollution Abatement. That well-rounded and distinguished group¹⁹ undertook field work and conferences

¹⁹ Members: Assemblyman Harold C. Ostertag, Chairman, Committee on Interstate Cooperation; Senator Chauncey B. Hammond, Chairman; Senator Floyd E. Anderson, Vice Chairman; Assemblyman Wheeler Milmo, Secretary; Senator Walter J. Mahoney; Assemblyman Elisha T. Barrett; Assemblyman George W. Foy; Assemblyman John S. Thompson; Attorney General Nathaniel L. Goldstein; C. Chester Dumond, Commissioner of Agriculture and Markets; Alger B. Chapman, Commissioner of Taxation and Finance. In addition, there were several advisory members from a variety of public and private organizations. See Leg. Doc. No. 51, p. 11 (1948).

throughout the state, and issued an interim report noting that Americans have been "fouling their own nests," and that public health is the state's "greatest asset" which the legislature should not permit to be endangered or jeopardized. Leg. Doc. No. 59, pp. 22, 25 (1947). The committee considered existing laws inadequate. The provision aimed at protecting fish, by then section 213 of the Conservation Law, was too limited, since it required proof that certain specific substances, discharged by a specific person, actually injured fish life. The sewage control statute was found inadequate because actual injury to health had to be proved, and industrial wastes seldom directly injured public health. The committee also reminded the legislature that proposed federal legislation would preempt state control unless New York assumed its own pollution abatement responsibilities. Id. 78.

After further study, and with recommendations from the State Conservation and Health Departments, the committee filed a second report containing a proposed Water Pollution Control Act. The bill had a statement of overall public policy calling for use of the state's water resources in "the best interests of the people," and a water classification system for determining the best public usage. Industrial wastes were "inevitable," the committee concluded, but they must be conditioned to avoid deterioration of

public waters "for the other purposes for which they are utilized..." Leg. Doc. No. 50, p. 17 (1948).

Hearings followed. Industry spokesmen expressed a preference for dealing with state authorities rather than federal, but they wanted the legislature to determine the specifics of water classification rather than an administrator. An engineering consultant to the committee, Morris M. Cohn, defended the proposed system as realistic and flexible. Pure surface waters is only an ideal, he wrote, which if achieved might result in "no industries or municipalities around to enjoy the beauties of such streams." He therefore saw "pollution" in relative terms, as a "condition which contravenes reasonable standards of quality which have been set up with full consideration of the many [appropriate] factors..."²⁰ Resume of Hearing on Proposed Pollution

20. He explained further:

"Pollution" is not a hard and fast characteristic. It is not like black and white. A sensible definition of pollution takes into consideration what is being polluted. It recognizes that what is pollution at one point of a stream may not be pollution at another point, or certainly not on another stream.

Is it not sensible to define "pollution" as a condition which contravenes reasonable standards of quality which have been set up with full consideration of the many factors described above?...If the standards are sensibly established, the criteria of pollution are sensible, just as certainly as two plus two makes four.

Resume of Hearing on Proposed Pollution Abatement Legislation, at 14-15 (Aug. 11, 1948).

Abatement Legislation, pp. 13-15 (Albany, N.Y. Aug. 11, 1948) (Legislative Reference of the New York State Library, Albany, New York).

The legislation was adopted. It established a pattern that is with us still: a system with the avowed purpose of protecting the environment, but through a methodology that explicitly accepts various degrees of contamination. The act was consolidated with others in 1960, and entitled the Environmental Law. L. 1970, c. 140.

In its present form, the ECL's declaration of policy is "to conserve, improve and protect" New York's natural resources and environment, and to "control" water and other pollution "to enhance the health, safety and welfare of the people of the state and their overall economic and social well being." ECL 1-0101(1). Coordination and cooperation at all levels of government are called for, and the state is to foster and maintain conditions under which men can thrive in harmony and achieve "social, economic and technological progress" by: assuring healthful and pleasing surroundings; guaranteeing the "widest range of beneficial uses of the environment...without risk to health or safety, unnecessary degradation or other undesirable or unintended consequences"; and "promoting patterns of development and technology which minimize adverse impact on the environment...." ECL 1-0101(2) & (3). The message conveyed is hardly one-sided. It is

basically an expression of concern for the environment, but mixed with strong concern for economic well being and maximum utilization.

At the heart of the ECL's provisions relating to water pollution is the water classification system adopted in 1949, and revised in various respects from time to time. The ECL recognizes, as the engineer Cohen and his committee would have had it recognize, "that due to variable factors, no single standard of quality and purity of the waters is applicable to all waters of the state or to different segments of the same waters." ECL 17-0301(1). To obtain the law's objectives, therefore, the Department is instructed to group designated waters into classes, after notice and hearing. ECL 17-0301(2). Then, after proper study and further hearings, the Department is to "adopt and assign (necessary) standards of quality and purity for each such classification...." ECL 17-0301(4). Acting pursuant to this mandate, the Department classified the waters at and imediately below Fort Edward and Hudson Falls as "Class D"; waters further downstream are classified "A" and "B". Class D waters must be "suitable for fish survival", though they need not "support the propagation of fish"; among their best usages is "secondary contact recreation," which is defined to include fishing, but only minimal contact and "improbable"

ingestion. 6 NYCRR 701. Since 1966, the "best usage" of Class A and B waters also includes fishing. Finally, an overall standard, applicable to waters classified A through D, is that they shall not contain "toxic wastes and deleterious substances...in amounts that will be injurious to fishlife or which in any manner shall adversely affect the flavor, color or odor thereof, or impair the waters for any best usage" assigned. 6 NYCRR 701.5.

Compliance with these standards is mandated by ECL 17-0501, which GE has been charged with violating. That section makes it unlawful to discharge, "directly or indirectly," any matter that shall "cause or contribute" to a condition in contravention of the water quality standards established pursuant to ECL 17-0301. The issues posed by this provision, therefore, are whether PCBs in the quantities discharged by GE have "caused or contributed" to a breach of standards that (1) prohibit the discharge of "toxic wastes" or "deleterious substances" in amounts "injurious to fish life" or (2) "impair the waters for any best usage," in particular fishing.

The federal government long ago moved to regulate water pollution through effluent limitations, rather than merely the setting of stream standards.²¹ In 1972, the Federal

21. For a history of federal water pollution regulation see 1 F. Grad, Treatise on Environmental Law §3.03(1975).

Water Pollution Control Act (FWPCA) was amended to give the states primary responsibility for pollution abatement, but only if they adopted a program based both on stream standards and effluent limitations. 33 U.S.C. 1251 et seq. New York adopted a State Pollution Discharge Elimination System (SPDES), essentially to avoid a federal takeover. See memo to Governor from Law Department, Senate 6394-A (June 21, 1973); id. (May 31, 1973) (H. L. Diamond).

The resulting legal structure requires any would-be discharger of pollutants to seek a certification from the state in which the waters are involved are located. 33 U.S.C. 1341. After state approval, the applicant must obtain a federal discharge permit for the activities permitted by the state. Discharging without a state permit violates ECL 17-0505; and increasing or altering a permitted discharge violates ECL 17-0507. In addition, ECL 17-0511, the second statute under which GE has been charged, prohibits any industrial discharge from outlets or point sources "unless such use is in compliance with all standards, criteria, limitations, rules and regulations promulgated or applied by the department pursuant to this article." The article involved, 17 ECL, includes provisions that make unlawful violations of both the permit and water classification systems.

B. Effect of SPDES and NPDES Permit

GE applied for a federal permit to discharge into the Hudson River from its plants at Hudson Falls and Fort Edward as early as November 22, 1971. See Refuse Act, section 13, 33 U.S.C. 407. After the FWPCA amendments of 1972, GE submitted a revised application to EPA on January 18, 1973. On August 23, 1973, the Department received GE's application under its new SPDES system. The application indicated that a daily average of thirty pounds of "chlorinated hydrocarbons" were being discharged, and in a footnote explained that the "test for the determination of the pounds or concentration from which the pounds were derived, was determined by analysis for PCBs." Tr. 401. This was an unnecessarily obtuse way of indicating its PCB discharges, since GE had been told by Monsanto on July 1, 1970, that "polychlorinated biphenyls...may be an environmental contaminant," and advised to use its best efforts to prevent them from entering the environment. Tr. 1171 (Dr. E. L. Simons). Nevertheless, the Department does not explicitly contend that it was misled. Department personnel appear to have been well aware by August 1973 of GE's PCB discharges, having already conducted studies of their effects. See GE Exhibit 11.

The Department acted quickly on GE's application. On September 11, 1973, the Department's Acting Assistant

Director, Bureau of Industrial Wastes, wrote to an official in the Regional Office of EPA stating that the Department had reviewed GE's permit application, and that "certification will be recommended since the present discharge complies with water quality standards." The letter goes on to specify areas in which the application should be tightened, but does not mention PCBs or "chlorinated hydrocarbons."

GE Exhibit 2. On November 13, 1973, the Department certified that no federal effluent limitations or standards under sections 301(6), 302, 306 and 307 of the FWPCA were applicable to GE's proposed discharges. It stated, however, that "the classification and standards governing the quality and purity of waters of New York State" are applicable, and set forth certain specific and some general limitations to assure compliance. Among the specifics, for example, was a limit of 75 lbs. per day of Kjeldahl nitrogen; nothing was said specifically concerning PCBs. A general qualification, however, is clearly pertinent. The certification limited effluent of "toxic wastes" or "deleterious substances" in the following manner: "None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to prevent fish survival or impair the waters for agricultural purposes or any other best usage as determined for the specific waters which are assigned to this

class." The certification then went on to limit discharges "at all times so as to be in full compliance with all applicable requirements of sections 701, 702 and 704 of title 6," NYCRR, the regulations establishing the classification and standards governing New York waters. Dep't Exhibit 2.

The EPA regional office issued a draft NPDES permit to GE on March 22, 1974, and invited comment. The draft proposed authorizing a daily average discharge of "chlorinated hydrocarbons" from the Hudson Falls plant (Discharge 002) of 10 pounds, and from the Fort Edward Plant (Discharge 004) of 20 pounds. It also proposed that chlorinated hydrocarbon discharge be reduced to zero within 21 months of the permit's issuance. GE Exhibit 3, pp. 4-7. The Department filed its comments on April 5, 1974, and as GE asserts did not mention the "chlorinated hydrocarbon" discharges. On the other hand, the Department specifically requested inclusion of the general condition it had placed in its certification requiring compliance with water quality standards. GE Exhibit 1, p. 3.

EPA issued an NPDES permit to GE on December 20, 1974. Though it contained no provision specifically requiring compliance with state water quality standards, it did comply in substance (as did the temporary permit) with the requirement that conditions of state certification must appear in

the federal permit. FWPCA, section 401(d), 33 USCA 1341(d). In paragraph 6, it warns that its issuance does not "authorize...any infringement of Federal, State or local laws or regulations...." And before detailing the applicable limitations in paragraph 9, it recites: "Nothing in this permit shall be deemed to preclude the institution of any legal action nor relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject...under any other Federal or state law or regulations." The permit authorized "chlorinated hydrocarbon" discharges of 10 and 20 lbs. from outfall numbers 002 and 004 respectively. At the same time it ordered that discharges from the same points of "Polychlorinated Biphenyls" be limited to 4.54 and 95.3 grams per day (or 3.52 oz.) by May 31, 1977. GE has appealed this limitation, though it represented at the hearing in this case that it intends to withdraw its appeal and will meet this standard by December 31, 1976.

GE claims that it has complied with its state certification and federal permit. Consequently, it asserts, it cannot be found to have violated any statute for its discharges until the permit is duly modified in accordance with the applicable regulations. "If the SPDES permit program is to be meaningful and effective,...it cannot, by its very

nature as a permit system, allow the imposition of penalties for permitted discharges. It is axiomatic that penalties may not be imposed by a governmental agency for acts permitted by law." GE Brief, p. 21. GE notes that the Department was fully aware of GE's PCB discharges, and thus suggests that it implicitly found them lawful.

GE's argument has more than superficial appeal. The effluent limitation system is intended and well designed to serve as a supplement to the water classification system. Both the state and federal governments are presented, when a discharge application is filed, with an opportunity to regulate so as to insure that water quality objectives are attained. Thus, when GE filed its application, the Department should have been made aware that GE proposed to continue discharging PCBs at an average rate of 30 lbs. daily. A relatively simple calculation at that point would have indicated that such a discharge rate was destined to cause the present situation. Had this anticipated result been unacceptable, the Department could then have denied or conditioned its certification. From the viewpoint of the regulated, as well as of the public, a system that mandated such inquiry - and, incidentally, provided the resources to fulfill the mandate - would make much more sense than one that leaves administrators with discretion to approve

discharges certain to undermine legislative objectives.

The first answer to GE's contention, however, is that neither the federal nor the state government has established such a system. Administrators are accorded power to include in the very certifications they issue conditions that might in effect preclude the activities apparently permitted. This is not because the legislature intended to allow administrators to avoid making difficult decisions, though that may sometimes be a consequence. Flexibility is preserved because of the numerous ways in which administrators may be unable, despite the best intentions, to regulate effectively through the effluent limitations system. Inadequate information, expertise, personnel or knowledge about the particular discharge, are only some of the reasons a permit might be issued authorizing activity that would contravene some other part of the state or federal government's regulatory scheme. The system seems clearly to place on the would-be discharger, whose influence with the agency might itself cause or contribute to regulatory insufficiency, the burden of insuring that the discharge violates no other federal, state or local prohibitions. It would defeat the legislature's objectives to impose the costs of such failures on the public rather than upon the discharging party.

The FWPCA informs us explicitly of another reason why GE cannot treat its NPDES or SPDES as part of a grant of

immunity from other proscriptions. The act places great pressure on the states to adopt an effluent limitation system, but at the same time it guaranteed that the states would be free to impose additional limitations, including those implicit in a water classification approach. Section 401 of the federal act requires that a state's conditions to its own permit become a part of the federal permit because Congress intended to allow states to include their other prohibitions in the general, undefined way that New York did so in this case. The Senate Report explains:

The provision (401) makes clear that any water quality requirements established under State law, more stringent than those established under this Act, also shall through certification become conditions on any Federal license or permit. The purpose of the certification mechanism provided in this law is to assure that Federal licensing or permitting agencies cannot override State water quality requirements....

Senate Rep. No. 92-414, 92nd Cong., 1st Sess. 69 (1971).

This provision, moreover, was only part of an overall philosophy favoring a local option to go beyond the federal program's limitations, as section 510, 33 U.S.C. 1370, makes abundantly clear:

Except as expressly provided in this chapter, nothing in this chapter shall (1) preclude or deny the right of any state...to adopt or enforce (a) any standard or limitation respecting discharges or pollutants, or (b) any requirement respecting control or abatement of pollution; except that if an effluent limitation, or other limitation...or standard of performance is in effect under this chapter, such State...may not adopt

or enforce any effluent limitation, or other limitation...which is less stringent than the effluent limitation or other limitation...under this chapter; or (2) be construed as impairing or in any manner affecting any right or jurisdiction of the States with respect to the waters (including boundary waters) of such States.

The only New York case on this question clearly supports the view that a permit may be conditioned in the manner that GE's is conditioned, and that these conditions become part of the permittee's obligations despite the permit's other terms. In Biggane v. City of Lackawanna, 80 Misc. 2d 816, 365 N.Y.S. 2d 107 (Sp. Ct. 1974), aff'd without opinion, N.Y.S. 2d (4th Dep't 1975), the Commissioner of Environmental Conservation sought an injunction and penalties for defendant's discharging sanitary sewage into a waterway without giving it "effective secondary treatment" as required by ECL 17-0509. The defendant City moved to dismiss the complaint, asserting that it had, and was complying with, an NPDES permit (which, of course, was issued only after state certification). The permit, however, contained the following language, identical in all material respects to paragraph 9 of GE's NPDES permit:

Nothing in this permit shall be construed to preclude the institution of any legal action nor relieve the permittee from any responsibilities, liabilities or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

The court rejected the City's argument. "The requirements of obtaining a (NPDES-SPDES) permit (Environmental Conservation Law Sections 17-0701 and 17-0803)," said the Court, "and the prohibition against discharging sewage which has not been given effective secondary treatment (Environmental Conservation Law Section 17-0509) are separate and distinct." Indeed, even had the permit contained no language generally incorporating other state prohibitions, the court suggests it would have reached the same result: "regardless of whether it has a permit it cannot discharge sewage which had not been given 'effective secondary treatment.'" The same reasoning applies to GE's obligations under ECL 17-0501, 17-0511 and 11-0503.²²

C. The Toxicity of PCBs

A question fundamental to GE's liability under all the violations charged is whether PCBs are "toxic" or "deleterious" substances. The law does not permit this question to be asked in the abstract. The fact, for example, that humans have been severely harmed by certain quantities of particular

²² In light of this conclusion, there is no need to consider whether GE violated its NPDES permit by exceeding its limits for PCB discharges, by discharging PCBs from outlets other than those specified in the permit, or in any other manner. See Dep't Reply Brief, pp. 5, 9. If such violations took place, they might in themselves constitute a violation of ECL 17-0511.

PCBs proves it is toxic in the ordinary sense of the word, but not necessarily toxic in the sense used by the legislature. A person violates the law only by discharging PCBs in quantities sufficient to cause the proscribed effects - in this case, injury to fish or an adverse effect upon the protected usage of fishing.

The potential toxicity of substances is ascertained in terms of standards accepted in both the scientific and legal worlds. The legislature provides the following definition, which is essentially indistinguishable from the FDA standard, and from the standard propounded by GE's witness, Dr. Golberg:

"toxic pollutant" means those pollutants, or combination of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly through food chains, will, on the basis of information available to the Department, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physical malfunctions, including malfunctions in reproduction, or physical deformations, in such organisms or their offspring.²³

23. 17-0105(19) "Pollutant" is defined to include any "chemical" or "industrial" waste. ECL 17-0105(17).

Dr. Kolbye, testified that he could perceive no difference between the ECL definition and that applied to the FDA. Tr. 1030.

Dr. Golberg said (Tr. 1768):

We generally consider the toxicity to be a manifestation of the injurious effect of a chemical or physical agent on a living organism as manifested in a variety of possible ways, such as structurally, functionally or in regard to the response of the organs, for instance, behavior.

If consumed in sufficient quantities by fish, animals or men, there is no doubt that PCBs can have the effects described in the ECL as "toxic." Accord, GE Reply Brief 16. Just as PCBs have qualities that make them useful in industry, they have qualities that make them hazardous in the environment. That they are non-biodegradable, for example, may be useful in capacitors, but it also makes them persistent. They are virtually indissolvable in water, and their effects in the Hudson are felt long after their discharge into the river. PCBs also bioaccumulate. They are highly soluble in lipids (fats and oils), and therefore are in effect attracted to organisms relatively high in lipid content. They tend to remain suspended in water, attached to plankton and other organisms, or they fall into the river sediment. In either case, they pass into snails and other aquatic organisms, including fish, and become stored in their bodies, particularly in areas with high lipid content. The significance of bioaccumulation is that the PCBs are accumulated in fish and other high lipid organisms to points far higher than the PCB concentrations to which the organisms are exposed. Experimental results introduced at the hearing showed, for example, that Fathead Minnows accumulate A-1254 to a point 200,000 times greater than the concentrations in which they are placed. Dep't Exhibit 36, pp. 8-9. Dr. Veith

estimated that the bioaccumulation factor for A-1016 and 1242 in small fish would be about 50,000. This means that, in water containing 1 ppb PCB 1016/1242, such a fish could be expected to accumulate PCB 1016/1242 to a level of about 50 ppm. Accumulation can also occur from PCBs in sediment. Dr. Veith showed that Fathead Minnows placed in a tank with PCB-free water, but with Hudson River sediment containing 166 ppm A-1016, accumulated a concentration of 109 ppm after 6 days. Dep't Exhibit 14, pp. 18-19. Aquatic organisms accumulate PCBs from sediments in direct proportion to the PCB concentrations. Dep't Exhibit 26(1), p. 9 (Hansen).

Bioaccumulation occurs rapidly in fish, and then levels off. The evidence shows that when fish are exposed to a constant concentration of PCBs, they accumulate the chemical for about 20 to 30 days, and then concentration reaches a "steady state." The steady-state concentration is directly proportional to the water concentration; if the concentration is increased, accumulation resumes. See Tr. 599. The evidence indicates that the lesser chlorinated PCB homologs bioconcentrate to a lower degree than the higher chlorinated homologs. This would mean, for example, that A-1254 would accumulate to a higher point than A-1016, making the former more toxic in general. The difference in steady-state levels among the Aroclors, however, is insignificant relative to the high levels of accumulation in them all. Dep't Exhibit 14,

p. 16. Also, lower chlorinated homologs tend to accumulate faster than higher ones, because of their relatively greater solubility. Here again, however, the differences are relatively insignificant (they all accumulate quickly) and would matter only in special circumstances.

Fish also accumulate PCBs through the food chain, by means of biomagnification. At each level of the food chain, organisms absorb the collected accumulations of PCBs in the lower-level organisms. Fish are relatively high on the chain. Humans are higher. Consequently, PCB levels in fish predicted on the basis of concentration in water alone will tend to understate the actual level of PCBs because of accumulation from sediment and by biomagnification from the food chain. Little wonder that fish were described by the Chief of the Department's Bureau of Environmental Protection as a "sink" for PCBs. Tr. 579 (J. Spagnoli).

Due to these characteristics, PCBs have been observed to cause toxic effects in fish food, a variety of estuarine organisms, fresh water fish, birds, rats, mink, monkeys and humans. In one series of tests, for example, population growth of a ciliate protozoan was reduced significantly by exposure to 1 ppb A-1254; growth in oysters was significantly reduced after 25 weeks of exposure to 5 ppb; various estuarine shrimp were killed by exposure

to 0.9, 1.4 and 4.0 ppb; a dose of 1.0 ppb was lethal after two weeks to Longnose Killifish and 5.0 ppb was lethal to Pinfish and Spot. Researchers observed structural changes in tissues of the oysters, fish and shrimp exposed to A-1254, including abnormal invasion of leukocytes (white bloodcells), atrophy, abnormal cell distribution, and the formation of crystalloids in the nuclei of shrimp digestive glands.²⁴ PCBs were found in other experiments to be lethal in low concentrations to the water flea, scud and midge, all important fish foods, as well as to the Fathead Minnow and Flagfish; fish fry and eggs were found particularly susceptible.²⁵

Time of exposure is an especially important factor in ascertaining the effects of PCBs. The LC-50 value for

24. D. R. Nimmo, et al., "Toxicity of Aroclor 1254 and its Physiological Activity in Several Estuarine Organisms," 3 Archives of Env. Contamination and Toxicology 22 (1975); Dep't Exhibit 24 (2). The authors speculate that the crystalloid inclusions were possibly produced by a virus because of PCB stress, and refer to another study indicating that "PCB enhanced the pathogenic effects of hepatitis virus in ducks." Id. 38, see M. Friend & D.O. Trainer, "Polychlorinated biphenyl: Interaction with duck hepatitis virus," 17 Science 1314 (1970). A table of the effects of PCBs on various salt water organisms, as reflected in the literature, prepared by Dr. David J. Hansen, is in Dep't Exhibit 26 (1).

25. A.V. Nebeker & F.A. Pugles, "Effect of Polychlorinated Biphenyls (PCBs) on Survival and Reproduction of Daphnia, Gammarus, and Tanytarsus," 103 Transactions of the Am. Fisheries Soc. 722 (1974); A.V. Nebeker, et al., "Effect of Polychlorinated Biphenyl Compounds on Survival and Reproduction of the Fathead Minnow and Flagfish," 103 Transactions of the Am. Fisheries Soc. 562 (1974). Dep't Exhibit 37.

A-1242 (the concentration that will kill 50% of the test organisms) was calculated to be 15 ppb for newly hatched minnows in a 96-hour test, but after eight months all the fish were killed at this level. Dep't Exhibit 37(2), p. 566. Rainbow trout showed a decline in LC-50 values from 156 ppb A-1254 at 5 days, to 8 ppb at 10 days. Dep't Exhibit 19(5), p. 162, table 4. In an acute (short-term) test, A-1254 was shown to be one-tenth as toxic as DDT to shrimp, in that 100 ppb Aroclor 1254 was necessary to achieve the same lethal effect (100%) as 10 ppb DDT. But in a chronic (longer-term), flowing water test, only 0.94 ppb A-1254 was necessary to kill 51% of all juvenile shrimp within 15 days, and 3.5 ppb A-1254 killed 50% adult shrimp in the same period. Dep't Exhibit 24(5). A-1254 registered an LC-50 on Rainbow Trout of 156 ppb in 5 days; in just five more days, the LC-50 was 8 ppb.²⁶ Stress is another important variable. The toxic effects of PCBs seem consistently greater when the contaminated organism is under some form of stress, such as a change in water temperature or in the process of reproducing.²⁷

26. D.L. Stalling & F.L. Mayer, Jr., "Toxicities of PCBs to Fish and Environmental Residues," Environmental Health Perspectives, p. 162 (April 1972); Dep't Exhibit 37 (8). The authors found bioconcentration factors in fish of over 40,000 times exposure levels, and said that adverse effects on reproduction may occur at 5 ppb or less. Id. 163.

27. Dep't Exhibit 377 (2), p. 567 (flagfish exposed 40 days to PCBs died when water temperature dropped 4°C.); Dep't Exhibit 37 (9), p. 13 (low dietary concentrations of PCBs affect thyroid activity); Dep't Exhibit 25, p. 5 and Exhibit 26 (14), p. 428 (shrimp exposed to sub-lethal quantities of PCBs died when water salinity gradually decreased over 8 hour period); Dep't Exhibit 5, p. 194 (juvenile shrimp exposed to PCBs died after molting).

Studies of the effects of PCBs on rats indicate that, at various levels, they affect reproduction, cause enlargement of the liver, interfere with normal metabolism, create growths, some malignant, and can be lethal.²⁸ Mink are especially sensitive animals, and experiments demonstrate that a diet of a 30 ppm proportional mixture of A-1241, 1248 and 1254 is lethal, and levels of 3.57 ppm and 0.164 ppm A-1254 fed in the meat of cows placed on PCB diets were determined respectively to be lethal and embryotoxic at the 100% level.²⁹

28. Dr. Renate Kimbrough, who has conducted or participated in much of the existing research on this subject, testified at the hearing. A dose of 20 ppm A-1254 enlarged the livers of rats, affecting the cytoplasm of liver cells and inducing dangerous metabolic activity. Dep't Exhibit 45, pp. 3-4. An early study showed a tumor in the bladder of one rat, causing an intensive follow-up in which 200 Sherman Strain rats were fed 100 ppm A-1260 for almost 21 months. Of 184 experimental rats, 170 had abnormal or autonomous growths on their livers; 26 were hepatocellular carcinomas (malignant lesions). None of the 173 control rats had such growths. Dr. Kimbrough concluded that the PCB had elicited a spectrum of response similar to established carcinogens. R.D. Kimbrough et al. "Induction of Liver Tumors in Sherman Strain Female Rats by Polychlorinated Biphenyl Aroclor 1260," in Dep't Exhibit 45 (8) (unpublished paper), discussed in Meeting Report, "Report of a Workshop on Classification of Specific Hepatocellular Lesions in Rats," 35 Cancer Research 3214 (Nov. 1975).

29. Dr. Robert K. Ringer, who conducted and participated in most existing research done regarding PCBs and mink, testified that the experiments yielded similar symptoms: impaired reproduction, internal bleeding, loss of appetite, degeneration of the liver and others. See R.T. Aulerich, R.K. Ringer & S. Iwamoto, "Reproductive Failure and Mortality in Mink Fed on Great Lakes Fish." 19 J. Reprod. Fert. Suppl. 365 (1973), a study caused by the threat that coho salmon diets posed for the mink ranching industry. The study relating to cow meat is N.S. Platonow & L.H. Karstad, "Dietary Effects of Polychlorinated Biphenyls on Mink," 37 Can. J. Camp. Med. 391 (1973), Dep't Exhibit 44.

The most dramatic - and tragic - known evidence of PCB toxicity is the so-called Yusho ("oil disease") incident. In 1968, an epidemic of a skin disease was reported in parts of Japan. Investigation proved it related to the consumption of cooking oil contaminated with Kanechlor 400 (equivalent to Aroclor 1248). A total of 1,291 reported cases have been counted as of April 1975. The affected individuals consumed an average of 2 grams of the PCB, with the minimum dose estimated as 0.5 grams. The victims had a variety of symptoms, especially acne-like eruptions, pigmentation of skin, increased eye discharge, swelling of upper eyelids and weakness. Nine of ten babies delivered by pregnant victims had unusually grayish, dark-brown stained skin; most had increased eye discharge and less-than-average weight, indicating placental transport. Many of the symptoms have continued to the present in many victims, indicating the persistence of PCBs in the human body. A report of 22 deaths of victims as of September 13, 1973 indicates that 9 "were caused by malignant neoplasms, suggesting a possible excess of deaths from cancer," though more information is needed to test that hypothesis.³⁰

30. M. Kuratsune, et al., "Epidemiologic study on Yusho, a Poisoning Caused by Ingestion of Rice Oil Contaminated with a Commercial Brand of Polychlorinated Biphenyls," Environmental Health Perspectives 119 (April 1972), Dep't Exhibit 42(5); M. Kuratsune, et al., "Some of the Recent Findings Concerning Yusho," paper presented at Nat'l Conf. on PCBs, Chicago, Ill., Nov. 19-21, 1975 (GE Exhibit 31). The investigators also reported on a chick edema disease in western

The Yusho incident triggered further investigations of PCBs, including some involving Rhesus monkeys. An initial study, in which monkeys were fed 300 ppm A-1248, led within three to four weeks to their exhibiting symptoms similar to those of Yusho victims: severe acne, swelling of eyelids and loss of hair. Many developed ulcers, and all died within three months. The same results occurred when monkeys were fed 100 ppm. A further study tested the effects of a diet of 25 ppm, and within one month the primates exhibited the symptoms of PCB intoxication. After two months they were removed from the diet to avoid unnecessary death; one of six died of PCB poisoning two months later, and the infants of those who survived were less-than-average in weight and had detectable levels of PCBs in their tissue at birth, which increased following nursing on their mothers' contaminated milk. Two years later, the animals

30. Continued.

Japan, caused by the same rice oil, in which over 400,000 chickens were reportedly killed. Their livers were yellowish and mottled.

GE presented testimony concerning the recent discovery that the Kanechlor involved in the Yusho incident contained polychlorinated dibenzofurans (PCDFs), a highly toxic chemical. Tr. 1774 (Dr. Golberg). This information is discussed by Dr. Kuratsune, et al. in their 1975 paper above. They find the evidence interesting and worth following up, but provide no support for GE's use of the data to undermine the fact that PCBs were the principal causative agent in Yusho. They note, for example, that evidence of the expected effects of PCDFs on the livers of deceased victims is lacking, and they also speculate that the PCDFs, if indeed present, may have been produced from the PCBs themselves when used as a heat transfer agent or in cooking. GE Exhibit 31.

continued to exhibit some of their original symptoms, and had detectable levels of PCBs in their tissues. A third study was initiated, involving a much lower dosage - 5.0 and 2.5 ppm A-1248 to two sets of animals. Within two months, after consuming from 35 to 50 mg PCB, some of the female monkeys began to exhibit the typical symptoms of PCB intoxication; at six months all the females were so affected. Their menstrual cycles were "decidedly altered" after consuming 60 to 120 mg PCB, and their reproductive capabilities were drastically lessened; only 5 of 8 on the 2.5 ppm diet and 1 of 8 on the 5 ppm diet had normal births, whereas 12 of 12 control animals had normal births. The infants were smaller than average, and contained PCBs; they accumulated more PCBs from their mothers' milk and, within four months, 3 of the 6 died of PCB poisoning. One female adult on each diet also died, and the tissue and organs of both were substantially altered, including widespread necrosis in the liver. Males also exhibited symptoms, but less severe ones, perhaps because their greater body weight provided more fatty tissue to store PCBs.³¹

31. Dr. J.R. Allen, who conducted or participated in these experiments, testified at the hearing that the levels chosen for the most recent experiment were designed to test those set by the FDA as tolerable limits for certain foods. Dep't Exhibit 41. He concluded (Id. 6-7):

GE contends that, whatever the toxicity of PCBs in general, A-1016 is far less toxic than the mixtures used in most experiments of PCB effects. A-1016 is said to be less toxic, not because it contains a lower percentage of chlorine than other PCBs, but because it contains a relatively low proportion of PCB homologs with 4 or more chlorine atoms. For example, A-1016 contains only 1% homologs with 5 or more chlorines whereas A-1242 contains 9% of such homologs, A-1248 contains 40% and A-1254 contains 77%. Dep't Exhibit 39, p. 7; GE Exhibit 13. The evidence in general establishes that the higher homologs are less biodegradable, that they bioaccumulate to higher levels, and in particular that a PCB isomer with 4 chlorines (2, 5, 2', 5' tetrachlorobiphenyl) may be metabolized into highly toxic hydroxylated PCBs. Tr. 1782-1783 (Dr. Golberg). Dr. Kimbrough also testified that, whereas homologs with 5

31. Continued.

Our studies have demonstrated a striking similarity between the signs and lesions produced by PCBs in man and in nonhuman primates. As is the case with man, we have found that the PCBs are extremely toxic to nonhuman primates over a wide range of dosages. Even at levels accepted in certain foods destined for human consumption, PCBs are capable of producing obvious skin changes within two months, and reproductive abnormalities within four to six months. In addition, it has been shown that PCBs transfer through the placenta and are deposited in the fetus. Infants born to exposed mothers are smaller than average and show increasing tissue levels of PCBs following birth due to the consumption of mothers' milk that contains relatively high levels of the compounds. Sufficient PCBs were consumed via their mothers' milk to cause morbidity and mortality in infants.

or more chlorines were carcinogenetic to rat livers, it was not yet known whether those with 4 or less chlorines caused such tumors. See Dep't Exhibits 45 (6) and 46 (8), p. 14.

The evidence shows, however, that the relative toxicity of PCB mixtures varies depending upon the organisms affected. The lower homologs are more soluble than higher ones, and are therefore more available to, and more rapidly absorbed by, fish swimming in the water. Dep't Exhibit 15 (9); Tr. 936-37. Furthermore, A-1016 has been observed to cause effects similar to those caused by other mixtures in many contexts. After a series of experiments designed specifically to test the toxicity of A-1016, because of its increased use, Dr. D.J. Hansen and his coauthors concluded that "Aroclor 1016 is similar to other PCBs in its toxicity to, and uptake and retention by estuarine animals." In a chronic exposure (42 days), for example, Pinfish accumulated 5.1 ppm A-1016 in edible flesh and 11.0 ppm in their whole bodies. Most of those that died exhibited symptoms of poisoning, including changed appearance and behavior. "Acute toxicities of Aroclor 1016 to oysters, brown shrimp, and pinfish," the researchers concluded, "were similar to that of Aroclor 1242 and Aroclor 1254...."³²

32. D.J. Hansen, P.R. Parrish & J. Forester, "Aroclor 1016: Toxicity to and Uptake by Estuarine Animals, 7 Env. Research 363 (1974) Dep't Exhibit 26 (8). The authors refer to comparative studies of the other Aroclors. A subsequent study showed that A-1016 was much less toxic to Sheepshead Minnows than A-1254, but the former was nevertheless lethal to adults

The Department introduced through Dr. Alan V. Nebeker data showing the effects on the water flea of PCB homologs with 3, 4 and 5 chlorines, tested separately. He found "not much difference in toxicity between trichlorobiphenyl and tetrachlorobiphenyl homologs which suggests that mixtures such as Aroclor 1016 and Aroclor 1242 would be similar in toxicity." Dep't Exhibit 36, p. 6. Further tests of the relative toxicity of A-1242 and A-1016 on Rainbow Trout and Bluegills made it "apparent" that their toxicity is "similar".³³

32. Continued.
at 32 ppb. Dep't Exhibit 26 (21). Furthermore, an experiment conducted at the National Water Quality Laboratory in Duluth, Minnesota, shows a strong similarity in the lethal effects of A-1016 and A-1242 on Fathead Minnows Fry. Dep't Exhibit 37 (6).

33. Id.; Dep't Exhibit 37 (5):

Comparative toxicity of Aroclor 1242 and 1016,
based on data from the Fish-Pesticide Lab. Colombia, Mo.,
in continuous-flow exposures.

| Test Organism | 1242 (ug/l) | | 1016 (ug/l) | |
|------------------|-----------------------|-----------------------|------------------------------|----------------------------|
| | 96 hr. LC50 values | LC50 values after- | 96 hr. LC50 values | LC50 values after- |
| Rainbow Trout | 67 109 | 10 days= 39 | 100 (sac fry) 440 (2.5 g) | 17 days = 4 23 days = 1 |
| Bluegill | 125 154 | 15 days= 54 | 46 (1.8 g) 420 (0.9 g) | 35 days = 4 22 days = 1 |

Other reliable and unchallenged data show that the toxicity of PCBs to some species (including Catfish and Bluegills) can vary inversely with the percent of chlorines or high homologs.³⁴ Finally, the evidence that tetrachlorobiphenyl may be metabolized into an hydroxylated derivative is inconclusive; A-1016 contains 21% tetrachlorobiphenyl, much of which has the isomers that are suspected of being particularly toxic.³⁵

34. Intermittant-flow bioassays of A-1242, 1248 and 1254 resulted in 15-day LC-50 values in Bluegills of 54, 76 and 204 ppb respectively, and in Channel Catfish of 107, 127 and 741 ppb respectively. D.L. Stalling & F.L. Mayer, Jr., "Toxicities of PCBs to Fish and Environmental Residues," in Env. Health Perspectives, pp. 159, 162 (April 1972); Dep't Exhibit 37 (8). The same inverse correlation was observed by Dr. Ringer in connection with single doses given to mink. See Dep't Exhibit 43, p. 4; Tr. 1079.

35. Dr. Golberg testified for GE that tetrachlorobiphenyl isomers with chlorine atoms in the "4" position had "special properties," apparently meaning they were potentially more toxic than others. Tr. 1805-06. Dr. Stalling testified that four of six of the most abundant isomers in PCBs contain chlorines in the "4" position.

An article coauthored by Dr. Golberg notes that "lower Chlorinated biphenyls....are of special interest because their biological degradability might lead to metabolites of increased toxicity." W. Greb, et al., "In Vitro Metabolism of Polychlorinated Biphenyls," 13 Bull. of Env. Contamination & Toxicology 424 (1975); Dep't Exhibit 61. See also Dep't Exhibits 60 & 62. Dr. Allen identified 2, 5, 2', 5' tetrachlorobiphenyl as capable of altering DNA and RNA, and therefore as linked with mutagenic, carcinogenic and necrogenic effects. Dep't Exhibit 41, p. 6; Tr. 1047.

Even if A-1016 is less toxic to some fish than other Aroclors, that fact fails to help GE in this case. The sediment, water and fish of the Hudson downstream of GE's plants are contaminated with substantial quantities of A-1242 and 1254, which have a continuing effect on living organisms in the river. Dep't Exhibit 5, p. 1920 (sediment heavily contaminated). The evidence shows that GE has in prior years purchased and used large quantities of higher chlorinated Aroclors.³⁶ Dr. Simons testified that he began planning PCB abatement steps in 1972. There is every reason to believe, therefore, that GE discharged higher chlorinated PCB wastes into the Hudson throughout the time the company was using those products. Assuming that substantial quantities of the higher chlorinated PCBs were discharged by persons or companies other than GE (of which there is no

36. Dep't Exhibit 6, reflects GE's purchases from Monsanto since 1966:

| <u>Years</u> | Lbs. in thousands | <u>1016</u> | <u>Aroclor</u> | | <u>1254</u> |
|-----------------|----------------------|-------------|----------------|-------------|-------------|
| | <u>TOTAL</u> | | <u>1242</u> | <u>1221</u> | |
| 1975 (Jan-Sept) | 4162 | 4146 | | 16 | |
| 74 | 8729 | 8699 | | 30 | |
| 73 | 9653 | 9234 | 384 | 35 | |
| 72 | 7901 | 7881 | | 20 | |
| 71 | 5561 | 1324 | 4223 | 14 | |
| 70 | 9682 | | 9589 | | 93 |
| 69 | 8323 | | 8219 | | 104 |
| 68 | 9939 | | 9839 | | 100 |
| 67 | 9496 | | 9395 | | 101 |
| 66 | 8767 | | 8667 | | 100 |

proof), GE's discharges of A-1016 are added to the PCBs already present and therefore have a greater toxic effect than they otherwise would have. For the same reason, it matters not at all that some of the PCBs were discharged more than three years before the complaint in this case, when GE claims the statute of limitations began to run,³⁷ or before March 24, 1974, when the definition of Class D waters was amended to include fishing as a best usage. The higher PCBs continue to have an effect -- continue to contaminate and pollute -- and the toxicity of the more recent discharges must be judged along with the PCBs already present, especially since GE is responsible for their presence. Counting in the effects of all existing PCB mixtures in judging GE's liability is especially necessary, since the record indicates that mixtures of A-1016 and higher chlorinated Aroclors are more toxic than the combined measures of their individual toxicities. See Dep't Exhibit 43, p. 5; Dep't Exhibit 37 (1), pp. 723-24, 726. Finally, it is entirely possible that A-1254 has been discharged by GE in the

37. NRDC argues that the applicable statute of limitations is CPLR 213(5), which allows the state to sue for misappropriation of public property either within six years from the time the cause of action accrues or within two years of the State's discovery of the facts, whichever is later. GE's discharges during the last three years violate ECL 17-0501, so no need arises to decide this question.

very recent past, because of accumulations in pipes, some of which have been moved in GE's abatement efforts. See Tr. 1279.

D. Violations of ECL 17-0501 and 17-0511

GE has violated ECL 17-0501 and 17-0511, as charged, by causing or contributing to a condition in contravention of the water quality standards adopted pursuant to ECL 17-0301. Two separate standards have been violated: GE has discharged wastes injurious to fish; and the company's conduct has caused and contributed to the impairment of a protected usage of the waters - fishing.

1. Injury to fish

GE argues that the toxic wastes discharged have not been shown to injure fish in that the evidence relied upon is largely based on laboratory tests concerning organisms other than species of fish found in the Hudson; no fish have been shown to have been directly affected; and GE in any event has brought its discharges to the point where no violation is continuing, making inappropriate the imposition of any penalty, including an injunction.

The argument against laboratory testing is inconsistent with the best scientific practice. Dr. Donald I. Mount, Director of the Environmental Protection Agency's National

Water Quality Laboratory in Duluth, Minnesota, commented generally that the results of laboratory toxicity work with fish or other organisms correlated within a factor of two to conditions actually found in the field. Tr. 964-66. Dr. Lauer testified for GE that the most accurate way of determining toxicity to fish was through controlled experiments, rather than by examining individual Hudson River fish. Tr. 1635. Dr. Golberg's observation that care must be exercised in tests because fish foods often contain contaminants is a well taken generality, but the evidence clearly shows that the scientists who testified, and whose findings were introduced, exercised adequate care in this regard. GE has voiced no challenge against any laboratory test in evidence on this or any other substantive ground.

Reliance by the Department on evidence concerning organisms and animals other than species of Hudson River fish is also proper. See, e.g., Synthetic Organic Chem. Manufacturers Assn v. Brennan, 503 F. 2d 1155, 1160-61 (3d cir. 1974) (upholding use of tests showing carcinogenic effects of ethyleneimine in rats and mice to show potential effects on men); Environmental Defense Fund v. EPA, 489 F. 2d 1247, 1253-54 (D.C. Cir. 1973) (reliance on general data, laboratory experiments on animals, etc. sufficient basis to prohibit uses of DDT concerning which no specific evidence was presented). Many experiments involved fish, some that

are found in the Hudson. Others involved creatures similar to those found in the Hudson and others used animals or organisms available in sufficient numbers and conventionally used to test for toxic effects. The range of PCB effects was such, testified Dr. Mount, that tests involving a variety of organisms was appropriate, and values concerning salt water species, for example, would be predictive of effects in fresh water species. Tr. 968-69. To the extent some creatures were especially sensitive, as mink are, or particularly resistant, as rats may be, the evidence of their reactions may be given less or more weight but is admissible and probative. See generally Judge Leventhal's instructive discussion upholding an extrapolation of the effects of aldrin/dieldrin "from mice to men," Environmental Defense Fund v. EPA, 1292, 1298-99 (D.C. Cir. 1975).

The record contains ample evidence from which an inference may be drawn that GE has discharged PCBs in quantities injurious to fish. The nature of this case makes it unnecessary that the Department prove that specific fish were directly affected or, as GE puts it, what "actually" took place not what "could" or "might" have taken place. GE Brief 29. ECL 17-0301 sets a water quality standard, and is part of a plan adopted in part to avoid the rigidities of the law aimed at punishing for harm done to identifiable

fish. See discussion supra, pp. 27-32. The experimental results in evidence show that fish, among other living things, have suffered toxic effects from PCB exposures equal to or lower than those to which fish taken from the Hudson were subjected.³⁸

In this regard, no weight need be given to the FDA tolerance limit of 5 ppm for the edible portion of fish. That standard is designed to protect consumers of fish, not the fish themselves. It would appear, on the one hand, that PCB levels of 5 ppm in fish may not be harmful to the fish themselves. Important variables would have to be weighed, including at what places in the fish the PCBs are located, and how sensitive is the particular species. On the other hand, when injury to fish is the relevant inquiry, the edible portions are far less significant than other areas and organs, such as the liver. The record shows that concentrations in the non-edible portions of fish are consistently higher than in the edible portions, and that the non-edible parts include vital organs. See Tr. 1625-29. An

³⁸. See the sources cited in footnotes 24-32, supra, particularly the low-dosage Rhesus monkey experiments. Dr. Nebeker testified that concentrations as low as 1.5 ppb PCBs kill or retard the growth and reproduction of Minnows, Flagfish and mosquito larvae. Dep't Exhibit 36, p. 9. Dr. Nimmo and others found A-1254 toxic to shrimp in the 1 ppb range. Dep't Exhibit 24(5), p. 197. Water concentration near the GE plants ranged from 1.3 to 3.0 ppb A-1016 between December 1974 and August 1975. Dr. Stalling referred in 1972 to the fact that residues of 500-600 ppm were associated with fish mortality in chronic continuous flow exposures. Dep't

ample basis is therefore present in the record to substantiate the unrebutted testimony of Dr. David L. Stalling that, "from what we know about the response to levels, certainly the concentrations in the fish exceeding the 100 micrograms per gram [parts per million] would have a very marked decreased chance for survival if mortality had not already occurred." Tr. 673. Applying GE's proposed test for proof by circumstantial evidence (even though in this context the evidence is scientific rather than based on unverifiable observation or speculation), the circumstances are indeed such "as to lead fairly and reasonably to the conclusion sought to be established and to exclude any other hypothesis fairly and reasonably." Ruppert v. Brooklyn Heights R.R. Co., 154 N.Y. 90, 93 (1897). The hypothesis of non-injury has been fairly and reasonably excluded.

GE would have this charge dismissed on the ground that it is now complying with the law. Its argument is both factually and legally unsound. The Department and NRDC demonstrate in their briefs that, even at present discharge levels, some fish will bioconcentrate PCBs to a level in

38. Continued.

Exhibit 19(5), p. 163. Hudson River fish were found with levels this high, and it is safe to assume that even higher levels have been reached in fish that were killed, and that some fish with lower concentrations were injured.

excess of 5 ppm from the water alone. GE's computations completely exclude, furthermore, the very substantial PCB contamination of sediment, which the evidence shows leads to fish contamination swiftly and to very high levels.³⁹ GE also characterizes as "anomolous" some substantial discharges that have occurred since September 1975 because of heavy rain or because of work associated with abatement efforts, such as moving contaminated pipes. The ECL may allow or even require the Department to disregard discharges caused by an "act of God" or other uncontrollable factors in considering GE's activities, but the relevant section does not exempt GE from its own negligence or wilfullness. See ECL 71-1935. The PCBs cannot be attributed to God, only to

39. Dep't Exhibit 15 (28), contains the experiment run by Dr. Veith on the effect of Hudson River sediments on fish in a tank with the sediment, as well as in a tank with just the water overflow from the first tank:

Concentration of PCB's in Fathead Minnows
After 6 Days in Lake Superior Water and Hudson River Sediments

| <u>Sample</u> | <u>Number of Fish</u> | <u>PCBs (ug/gm) as Aroclor 1016</u> |
|---|-----------------------|---|
| 6 Days in Tank Containing Hudson River Sedimenta | 8 | 109 116 |
| 6 Days in Tank Receiving Overflow from Sediment Tankb | 6 | 36.4 |
| Control Fish (Lake Superior Water) | 6 | Not detectable |

a Sediment contained 116 ug/gm (dry weight basis) Aroclor 1016

b Estimated PCB's in tank B water was 0.45 ug/l (as Aroclor 1016)

GE; and He has provided heavy rains at sufficiently regularly intervals to have made predictable those that drained PCBs from the land around GE's plants. GE's abatement activities are commendable, but GE made them necessary and is responsible for consequences that could be expected to occur. There is no reason, moreover, to consider only GE's discharge rate after this suit was brought. GE is responsible for all its discharges for at least the three years preceding the complaint, the period covered by the statute of limitations the company contends is applicable. CPLR 214 (2).

The theory on which GE argues in effect that its unlawful conduct should go unremedied is that no injunction may be issued to require a level of discharge that has already been achieved. This is simply incorrect. The Department is not required to accept GE's representations - mainly unsupported and equivocal⁴⁰ - as a substitute for an order

40. When GE received its NPDES permit on Dec. 31, 1974, the maximum daily discharge of PCBs was set at 100 grams to be achieved by May 31, 1977. GE filed with EPA a request for an adjudicatory hearing on this effluent limitation - in effect staying its applicability until the question was litigated. GE Exhibit 17. Since filing the request, on the basis of "new experimental data," GE contends that an abatement system can be designed that will keep the PCB daily discharge below the 100 gram level. Tr. 1144. In addition GE contends that, but for the uncertainty presented by the PCB limit that may be imposed in this proceeding, they are now prepared to withdraw their hearing

requiring discharges at a lawful level. Furthermore, while GE's promised discharge rate of 100 grams per day may be lawful if the use of PCBs is commercially necessary, the Department is entitled to attempt to show that adequate substitutes are available. Nor is the Department precluded by any equitable principle from attempting to require GE to take steps to rectify its prior violations. However negligent the Department may have been in granting GE a permit to discharge those large amounts, the permit and the ECL required GE to conform its effluent to stream classification standards. This proceeding is designed to protect public resources, and cannot be made into a forum for determining the relative fault of GE and the Department.

40. Continued.

request. Dr. Modan, responsible for "scoping" the treatment system, testified that, based on his engineering judgment, the bench scale studies of the system indicate that the 100 gram daily maximum is achievable. Tr. 1305. These studies and other material developed in connection with this system have not yet been seen by the Hearing Officer or the other parties, although their production was promised. Tr. 1321-22. Neither had GE withdrawn its request for a hearing at EPA on the 100 gram level as of January 1976. Electrolux Corp. v. Valworth Inc., 6 N.Y. 2d 556, 190 N.Y.S. 2d 997 (1959), and other similar cases are distinguishable, given these facts as well as GE's continuing discharges and the continuing effects of its past discharges.

2. Impairment of best usage - recreational fishing.

The ECL and its regulations are also violated by discharges that cause or contribute to an impairment of recreational fishing. A violation of water standards sufficient to injure fish would ordinarily seem to impair fishing. This is true here, since GE's discharges are at least "contributing" to a condition in which fishing is impaired. The proscriptions do not entirely overlap, however, since fishing may be impaired even though fish have not been injured in the sense legally required.

Recreational fishing is impaired when fish, though healthy enough to survive, are dangerous to use as food. GE argued at the hearing that recreational fishing does not require fish that are edible. Tr. 986-93. This may be true as a matter of abstract theory, but in reality recreational fishermen frequently consume the fish they catch, as the testimony shows. Tr. 1875, 1880-81 (J. Pickett); Tr. 1885 (E. Nash). Fishing in the Hudson has in fact been greatly reduced since Commissioner Ogden Reid informed the public of PCB contamination, Tr. 1870-73, 1879, 1886, which demonstrates that the activity is undertaken by some only if the fish they hope to catch can safely be eaten. The regulations themselves contemplate fish consumption by prohibiting the discharge of substances that adversely affect the

"flavor, color and odor" of fish. 6 NYCRR 701.5. The regulations were therefore intended to protect the fishing activities of fish eating anglers as well as those who catch fish purely for sport.

Hudson River fish have been rendered inedible by GE's PCB discharges. The Department properly relies in proving this fact in part upon the FDA's temporary tolerance limit of 5 ppm for the edible portion of fish. Dr. Kolbye testified that the FDA derived its present standard to a large extent from the Yusho incident, in which the victims "received an exposure of approximately two grams of PCBs, which is translated to 2,000 milligrams of PCBs." He said the FDA employed a safety factor of 10, and therefore estimated that human beings could tolerate "without adverse effects on health ... roughly 200 milligrams spread out over 1,000 days...." Tr. 993. In adopting this standard during September 1971, the FDA contemplated that consumption of PCBs would taper off and cease after 1000 days, as PCB discharges were reduced or eliminated. It recognized that exposures over a longer period would enhance the possibility of toxic effects. Dep't Exhibit 39, p. 4. The standard promulgated by FDA concerning fish was unchallenged by any party when issued, and was not meaningfully attacked by GE in this proceeding. Dr. Kolbye said the standard is under

review in light of new evidence of PCBs carcinogenic effects and of its continued persistence in the environment at high levels. Tr. 1023-24. His conclusion regarding Hudson River fish was unambiguous. "The FDA is extremely concerned about the problem of PCB's in Hudson River fish," he testified, "since the regular ingestion of fish containing PCBs above 5 ppm represents a potential public health problem with unknown long range consequences." Exhibit 39, p. 10. A single 200 gram meal of fish containing 100 ppm PCBs, according to his estimates, would result in the ingestion of 20 mg. PCBs, or 10% of the total 1000 day exposure deemed tolerable for adults, and 40% of the total allowable exposure (50 mg) for children. See Id. 9. Significantly, the average PCB content of fish sampled by GE downstream of its plants was 94.66 ppm in their edible flesh, which excluded the PCBs in their skin. A single, 200 gram meal of the eel captured by the Department at Stillwater and found to contain 559.25 ppm PCBs in its edible parts would contaminate an adult with over 50% of the FDA estimated lifetime limit, and a child with 200% of its allowable lifetime exposure.

Any doubts raised by the evidence in this record concerning the FDA standard indicate that it is dangerously low rather than high. The FDA relied on an estimate of PCB consumption by Yusho victims of 2 grams. The published

analysis of the incident by members of the study group that examined its consequences reports, however, that 2 grams was the average consumption. The same report estimates that the minimum consumed by a "patient" was .5 grams, or 500 milligrams PCBs. Moreover, the average consumption of oil by Yusho victims was 800 ml, but the researchers found that "the attack rate" for consumers of less than 720 ml of oil was 88%; for those who consumed over 720 ml oil, that attack rate was 100%. Finally, while the Yusho results find a strong correlation between amount of PCBs consumed and clinical severity, it is important to note that 38.7% of those who consumed less than 720 ml oil contracted "severe" as opposed to "light" cases of poisoning. M. Kuratsune et al., supra, pp. 123-25. It is clear, therefore, that the ten-fold margin of safety adopted by FDA is based on a statistical average, and affords much less than ten-fold protection to just about half the potential victims, many of whom are likely to suffer severe attacks. And the ten-fold safety factor appears itself to be far lower than safety factors adopted in other, similar contexts.⁴¹

41. See Society of Plastics Ind. v. OSHA, 509 F. 2d 1301, 1308 (2d Cir. 1975) (testimony by Dr. Kraybill of the Nat'l Cancer Institute that a 50-fold standard was insufficient for the highly toxic carcinogen vinyl chloride, since a 100-fold margin was used for non-carcinogens).

The history of vinyl chloride regulation is generally instructive. Evidence of its toxic effects led Dow Chemical

GE's argument that it is now in compliance with the ECL has been dealt with above. The contention is particularly inappropriate in connection with the impairment of fishing. Fishing has been a protected use in Class D waters since March 24, 1974. Furthermore, fishing was a protected use in Class A and B waters long before then, and the waters into which GE has discharged PCBs flows into Class A and B waters. 42

41. Continued.

Company to recommend a maximum exposure to workers of 50 ppm. The industry refused to give up its 500 ppm standard then, and even as further evidence of carcinogenicity accumulated, partly on the ground that extrapolations from experiments involving rats was improper. By 1972, when the industry agreed to finance a study, the first deaths of American workers due to VCM exposure were recorded. By 1974, thirteen workers had been killed. No sooner had the federal government been led to adopt the 50 ppm standard than evidence established it was too high. After a hearing before an administrative judge, a standard of 1 ppm was proposed, with some variance allowed. Industry protested the standard was unnecessary and infeasible. The D.C. Circuit upheld the standard, however, noting that no "safe" levels had been established, that human lives were at stake, and that experience had shown that the industry had greatly underestimated its technological capacity to reduce exposure levels. 509 F. 2d at 1308-10.

The present case also involves a carcinogen of unknown potential effects, and human health is at stake. GE has managed to reduce discharges from a daily average of 30 lbs. to a projected daily maximum of 100 grams, once its resources were turned to coping with the problem. Some 49 GE employees between 1960 and 1975 were diagnosed as having developed chloracne or dermatitis reactions from PCB contact. Another 16 reported nausea, dizziness and eye and nasal irritations. Dep't Exhibit 48. Follow up studies are obviously called for.

42. See 6 NYCRR Section 701.4. The Hudson River from Batten Kill to Lock 3 is designated Class B; from Lock 2 to the Confluence of the Mohawk it is designated Class A. The Lower Hudson from Coxsackie to Chelsea is Class A and from Chelsea south to Westchester and Rockland County is Class B. Dep't Exhibit 11.

The act requires that GE be found liable for impairing that protected use, and ordered to cease contributing to the condition it has caused.

E. Alleged Violation of ECL 11-0503

The Department claims GE has violated ECL 11-0503(1) by discharging a poisonous or deleterious substance into a public water in quantities "injurious" to fish or wildlife, or to the propagation of fish or protected wildlife. The evidence that proves a violation of ECL 17-0501 and 17-0511, the Department contends, likewise proves a violation of ECL 11-0503(1). Further, it offers proof that mink reside in the Hudson River basin, and that they are wildlife that would be injured and whose propagation would be adversely affected if they consumed fish with the quantities of PCBs shown to exist in the river.

ECL 11-0503(1) is, however, very different in background and purpose than ECL 17-0501 and 17-0511. The former has nineteenth century roots, and is an isolated provision aimed specifically at protecting fish and wildlife. The latter are relatively modern parts of an overall system of water classification. As we have seen, the water classification program was adopted pursuant to a committee recommendation

based in part on the narrow scope of ECL 11-0503(1). The committee's perception of the statute, as requiring proof of injury by a specific substance on a particular occasion, is hardly entitled to binding weight. But a relatively narrow purpose for the provision is also strongly suggested by ECL 71-0925(5), which states that "any act" in violation of ECL 11-0503(1) may be punished by a fine of from \$500 to \$1,000 "for each offense and an additional penalty of ten dollars for each fish killed in violation thereof...." The statute seems aimed at specific, identifiable "acts" and offenses" that injure or kill fish.

A further characteristic of ECL 11-0503(1) is that its violation is punishable (and apparently in the case of wildlife must be punished) as a misdemeanor. ECL 71-0919 incorporates by reference this penal remedy in ECL 71-0921(d), and the punishment for each offense is up to a \$500 fine and 1 year imprisonment, ECL 71-0921(3)(a). Thus, ECL 11-0503(1) seems aimed, not only at episodes of toxic discharge, but also wilful or grossly negligent episodes, where severe penalties are appropriate. The potential unfairness is compounded by the fact that ECL 11-0503(1) makes it unlawful adversely to affect the reproduction of fish or wildlife, whereas the water classification regulations specifically provide that Class D waters need not be suitable for reproduction. 6 NYCRR 701.4.

GE's conduct is not the sort against which ECL 11-0503 was written. The company engaged in a continuing practice, in which discharges at any particular time or day have not been shown in themselves to be injurious to fish or wildlife. Unlike ECL 17-0501, moreover, under ECL 11-0503 GE's insistence that injury to specific fish be shown has considerable merit. GE's activities were in addition revealed to the relevant state and federal agencies. The company may have acted at its own risk, but its conduct could hardly be characterized as wilful in the criminal sense. - Circumstances may arise where ECL 11-0503 should be applied although no specific fish can be identified as injured, and even in conjunction with ECL 17-0501, but the present case does not fit the anticipated pattern. Cf. People v. Consolidated Ed. Co., 34 N.Y. 2d 646, 355 N.Y.S. 2d 379 (1974).

The Department has shown injury to fish, but not in a context to which ECL 11-0503 should be applied. As to the proof concerning wildlife, the Department's case, as GE properly notes, is based entirely upon hearsay evidence. A Department witness testified that he had read books stating that mink existed in the Hudson River basin, and that unidentified citizens of unascertained expertise had reported sighting mink. This is not only hearsay, but hearsay of unproven reliability. Even if believed, it would prove only

that mink existed, in unknown quantities, in a very large area encompassing many thousands of potential food sources other than the Hudson River. An inference of injury cannot as readily be drawn in this context as in the case of fish, essentially trapped in the PCB contaminated waters, and actually shown to have absorbed PCBs in quantities demonstrably high enough to be injurious to themselves and potentially to their consumers. The allegation must be dismissed as inappropriate and unproven.

III. Outstanding Remedial Issues

The Department has proven violations of ECL 17-0501 and 17-0511. It has also shown itself entitled at the very least to an order requiring GE to reduce its PCB discharges to a lawful level. Whether the levels GE represents it has and can attain are lawful is only the first of several issues to be examined when this proceeding reconvenes. Other issues include:

1. The extent to which GE should be ordered to rectify the effects of its prior discharges, including whether any practicable and environmentally safe method exists or can be devised to remove PCBs from the river bottom, and the expected duration and extent of PCB contamination if no remedial steps are taken;

2. The extent to which GE should be required to remove PCB-contaminated earth and equipment from around its plants, and the manner in which this operation should be conducted;
3. The existence of substitutes for PCBs, including their adequacy and environmental acceptability;
4. Whether GE is presently utilizing proper care in its manufacturing and sales processes to avoid PCB contamination, including what controls GE has in effect if any to insure that PCB-impregnated equipment is not being permitted to become a hazard to the environment after use; and
5. Whether the system of supervision proposed by the Department would be lawful and adequate, particularly the legality and necessity for a bond as requested.

An aspect of all these questions is the cost involved in proceeding in one way or another. The Department of Commerce will hopefully provide assistance in this regard, by analyzing the costs of alternatives. The Department of Commerce should, in this connection, note that the extreme

prospect of closing down GE's plants has not been suggested by any party as warranted or necessary; the Department and NRDC have heretofore relied in advocating a zero PCB discharge on their claims that adequate alternatives exist.

These are complicated matters that will require technical proof. The Department will have to go forward on these issues. GE is hereby ordered, however, to provide the parties and the Hearing Officer, within two weeks of the date of this opinion, with as comprehensive as possible a description of its present abatement plans. The hearing should proceed with a full appreciation for what GE is prepared to accomplish without compulsion. The Department should inform the parties as soon as possible when it will be prepared to present its proof. After the forthcoming hearing, a proposed order will be prepared and submitted to the Commissioner, containing all the findings made and conclusions drawn at both parts of this proceeding. Meanwhile, this opinion shall constitute the interim findings and conclusions on GE's liability.

By

Abraham D. Sofaer
Abraham D. Sofaer

Date February 9, 1976