

107 F.Supp.2d 817
United States District Court,
W.D. Michigan,
Southern Division.

KALAMAZOO RIVER STUDY GROUP, Plaintiff,
v.
ROCKWELL INTERNATIONAL, et al.,
Defendants.

No. 1:95-CV-838.
|
June 3, 2000.

Synopsis

Association of paper companies sued manufacturing plant owner under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Michigan Natural Resources and Environmental Protection Act (NREPA), seeking contribution for response costs incurred in responding to releases of polychlorinated biphenyls (PCB) into river. Following bench trial, the District Court, Robert Holmes Bell, J., entered judgment against plant owner as to liability only. Following trial on allocation, the Court held that paper companies were not entitled to contribution, in view of relatively minimal release of PCB by plant owner.

Order accordingly.

Attorneys and Law Firms

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In 1995 Plaintiff Kalamazoo River Study Group (“KRSG”) filed this action against eight corporations under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (“CERCLA”), 42 U.S.C. § 9601, *et seq.*, the Michigan Natural Resources and Environmental Protection Act (“NREPA”), M.C.L.A. § 324.20101 *et seq.* and various common law theories. Through this action Plaintiff seeks to recover its response costs from other entities that allegedly contributed to the PCB contamination of a portion of the Kalamazoo River.

Prior to trial six of the Defendants were dismissed pursuant to a voluntarily dismissal, ***819** settlement, or summary judgment.¹ The case against the remaining two defendants, Eaton Corporation and Rockwell International, Inc., was tried to the Court in two phases. The liability phase was tried from August 10, 1998 to August 17, 1998 (the Phase I trial). After the Phase I trial this Court entered an opinion, order and partial judgment dated December 8, 1998, entering a judgment in favor of Eaton, and entering a judgment as to liability only in favor of Plaintiff Kalamazoo River Study Group (“KRSG”) and against Defendant Rockwell International (“Rockwell”). The Court also entered a judgment as to liability only in favor of Rockwell on its counterclaim against KRSG.

The allocation phase, involving only Plaintiff KRSG and Defendant Rockwell, was tried to the Court from November 8, 1999 to November 10, 1999 (the Phase II trial). The Court has considered opening statements of counsel, written closing arguments of counsel, proposed Findings of Fact and Conclusions of Law from both parties, the testimony of witnesses at trial, documents and photos admitted as exhibits at trial, and deposition excerpts designated by the parties in the Joint Final Pretrial Order. The Court has considered what inferences can reasonably be drawn from the direct and circumstantial evidence, and has considered the demeanor and manner of the witnesses who testified at trial in assessing the credibility of and weight to be accorded to the testimony of those witnesses. This opinion contains the Court’s findings of fact and conclusions of law, in accordance with FED.R.CIV.P. 52(a).

I. The Parties

Plaintiff KRSG is an unincorporated association of four paper companies duly existing under and by virtue of the laws of the State of Michigan. Its members are

OPINION

ROBERT HOLMES BELL, District Judge.

Millennium Holdings, Inc. (formerly HM Holdings, Inc./Allied Paper Inc.), a Delaware corporation (“Allied”); Georgia-Pacific Corporation, a Georgia corporation (“Georgia-Pacific”); Fort James Operating Company, Inc. (formerly James River Paper Company, Inc.), a Virginia corporation (“James River”); and Plainwell Inc. (formerly Simpson-Plainwell Paper Company and Plainwell Paper Company, respectively), a Michigan corporation (“Simpson”).

Defendant Rockwell is a Delaware corporation. Meritor Automotive is the successor in interest with respect to Rockwell’s Allegan facility that is at issue in this case.

II. Administrative History of The Site

In August 1990 a thirty-five mile length of the Kalamazoo River from the confluence of Portage Creek with the river (in the City of Kalamazoo) downstream to the Allegan City Dam, and a three-mile portion of Portage Creek upstream of its confluence with the Kalamazoo River was added to the National Priorities List (“NPL”) by the United States Environmental Protection Agency (“EPA”) pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605. The NPL Site is known as the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund (National Priorities List) Site (“NPL Site”).

In 1990, the Michigan Department of Natural Resources (now the Michigan Department of Environmental Quality) (“MDNR” or “MDEQ”) and the EPA signed a Cooperative Agreement authorizing the MDNR to conduct an Endangerment/Risk Assessment for the NPL Site. The MDNR determined that the NPL Site is contaminated with hazardous substances, including polychlorinated biphenyls (“PCBs”). PCBs are hazardous substances ***820** as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

The MDNR identified three paper mills—Allied, Georgia-Pacific and Simpson—as the principal sources of PCBs contaminating the NPL Site due to past business operations involving the recycling of paper, including deinking, during the period of 1950–1975.

In December 1990, following the listing of the NPL Site, three members of KRSG (Allied, Georgia-Pacific, and Simpson) entered into an Administrative Order by Consent (“AOC”) with the MDNR to fund and conduct a Remedial Investigation/Feasibility Study (“RI/FS”) of the NPL Site. James River subsequently joined the KRSG, but did not sign the AOC. James River has nevertheless

participated in the RI/FS process.

In the AOC the MDNR made a finding that the sediments, water column and biota in the Kalamazoo River/Portage Creek Site are contaminated with PCBs. In 1990 the MDNR estimated that there are about 200,000 pounds of PCBs in the sediments in and adjacent to Portage Creek and the Kalamazoo River at this Site.² Since then the MDEQ has determined that the river sediments contain well over 350,000 pounds of PCBs.³ PCBs continue to migrate off-site due to the river flow, and substantially contribute to the ongoing contamination of Lake Michigan.⁴

Under the RI/FS Plaintiff’s members are required to extend their investigation upstream and downstream of the NPL site to include a ninety-five mile stretch of the Kalamazoo River from upstream of Morrow Lake to downstream of the Rockwell facility and four Operable Units (“OUs”) consisting of five disposal areas used to dispose of paper making residuals or “sludges” from the KRSG members’ mills. The OUs include: (1) Allied Paper, Inc./Bryant Mill Pond (operated by Allied); (2) Willow Boulevard/A-Site (operated by Georgia-Pacific); (3) King Highway Landfill (operated by Georgia-Pacific); and (4) the 12th Street Landfill (operated by Simpson). The MDNR determined that each of the respondents (Allied, Georgia-Pacific and Simpson) is a “responsible party” under Section 107(a) and a “potentially responsible party” (“PRP”) within the meaning of Section 122 of CERCLA, 42 U.S.C. §§ 9607(a) & 9622; that the Site is a “facility” within the meaning of Section 101(9) of CERCLA, 42 U.S.C. § 9601(9); that there were and are “releases” and the threat of continuing releases of “hazardous substances” at or from the Site within the meaning of Sections 101(22) and 101(14) of CERCLA, 42 U.S.C. §§ 9601(22) and 9601(14); and that the response actions called for in the AOC are consistent with the National Contingency Plan (“NCP”), 40 C.F.R. Part 300.⁵

The AOC requires the Respondents to perform and pay for the RI/FS activities in accordance with the applicable Statement of Work (“SOW”); to perform and pay for any additional tasks conducted independently of the AOC as determined to be necessary by the MDNR to perform the RI/FS activities required by the AOC; and to reimburse the MDNR for all direct and indirect costs incurred by the MDNR in overseeing and reviewing the conduct of activities required under the AOC.⁶ Under the AOC, the Respondents are jointly and severally liable for the performance of the RI/FS activities specified in the AOC and for any penalties arising from the AOC. The AOC does not purport to include as respondents all persons that may have caused or contributed to the disposal of PCBs

or other hazardous substances at the Site.

***821** During Phase I of this case, this Court held that “[t]he contributions of PCBs to the NPL Site by Allied, James River, Georgia-Pacific and Simpson, individually and together, are in nature, quantity and durability sufficient to require imposing the costs of response activities for the NPL Site upon each of those four parties.”⁷ This Court also determined that “[i]n light of the high concentration of PCBs found at the outfall of the Oil Floatation House, and the presence of PCBs in all of the oil handling areas on the Rockwell property ... Rockwell’s release of PCBs to the river was more than incidental or sporadic. The evidence is sufficient to enable the Court to conclude that PCBs were regular ingredients of the Rockwell plant’s process oils, at least for a period of time, and that they were released to the Kalamazoo River in measurable or detectable quantities.”⁸ In sum, this Court adjudged both KRSG and Rockwell liable under CERCLA for PCB contamination at the Site. This Court also observed that Rockwell’s release of PCBs appeared to be minimal in comparison to the release of PCBs by Plaintiff’s members.

III. KRSG’s Response Costs

The parties have stipulated that the response costs incurred by Plaintiff for the work conducted relating to the RI/FS at the Site, including the work conducted by Blasland, Bouck & Lee (“BBL”) and the oversight work conducted by the MDEQ, were necessary and consistent with the National Contingency Plan.

Many of the RI/FS-related activities and investigations conducted by Plaintiff at the Site have not been associated specifically with the locations of individual KRSG member facilities due to the whole-river nature of the investigation. Plaintiff, through August, 1999, has paid approximately \$21 million to BBL for work relating to the RI/FS. Of that \$21 million, approximately \$8.6 million relates to activity conducted by BBL adjacent to and downstream from Rockwell’s Allegan facility, plus general river (sediment, water and biota) investigation for the entire ninety-five mile stretch of the river at issue in this litigation, excluding specific PCB testing between the upstream-most KRSG member and Rockwell’s Allegan facility.⁹ None of the \$8.6 million relates to costs Plaintiff has incurred relating to Plaintiff’s members’ mills, the OUs at the NPL site, work performed by Seyferth & Associates, or Plaintiff’s search for other potentially responsible parties.

Plaintiff, through August, 1999 has paid the MDEQ approximately \$3.1 million for oversight costs incurred by MDEQ relating to the RI/FS. The MDEQ’s activities at the Site generally shadowed BBL’s activities, and therefore it is appropriate to take the same percentage of BBL’s total costs that related to the general river investigation to determine the portion of MDEQ’s total oversight costs that relate to the general river investigation. Thus, approximately \$1.2 million of the \$3.1 million expended by MDEQ is attributable to general river (sediment, water and biota) investigation for the entire ninety-five mile stretch of the Kalamazoo River at issue in this litigation, excluding specific PCB testing between the upstream-most KRSG member and Rockwell’s Allegan facility.

Plaintiff’s individual group members have allocated among themselves their percentage shares for response costs at the Site as follows: 35 percent to Allied, 35 percent to Georgia-Pacific, 15 percent to Plainwell and 15 percent to James River.¹⁰

***822 IV. KRSG’s Contribution Claim**

Section 113(f) CERCLA provides that “[i]n resolving contribution claims, the court may allocate response costs among liable parties using such equitable factors as the court determines are appropriate” 42 U.S.C. § 9613(f). Thus, under § 113(f) the Court may consider *any* factor it deems in the interest of justice in allocating contribution recovery. A nonexhaustive list of such factors, commonly referred to as the “Gore Factors,” includes:

- (1) the ability of the parties to demonstrate that their contribution to a discharge, release or disposal of a hazardous waste can be distinguished;
- (2) the amount of the hazardous waste involved;
- (3) the degree of toxicity of the hazardous waste involved;
- (4) the degree of involvement by the parties in the generation, transportation, treatment, storage, or disposal of the hazardous waste;
- (5) the degree of care exercised by the parties with respect to the hazardous waste concerned, taking into account the characteristics of such hazardous waste; and
- (6) the degree of cooperation by the parties with the

Federal, State or local officials to prevent any harm to the public health or environment.

Centerior Service Co. v. Acme Scrap Iron & Metal Corp., 153 F.3d 344, 354 (6th Cir.1998) (citing *United States v. Colorado & Eastern Railroad*, 50 F.3d 1530, 1536 n. 5 (10th Cir.1995)). See also, *United States v. R.W. Meyer, Inc.*, 932 F.2d 568, 571 (6th Cir.1991). The Gore factors enable the Court to take into account more varying circumstances than common law contribution. *R.W. Meyer*, 932 F.2d at 573.

Because one of the primary goals of CERCLA is to encourage timely cleanup of hazardous waste sites, and because CERCLA seeks to place the cost of that response on those responsible for creating or maintaining the hazardous condition, the most important factors in the allocation phase are harm to the environment and care on the part of the parties. *Control Data Corp. v. S.C.S.C. Corp.*, 53 F.3d 930, 935–36 (8th Cir.1995). Because harm to the environment is a product of volume and toxicity, the parties' assert that the most relevant Gore factors in this allocation phase are volume of discharge, toxicity, and cooperation with governmental authorities.

Courts are not required to make meticulous findings as to the precise causative contribution each of the parties have made to a hazardous site, as in many cases such a finding would be literally impossible. *R.W. Meyer*, 932 F.2d at 573–74. Similarly, the plaintiff in a contribution action may seek reimbursement even though it cannot make a meticulous factual showing as to the causal contribution of each defendant. *Id.* at 573–74. Although the CERCLA plaintiff is not required to prove its case with scientific certainty, it still has the burden of proving its case by a preponderance of the evidence. *B.F. Goodrich v. Betkoski*, 99 F.3d 505, 526 (2d Cir.1996).

In an appropriate set of circumstances, a tortfeasor's fair share of the response costs may be zero. *Acushnet Co. v. Mohasco Corp.*, 191 F.3d 69, 78 (1st Cir.1999). For example, in *PMC, Inc. v. Sherwin-Williams Co.*, 151 F.3d 610, 616 (7th Cir.1998), the Seventh Circuit held that even though PMC conceded that it had dumped toxic wastes at the site, it was not unreasonable for the district court to find that a zero allocation to PMC would be appropriate where PMC's spills were "too inconsequential to affect the cost of cleaning up significantly." 151 F.3d at 616. As the First Circuit observed in *Acushnet*, "there is nothing to suggest that Congress intended to impose far-reaching liability on every party who is responsible for only trace levels of waste." 191 F.3d at 78.

In this action Plaintiff contends that Rockwell is responsible for contributing 20% of the estimated 50,000 pounds of PCBs in Lake Allegan. Based upon Plaintiff's assertion that Aroclor 1254 discharged by Rockwell is 3 to 4 times more *823 toxic than Aroclor 1242 discharged by Plaintiff's members, Plaintiff requests the Court to allocate to Rockwell a 13% share of the current and future general river investigation costs upstream of the Allegan facility, and a 40% share of current and future study and investigation costs downstream of the Allegan facility, plus prejudgment interest.

Rockwell, on the other hand, contends that its releases of PCBs were of such a small quantity as to be negligible, and that the equitable share that should be allocated to Rockwell should be zero.

V. PCBs

PCBs were originally produced in the late 1920s. They were manufactured almost exclusively by Monsanto Corporation and were marketed under the trade name "Aroclor." PCBs were used by industry in a variety of applications, including in dielectric fluids in capacitors and transformers, in hydraulic fluids, in cutting and soluble oils, and in quench oils. The Aroclors pertinent to this case are Aroclor 1242, Aroclor 1248, Aroclor 1254 and Aroclor 1260. The last two numbers in the particular Aroclor mixture signifies the percentage of chlorine within the mixture; the higher the number, the greater the molecular weight of the Aroclor.

PCB Aroclor 1242 is the Aroclor predominantly associated with paper recycling operations, including the recycling operations undertaken by the paper mills operated by Plaintiff's members. Aroclor 1242 was used in carbonless copy paper produced by National Cash Register ("NCR paper") as an ink carrier or solvent during the period 1957–1971.¹¹ Over 44 million pounds of PCBs were used for this purpose, accounting for 28 per cent of the total estimated Monsanto sales for plasticizer applications and 6.3 per cent of Monsanto domestic sales of PCBs during 1957–1971. The average content of Aroclor 1242 in the carbonless copy paper was 3.4%.¹² PCB Aroclor 1242 is also associated with hydraulic fluids and heat transfer fluids.

PCB Aroclor 1254 was used in several applications, including quench oils, hydraulic oils, and cutting oils. Aroclor 1254 was also used to a limited extent in printing inks beginning in 1968.¹³ The total usage in this

application is estimated at 50,000 pounds.¹⁴

PCBs did not become a regulatory concern until the early 1970s. Accordingly, they entered the waste stream from a variety of sources without detection, quantification or concern by industry or government regulators until the 1970s.

PCBs have an affinity for solids or particulate matter, and generally adhere more readily to fine grained particles than to coarse grained particles. PCBs are not very water soluble.¹⁵ In a river environment, PCBs are likely to accumulate in the sediment in quiescent areas or depositional zones. When PCBs are discharged to the river in oil, some will float on the surface and be carried down river, and others will attach to particles and eventually settle out and become part of the sediment in depositional zones. The higher the concentration of PCBs in an oil, the heavier the oil, and the closer the PCBs will be found to the discharging source.¹⁶

VI. Evidence of Rockwell's PCB Use and Discharge

Rockwell owned property and a manufacturing plant at 1 Glass Street, Allegan. *824 Rockwell and its predecessors operated that plant from the early 1900s until approximately 1988–89. The plant, which manufactured universal joints for the automotive industry, was located on the Kalamazoo River, downstream of the Allegan City Dam, and upstream of the Lake Allegan Dam.

The portion of the Kalamazoo River adjacent to the former Rockwell plant is not within the NPL Site as defined by the AOC. It is, however, within the ninety-five mile stretch of river Plaintiff has been required to address in its RI/FS. It is undisputed that to the extent Rockwell may have released PCBs to the Kalamazoo River, those PCBs cannot come to be located within the NPL Site because it is *upstream* of Rockwell.

The former Rockwell Allegan facility is a Superfund Site separate and apart from the Plaintiff's Superfund Site. In 1988 Rockwell entered into an AOC with the EPA to undertake a remedial investigation and feasibility study of the property. The Rockwell property became a Superfund Site because of heavy metals and other chemicals, not because of PCBs.

From 1945 until the early 1960s, Rockwell discharged its industrial wastewater into the Kalamazoo River following treatment in the Oil Floatation House. The wastewater from the Oil Floatation House contained certain amounts

of sludge, heavy metals, process wastes, and oil. Rockwell's wastes included machine coolants, oily wastewaters, and spent cutting oils. There are no records indicating that the Rockwell plant purchased quench oils, cutting oils or hydraulic oils containing PCBs. The most substantial releases of oil from the Rockwell facility were from Outfall Number One, the old outfall that received discharges from the Oil Floatation House. The dominant PCB mixture found on the Rockwell property is Aroclor 1254, but evidence of Aroclors 1242 and 1260 was also found.

There is no evidence that Rockwell conducted forging, die casting or other extremely high temperature operations that would have benefitted from the fire-resistant qualities of PCB-containing oil. From the early 1960s onward, Rockwell began making increasing use of water-based process oils, *i.e.*, water-soluble oils. Because PCBs do not readily mix with water, they are an unlikely additive to water soluble oils. Beginning in that time frame, Rockwell discharged its waste oils into the soluble oil separation pond. The wastewater effluent from Rockwell's treatment ponds was tested by the MDNR in 1976 and 1986. Those tests found no PCBs in Rockwell's outfall to the Kalamazoo River.¹⁷

Rockwell kept no records of its oil purchases from the 1940s to 1970s. Neither did it screen its incoming process oils for PCBs, or test its oils or effluent for PCBs until after Monsanto pulled PCBs from use in open applications in 1971. Because of this lack of information, the parties were prevented from making a precise calculation of Rockwell's PCB discharges to the river and Rockwell's contribution of PCBs to Kalamazoo River sediment. Nevertheless, some reasonable inferences can be drawn from the available evidence.

Based upon the higher cost of PCB-containing oils, the lack of necessity for PCB-containing oils in Rockwell's manufacturing processes, and the low levels of PCBs found on the property, it is unlikely that Rockwell intentionally purchased PCB-containing oils. Nevertheless, it is likely that Rockwell purchased oils that contained PCBs. Mary Shafer (a/k/a Mary Geika), Project Manager of the Superfund Section of the MDEQ Environmental Response Division, observed that "vendors may not have known [that oils contained PCBs], as tests were not regularly done on oils, to look for PCBs. PCBs were commonly *825 contained in oils at that time (especially pre-1970)."¹⁸ If Rockwell purchased recycled oils, those oils may very well have contained PCBs. In addition, Robert C. Barrick, Rockwell's expert, testified that oils purchased by Rockwell may have been contaminated with traces of PCBs from residue from PCB-containing oils transported in oil tankers.¹⁹

Plaintiff's expert, Dr. Kenneth Z. Crumrine, estimated that Rockwell discharged between 5,000 and 10,000 pounds of PCBs to the Kalamazoo River. Dr. Crumrine based his estimate on available data relating to known oil losses to the river in 1965 as documented by the Michigan Water Resources Commission ("MWRC"), and data from Rockwell documents which shed light on the amounts of hydraulic and cutting oils Rockwell historically stored and reclaimed.²⁰ Dr. Crumrine's estimate is basically extrapolated from the March 9–11, 1965, MWRC survey of the outfall from the Oil Floatation House. The survey found that Rockwell discharged 270 gallons of oil to the Kalamazoo River from the Oil Floatation House in a twenty-four hour period on March 9–10, 1965. After the oil storage and separation tanks were pumped out on March 10, a second survey was done, and Rockwell's oil discharge was reduced to approximately 5.1 gallons.²¹ Using only these two figures, Dr. Crumrine estimated Rockwell's release of hydraulic and cutting oils to the Kalamazoo River over a thirty-two year period. Dr. Crumrine used the high number (270 gallons per day) for the five years of 1941 to 1945, and the low number (5.1 gallons per day) for the next twenty-seven years of 1946 through 1972.²² Dr. Crumrine estimated that the total amount of oil released over this thirty-two year period was 520,695 gallons. Dr. Crumrine attempted to verify this figure by comparing it to data regarding the size of Rockwell's oil tanks, and sparse documentation regarding Rockwell's oil reclamation efforts.²³

Based upon the PCB content of Monsanto hydraulic oils and cutting oils, Dr. Crumrine concluded that Rockwell is responsible for the discharge of a minimum of 5,000 to 10,000 pounds of PCBs to the Kalamazoo River.²⁴

Dr. Crumrine's calculations are highly speculative. The Court is not persuaded that Dr. Crumrine's estimate of the total volume of oil released by Rockwell is very probative because his thirty-two year estimate is an extrapolation from one data point. Dr. Crumrine contends that his estimate is conservative because it gives Rockwell the benefit of peak efficiency of the Hog House from 1945 to 1972, a fact known not to be true, and the most favorable discharge scenario for Rockwell from the period 1941 to 1945, when in actuality *no* system of any kind was in place to control oil discharges to the river. The estimate further does not account for PCB releases from other river outfalls at the Allegan facility, does not account for known seeps of oils to the river from Rockwell's sludge pit area, which area has tested positive for PCBs, and does not account for losses from the wastewater treatment ponds, which also tested positive for PCBs.²⁵

***826** Notwithstanding Dr. Crumrine's assertions as to the

conservative nature of his estimate, Plaintiff has produced no evidence that the two-day survey in 1967 was representative of Rockwell's daily activities over the thirty-two year period. Dr. Crumrine's estimate assumes, without evidentiary support, that Rockwell's daily oil use and discharges to the river remained constant—without evidence of how often the weir was cleaned, how thoroughly it was cleaned on March 10, 1965, or whether industrial oil usage remained constant.

A single measurement of a discharge, taken at a single location and point in time, should not be the basis for extrapolation to a multi-year time period, at least not without sufficient corroborative evidence that the single point was representative. See *Textron Inc. By and Through Homelite Div. v. Barber-Colman Co.*, 903 F.Supp. 1546, 1555 (W.D.N.C.1995) (where a claim rests on wastewater test results from one year, those test results are not significantly probative absent evidence indicating they are typical); *Renaud v. Martin Marietta Corp.*, 749 F.Supp. 1545, 1553 (D.Colo.1990), *affirmed* 972 F.2d 304, 308 (10th Cir.1992) ("It is unsound scientific practice to select one concentration measured at a single location and point in time and apply it to describe an 11-year period.").

Even if the Court were to assume that Dr. Crumrine's estimate of the volume of oils released is correct, the Court would still be faced with a matter of much greater concern—his estimate of the level of PCBs contained in that oil. Central to Dr. Crumrine's calculation was his assumption that the hydraulic oils used by Rockwell contained 50% PCBs, based upon Monsanto records showing that its PCB-containing hydraulic fluids contained 40–70% PCBs (400,000 ppm to 700,000 ppm).²⁶ Dr. Crumrine assumed that the cutting oils contained 5% PCBs (50,000 ppm), also based on Monsanto records. Dr. Crumrine's calculation assumes a level of PCBs that would be found in oils purchased from Monsanto for their PCB-containing quality. As noted earlier, the evidence does not support the assumption that all of the hydraulic and cutting oils purchased by Rockwell from 1940 to 1972 were Monsanto oils containing PCBs. In fact, this assumption is contradicted by the actual site data from the Rockwell property.

The Rockwell property rests on a layer of "light non-aqueous phase liquid," or "LNAPL." LNAPL is oil floating on groundwater. When oil is too heavy to float on the groundwater, it is called "dense non-aqueous phase liquid," or "DNAPL."²⁷ If the hydraulic oils used by Rockwell were 50% PCBs as posited by Dr. Crumrine, those oils would be denser than water, and would sink below the water, to be found as DNAPL deposits. No DNAPL has ever been detected on the Rockwell

property.²⁸

The highest concentration of PCBs found anywhere on the Rockwell property was 9 ppm of Aroclor 1254 found in the LNAPL. Aroclor 1254 was found in soil at concentrations of between .34 ppm and 1.6 ppm, and in the groundwater at concentrations of between 0.3 ppb and 3.5 ppb. Rockwell's expert, Mr. Barrick, testified convincingly that it is physically impossible, under the circumstances at the Rockwell property, for cutting oil with a PCB concentration of 50,000 ppm or a hydraulic oil with a concentration of 500,000 ppm to be reduced to the 9 ppm concentration found in the LNAPL on the property.²⁹ Mr. Barrick concluded that the low level PCBs found on Rockwell's property were more likely the result of the handling and spilling of oils that were incidentally contaminated with PCBs.

***827** This Court finds the opinion of Mr. Barrick more persuasive than the opinion of Dr. Crumrine. Based upon the low concentrations of PCBs found on the Rockwell property, it does not appear that Rockwell purchased PCB-containing hydraulic fluid from Monsanto. There is no basis for concluding that the oils used in manufacturing by Rockwell contained significantly greater proportions of PCBs than the concentrations found in the LNAPL. Plaintiff has presented no credible or persuasive scientific evidence by which to conclude that oils containing 5 to 50 % PCBs could be used regularly and discharged for thirty-two years and nevertheless yield LNAPL containing less than 10 ppm of PCBs.³⁰ By contrast, the effects of discharges from NCR paper are seen clearly everywhere in the river, by clear detections of significant amounts of PCBs, even though NCR paper contained only 3.4% PCBs.³¹ Based upon the evidence presented, the Court concludes that the oil in the LNAPL layer found on the Rockwell property is more characteristic of incidental PCB contamination in the oils used by Rockwell than a steady purchase of PCB-containing oils manufactured by Monsanto.³²

Thus, even if the Court were to accept Dr. Crumrine's assumptions regarding the volume of oil discharged, the PCBs associated with that volume would be far less than the figures suggested by Dr. Crumrine. If the Court were to assume PCB concentrations of 9.2 ppm, the highest concentration of PCBs found in Rockwell's LNAPL, there would be a release of approximately 8 pounds of PCBs. Even if the Court were to use the highest PCB concentration associated with Rockwell, the 35 ppm found in the sediment by the outfall from the Oil Floatation House, the total release would be approximately 16 to 20 pounds.³³

Assuming releases as Dr. Crumrine suggested, and

assuming approximately 50,000 pounds of PCBs in Lake Allegan, the PCB discharge by Rockwell at a concentration of 9.2 ppm PCBs, would yield a theoretical contribution of no more than .002% of the total mass of PCBs in Lake Allegan.³⁴ Alternatively, if the Court were to use the highest PCB detection near the Rockwell property, 35 ppm, it would yield a theoretical contribution of approximately .008%. In any event, such a contribution, if it occurred, is negligible and does not rise above background concentrations of PCBs in the river.³⁵

Plaintiff contends it is inappropriate to use the 35 ppm, or any other PCB level found on Rockwell's property, as the multiplier for calculating Rockwell's PCB contribution to the river because Rockwell discharged these oils to the river with these high levels of PCBs through discharge pipes without dilution.³⁶ Dr. Crumrine testified that the fact that lower concentrations were found on Rockwell's property is neither surprising nor uncommon, and is consistent with findings at other NPL sites where PCBs are found.

Dr. Crumrine's general reference to other sites where there was little contamination on the site itself, yet high concentrations of PCBs in an adjoining water body³⁷ is not sufficient to refute Mr. Barrick's explanation on why the relatively low level of PCBs on the ground, in the groundwater and in the LNAPL at Rockwell cannot be reconciled with the usage of 50% PCB-containing hydraulic fluids. Dr. Crumrine did not discuss any other sites where a comparison could be made with ***828** the PCBs in the LNAPL at Rockwell. Because PCBs adhere to the oils, it is unlikely that they would have been used in such high concentrations but would not be found in high concentrations in the LNAPL. Finally, Dr. Crumrine's estimate ignores evidence that from the early 1960s on, Rockwell began making increasing use of water-soluble oils that would be even less likely to contain PCBs.

For all these reasons, the Court rejects Dr. Crumrine's opinion that Rockwell released 5,000 to 10,000 pounds of PCBs to the Kalamazoo River. The Court finds more persuasive Mr. Barrick's estimate that the total PCBs released by Rockwell were not likely to have exceeded 20 pounds.

VII. Evidence of KRSB Members's PCB Use and Discharge

The four members of plaintiff KRSB have operated paper recycling mills conducting recycling and deinking operations, adjacent to the Kalamazoo River or Portage

Creek, within the NPL Site. Each of the mills owned by KRSG's members performed deinking or used carbonless copy paper as a component in their feedstock at some point in the past.³⁸ From the 1950s through the 1970s, carbonless copy paper was often found in office waste paper, and office waste paper provided the furnish for recycling operations by each of the plaintiff's member companies. The average content of Aroclor 1242 in carbonless copy paper was 3.4 percent (34,000 ppm).³⁹ Plaintiff's members have each contributed PCBs to the NPL Site in large quantities, on a regular basis, and over a long period of time, as a result of their deinking and paper recycling operations.⁴⁰ Plaintiff's principal expert, Dr. Mark Brown, conceded that it is likely that most of the Aroclor 1242 found in the river came from the paper recycling industry.⁴¹ NCR paper was not the only source of PCBs contributed by the paper companies. Printing inks and transformers also contained PCBs.

Any equitable allocation of clean-up costs must consider the relative volume of PCBs contributed by the various parties. The KRSG members admit that waste containing detectable levels of PCBs have been released from their paper-making facilities to either Portage Creek or the Kalamazoo River within the NPL Site. Plaintiff's proposed findings of fact and conclusions of law, however, contain no findings of fact with respect to the volume of PCBs discharged by its member companies. The Court is confounded by Plaintiff's request for an allocation of costs between its members and Rockwell, and its contemporaneous refusal to offer the Court any guidance with respect to one of the most important factors in such an allocation—the volume of PCBs released by its own members.

Defendant Rockwell has produced evidence with respect to PCB releases by Plaintiff's member companies. Because Plaintiff has offered no evidence to rebut the evidence produced by Rockwell on the issue of PCB discharges by Plaintiff's members, the Court relies heavily on Rockwell's findings of fact with respect to PCB contributions by the KRSG members.

The Court recognizes that Plaintiff is not seeking contribution from Rockwell for the remediation of the PCBs at Plaintiff's member's landfills or at the facilities themselves. ***829** The PCB contamination at these sites is nevertheless an important key to understanding the quantity of PCBs in the wastes generated by these operations and discharged into the river.

A. Allied Paper Company, Inc.

Of the four KRSG members, Allied Paper was the largest manufacturer. Allied operated three mills within the NPL Site: Bryant Mill, Monarch Mill and King Mill. These mills practiced deinking from the 1950s through 1971.⁴² During the 1950's and 60's Allied operated the largest waste paper deinking operation in the world.⁴³ The deinking capacity at the Allied mills complex was listed at 100 tons per day in 1960 and 1962, and at 350 tons per day in 1965.⁴⁴ As one of the largest paper manufacturing facilities, Allied probably discharged the most waste.⁴⁵

Prior to 1953, there was no wastewater treatment at Monarch. Wastewater was discharged directly into Portage Creek. Beginning in 1953, Monarch installed a clarifier, but the clarifier effluent was still discharged to Portage Creek upstream of Bryant Mill Pond.⁴⁶ From the mid-1950s on, the Bryant clarifier was also discharged to Portage Creek upstream of Bryant Mill Pond. It was not rerouted to the City's treatment plant until the early 1970s.⁴⁷ Throughout its operation, the King clarifier effluent was discharged to the Kalamazoo River through the King Highway storm sewer.⁴⁸ In 1961, Allied discharged 156,494 pounds per day of suspended solids to the Kalamazoo River and Portage Creek.⁴⁹ This data only reflects discharges from the clarifiers, and does not include suspended solids in waste waters that were bypassed directly to Portage Creek or the Kalamazoo River.

During the entire time that Allied was engaged in deinking, Allied experienced recurrent breakdowns with the operation of its various waste treatment systems. periodic bypasses of untreated waste from deinking operations occurred at each of the mills. Periodically, from the 1950's through the 1970's, MDNR staff and other witnesses observed bypasses of untreated wastes into Portage Creek and Bryant Mill Pond and observed the Pond itself to be a milky white color.⁵⁰

Allied disposed of its paper-making residuals at the Bryant Mill Pond, Bryant Sludge Beds, and Monarch Mill Pond landfills. The EPA has concluded that Allied's Bryant Mill Pond is the most important upstream source of PCB-contamination at the Site and to the Kalamazoo River.⁵¹ In seventy-four surficial samples throughout the Bryant Mill Pond, the average PCB concentration is 110 ppm. At the landfills operated by Allied, there were PCB concentrations as high as 2000 ppm in the residuals/soil samples.⁵² In 222 subsurface samples from the pond sediments, the average PCB concentration is 63 ppm.⁵³ At the Allied King Mill, PCBs were detected ***830** in the former lagoon at levels as high as 79 ppm.⁵⁴

The Bryant Mill ponds were drained in July 1972, washing sediments from it downstream, and contributing to the PCB enrichment of Portage Creek by exposing these sediments to additional water surface, erosion and decomposition.⁵⁵

In 1976 Bryant Mill Pond was again lowered, and sediments from the pond were washed downstream into the Kalamazoo River. Over a three week period, Portage Creek turned a gray-black color from pond sediments that were churned up and transported over the dam during the lowering process. During this time period, Portage Creek water samples showed PCB levels ranging between 92.7 to 292 ppb in the water traveling over the Alcott Street Dam toward the Kalamazoo River.⁵⁶

Sampling and analysis of floodplain sediment in the Bryant Mill Pond Area disclosed PCB-levels as high as 1,000 ppm with surface sediment concentrations exceeding 500 ppm.⁵⁷ In September 1999, because of the continuing risk to human health and the environment, the EPA removed 150,000 cubic yards of Bryant Mill Pond sediments within Portage Creek. Approximately 10 tons of PCBs were removed at this time. This was nearly double the amount of paper waste and PCBs expected to be found when EPA began the removal action.⁵⁸

In addition to releases of PCBs caused by deinking operations, the EPA filed a civil administrative action against Allied for leakage of PCBs from transformers in violation of the Toxic Substance Control Act.⁵⁹

B. Georgia-Pacific

The Georgia-Pacific mill in Kalamazoo, located on King Highway, in Kalamazoo, was formerly known as the Kalamazoo Paper Company. The company practiced deinking from the 1950s to the present.⁶⁰ Company records reveal that Georgia-Pacific de-inked up to 200 tons of waste paper per day. Georgia-Pacific ranked behind only Allied Paper in terms of the size of its deinking operations in the Kalamazoo River Valley.⁶¹ NCR carbonless copy paper comprised 10% of the furnish in one of Georgia-Pacific's deinking operations.⁶²

Prior to 1954, all industrial wastewater was discharged directly to the Kalamazoo River. In 1954, a primary treatment clarifier was installed. Until 1964, overflow from the clarifier went to the Kalamazoo River. From 1964 on, the effluent from Georgia Pacific's clarifier was

sent to the Kalamazoo Waste Water Treatment Plant. During most of the 1950's, Georgia-Pacific's paper residuals were pumped from the clarifier to adjacent sludge de-watering lagoons located along the river. In the late 1950's, the King Highway de-watering lagoons were constructed on the opposite side of the Kalamazoo River and paper sludge, at two to four percent solids, was pumped across the river via pipeline for *831 de-watering in the unlined lagoons.⁶³

Paper sludge was periodically excavated from the de-watering lagoons and disposed of at the Willow Boulevard landfill until 1975, when the landfill reached capacity. From 1975 to 1987, the paper sludge was disposed of at the landfill known as the Willow Boulevard/A-Site (an area formerly operated by Allied as de-watering lagoons). After this time, sludges were disposed of at the King Highway Landfill, a landfill created over the top of the old Georgia-Pacific de-watering lagoons.⁶⁴

There is no visible berm or storm water collection system at the Willow Boulevard Landfill. PCB-contaminated paper residuals have been identified in areas throughout the landfill and extend into the Kalamazoo River adjacent to the Landfill. PCB-contaminated paper residuals continuously erode from the Willow Boulevard Landfill into the Kalamazoo River.⁶⁵

PCB-contaminated sludges have also been identified in areas throughout the King Highway Landfill. Prior to the placement of a steel wall between the landfill and the river, PCB-contaminated paper residuals from the King Highway Landfill eroded into the river.⁶⁶ PCB-contaminated paper residuals are located in the King Highway storm sewer on the west boundary of the landfill, and extend into the Kalamazoo River. Evidence indicates that these PCB-contaminated residuals in the river originated from Allied's King Mill which utilized the storm sewer for its waste water discharges. The PCB-contaminated paper mill discharges from the King Highway storm sewer formed a paper sludge "delta" extending into the Kalamazoo River. The volume of these residuals is well over 33,000 cubic yards and contain PCB concentrations up to 190 ppm.⁶⁷ In 1996, PCBs were detected in four out of five surface samples from the former lagoon areas next to the old Georgia-Pacific clarifier in concentrations as high as 110 ppm.⁶⁸ PCBs were also detected in sediment from Georgia-Pacific's storm water drainage system, which discharges to the Kalamazoo River. PCBs were also detected in a remnant of waste water from the old Georgia-Pacific clarifier.⁶⁹

The Willow Boulevard Landfill operated by Georgia Pacific contains PCB levels in surface samples as high as

270 ppm, with an average of about 88 ppm, and subsurface PCB concentrations as high as 160 ppm, with an average of about 54 ppm.⁷⁰ There is no stormwater berm at the Willow Boulevard landfill, and therefore PCB-contaminated residuals in the landfill are a continuing source of PCBs to the Kalamazoo River. There are an estimated 1900 cubic yards of paper waste located in the river adjacent to the landfill.⁷¹ The maximum PCB concentration in paper residuals present in the river adjacent to the Willow Boulevard Landfill is 44 ppm with an average ***832** of 11 ppm.⁷²

PCB concentrations in the subsurface at the A-Site Landfill used by both Georgia Pacific and Allied are as high as 330 ppm, with an average detected concentration of about 55 ppm.⁷³ The King Highway Landfill operated by Georgia Pacific had subsurface concentrations as high as 310 ppm.⁷⁴

In 1999 Georgia Pacific excavated PCB-contaminated waste from five former sludge lagoons on its mill property including waste in a flood plain that extended into the Kalamazoo River, but declined to excavate paper waste located in the river. Georgia Pacific also declined to excavate PCB-contaminated paper residuals located in the river off of the King Street storm sewer. Accordingly, these wastes continue to release PCBs into the river.⁷⁵

C. Simpson–Plainwell Paper Company

The Simpson–Plainwell paper mill practiced deinking from 1910 through 1962 at its Plainwell, Michigan, mill. Various types of waste paper were recycled at the Simpson Mill, including office paper. An internal inquiry revealed that there were significant quantities of NCR type papers in the waste.⁷⁶ Wastewater was discharged directly into the Kalamazoo river until 1954, when a clarifier was installed. The clarified effluent was discharged into the Kalamazoo River.⁷⁷

In 1962 the Plainwell Mill listed deinking at 60 tons per day.⁷⁸ A document summarizing waste disposal practices through 1960 refers to a range of deinking volumes of 300 to 900 tons per month with suspended solids discharges to the river averaging 14,000 to 34,000 pounds per day.⁷⁹ PCBs were detected in samples from the end of a former discharge pipe from the Plainwell Mill at concentrations of 240 ppm.⁸⁰

Annual waste water reporting forms filled out by Simpson

for the MWRC during the 1970s, which reflect estimates of discharges of critical materials from Simpson’s outfalls to the Kalamazoo River, indicate annual discharges of PCBs ranging from less than 11 pounds to between 11 and 100 pounds.⁸¹

From the early 1950’s through the early 1980’s, Simpson used the 12th Street Landfill, located adjacent to the Plainwell Dam on the Kalamazoo River, for disposal of its paper residuals. PCBs have been detected in paper residuals located in areas throughout the Twelfth Street Landfill.⁸² The maximum PCB concentration at the site is 158 ppm, with an average of 19 ppm or 42 ppm.⁸³ No consistent berm or storm water collection system existed at ***833** the landfill. Although a berm has been constructed around the perimeter of the fill area of the 12th Street Landfill, the berm is constructed of paper residuals along with sand and gravel. Some PCB-contaminated sludges have been identified on the outside of the berm, on the banks of the Kalamazoo River and into the wetland area adjacent to the landfill.⁸⁴ PCB-contaminated residuals continue to erode into the river from the 12th Street Landfill through wind erosion and in areas where the river is in direct contact with paper sludge.⁸⁵

D. James River Paper Company

James River Corporation and its predecessors (KVP Sutherland and Brown Company) have operated two paper-making facilities along the Kalamazoo River since 1939. One is the Specialty Papers Division located in Parchment, Michigan (“Parchment Facility”), and the second is a box board manufacturing plant in Kalamazoo (“Kalamazoo Mill”). The Kalamazoo Mill also operated a deinking facility for a period of years during the 1970s.⁸⁶

From 1939 through the mid 1970s, all effluent from Mill No. 1 operations at the Parchment Facility was discharged directly to the Kalamazoo River after passing through a series of settling lagoons. A clarifier and sludge dewatering system was implemented at Parchment Mill No. 2 in the mid to late 1970s.⁸⁷ Prior to the late 1960s, treated wastewater from the Kalamazoo Facility was discharged to the Kalamazoo River.⁸⁸

The Kalamazoo Mill box board manufacturing plant used pulp made of 100% recycled waste paper as furnish in its operations.⁸⁹ PCBs were detected in nearly every sample taken of James River’s box board during the early 1970s

to mid-1970s.⁹⁰

The pulp mill used primarily office waste paper as furnish for its operations.⁹¹ On at least two particular days, 100% of the furnish for James River's pulp mill was NCR paper.⁹²

In 1976, James River conducted a study to determine PCB concentrations in samples of white and colored ledger waste paper used as furnish in its deinking mill. All of the samples taken contained PCBs, some with PCB levels as high as 6549.5 ppm, 9605.9 ppm, 6025.4 ppm, and 11,312.7 ppm.⁹³ In 1976 PCBs were detected in James River's vacuum filter solids at levels ranging between 12.7 and 125.7 ppm.⁹⁴ Vacuum filter solids are the paper residuals or sludge that was sent to the landfill.⁹⁵ On March 13, 1977, the vacuum filter solids had PCB levels of 180.6 ppm.⁹⁶ As Frank Yankoviak, James River's Technical Director, stated in a memorandum describing *834 the study of furnish for the mills: "These results indicate that there is a considerable amount of PCB's coming in through our waste paper furnish."⁹⁷

The paper residuals from both the Kalamazoo Mill and the Parchment Mill were deposited in James River's landfill at the Parchment Mill located near the Kalamazoo River. In 1987, the MDNR detected PCBs in soil/sludge samples from James River's landfill.⁹⁸ PCBs were detected in the pulp generated at James River's deinking mill at levels ranging from a trace up to 110 ppm.⁹⁹

A reasonable inference can be made that PCBs were attached to the suspended solids in the effluent that the paper mills discharged to the Kalamazoo River. James River's comparison of PCB levels in clarifier influent, effluent and paper residuals (vacuum filter solids) from the James River clarifier prompted a James River employee to note that the concentration of PCBs generally follows the trend of suspended solids in the effluent: the higher the suspended solids, the higher the PCBs.¹⁰⁰

E. Total contributed by Plaintiff's members

An expert retained by Georgia-Pacific Corporation, Richard B. Valley, prepared a report in 1990, estimating amounts of PCBs discharged by the paper mills during the period from 1960 to 1979. Mr. Valley estimated that Allied discharged between 895,000 and 1,790,000 pounds of PCBs; Georgia-Pacific discharged between 560,000 and 1,120,000 pounds of PCBs; James River discharged between 512,000 and 1,025,000 pounds of PCBs; and Simpson discharged between 254,000 and 507,000

pounds of PCBs.¹⁰¹ According to Mr. Valley, 90% of the PCBs entering the mills went out in the effluent.¹⁰²

Not all of those quantities are at issue in this allocation action. The focus of this action is only on those PCBs in the relevant portions of the Kalamazoo River and Portage Creek. In 1997 the MDEQ estimated that approximately 350,000 pounds of PCBs are present at the NPL Site.¹⁰³ In the spring of 1998 Dr. Brown calculated the volume of PCBs in the river to be approximately 120,000 pounds in the riverbed from Portage Creek downstream.¹⁰⁴ He acknowledged, however, that taking into account the roughness of the estimate, the range of volume of PCBs could be from 60,000 to perhaps 240,000 pounds.¹⁰⁵ Dr. Brown's estimate does not include the PCBs in KRSB members' landfills and historical lagoons, many of which are a continuing source of new PCBs to the river and creek.¹⁰⁶ Dr. Brown has conceded that Plaintiff's PCB-containing residuals in the operable units, some of which continue to erode and leak into the river today, exceed one million cubic yards, and are "probably a little less than" three million cubic yards.¹⁰⁷

*835 The evidence is uncontradicted that Plaintiff's members deinked or recycled large quantities of NCR carbonless copy paper, and that as a result of that activity PCBs entered their waste streams. Based upon the presence of high concentrations of PCBs in all of Plaintiff's members' landfills, lagoons, clarifiers, and Plaintiff's members' practice of discharging effluents with suspended solids directly to the Kalamazoo River, this Court concludes that PCBs were present in Plaintiff's members' effluent to the Kalamazoo River. This Court also concludes that this history, together with the current volume of PCBs in the river, and the ongoing erosion of PCBs from the landfills located on the edge of the river, supports the conclusion Plaintiff's members contributed massive amounts of PCBs to the NPL Site, the Kalamazoo River and Portage Creek. Based upon the limited evidence presented, this Court cannot begin to arrive at a precise figure regarding the volume of PCBs contributed by KRSB members that are still in the river. Nevertheless, based upon the Valley Report, the MDNR estimates, and Plaintiff's failure to present any evidence on the quantity of its members' PCB contributions to the river, the Court concludes that Plaintiffs' members are responsible for hundreds of thousands of pounds of PCBs in the river.

VIII. Evidence from the Fish

Plaintiff seeks a finding that because the Aroclor 1254

bioaccumulation rate in fish is three to four times greater than the bioaccumulation rate of Aroclor 1242, and because PCBs in fish are driving the investigation and clean-up at the Site, Rockwell's PCB releases are more toxic than plaintiff's release by a factor of between three and four.

Since 1977 the Michigan Department of Community Health has placed a fish advisory/ban on portions of Portage Creek and the Kalamazoo River, due to elevated levels of PCBs in fish.¹⁰⁸ Dr. Brown testified that roughly half the PCBs in the Kalamazoo River fish along the main stem are associated with or derived from Aroclor 1254. He contends that this figure contrasts dramatically to fish collected from Bryant Mill Pond, which, in his opinion, reflects what the fish would look like if only the paper industry had discharged PCBs to the system.¹⁰⁹

Yet, on cross-examination, Dr. Brown testified that there are components in fish in Bryant Mill pond that come from 1254 and 1260.¹¹⁰ He also conceded that there was a highly variable ratio of Aroclors 1242 and 1254 in the fish from Bryant Mill Pond.¹¹¹ He acknowledged that there is a toxic contribution of both lighter and heavier Aroclors all along the river, both upstream and downstream of Rockwell.¹¹² In fact, he stated that there is no significant difference in the relative amounts of lighter and heavier Aroclors from Kalamazoo to Lake Allegan.¹¹³ Aroclor 1254 is found in the fish in Morrow Lake which is upstream of Rockwell.¹¹⁴

According to Mr. Barrick, fish studies do not indicate any additional bioaccumulation of 1254 in the area of Rockwell.¹¹⁵ Dr. *836 Brown agreed that the fish data support the conclusion that there is no real change in the PCB fingerprint along the Kalamazoo River.¹¹⁶ The fish data also does not provide any evidence of a discernible source of PCBs downstream of the confluence of Portage Creek and the Kalamazoo River.¹¹⁷

Because there is no evidence of elevated levels of PCBs in the fish downstream of Rockwell, the fish do not provide evidence that Rockwell contributed significant or measurable amounts of PCBs to the river.

Plaintiff nevertheless relies on evidence that more highly chlorinated PCB mixtures (those with higher molecular weights) are more carcinogenic than lower chlorinated PCB mixtures. Moreover, higher molecular weight PCBs bioaccumulate in fish in quantitatively higher levels than lower molecular weight PCBs. Given exposure to equal amounts of Aroclors 1242 and 1254, fish bioaccumulate three to four times more of Aroclor 1254 than Aroclor 1242. PCB levels in fish are one of the driving forces in determining the need for environmental responses in the

Kalamazoo River and other aquatic PCB sites. This is because PCBs may be introduced into the food chain when fish are consumed by animals, and, potentially, by humans. Plaintiff contends that because Aroclor 1254 is more toxic than 1242, a smaller contribution of Aroclor 1254 should be weighted more heavily than an equal contribution of Aroclor 1242.

On the other hand, there is also evidence in the record that Aroclor 1242 contains a particularly toxic congener, known as Congener 77. That congener makes up a greater percentage of 1242 than it does of 1254 (in which it is also found, but in smaller amounts).¹¹⁸

The MDEQ establishes regulatory criteria and fish advisories based upon the presence of total PCBs. It does not distinguish between Aroclors, such as Aroclor 1242, Aroclor 1254, and Aroclor 1260.¹¹⁹ The regulatory bodies have apparently decided that because toxic congeners are found in each of the Aroclors, there was no basis for distinguishing among the Aroclors.¹²⁰ No evidence was presented on the relative toxicity between the higher weight 1254 and the concerns associated with Congener 77 which are more prevalent in Aroclor 1242, leaving this Court without the ability to weigh these two competing toxicity factors. Accordingly, this Court will follow the regulatory bodies, and will treat all PCBs on an equal basis. The Court will not weigh any particular Aroclors higher than others.

IX. Evidence of PCBs in the River

Notwithstanding the overwhelming evidence of Plaintiff's members' contribution of large quantities of PCBs to the river, or perhaps because of that evidence, Plaintiff has attempted to shift this Court's focus from Aroclor 1242 to Aroclor 1254 and from the entire ninety-five mile length of the Kalamazoo River at issue in this case to Lake Allegan, at the most downstream end of the Site.

Plaintiff contends that its members contributed only very minor amounts of Aroclor 1254 to the river. In support of this contention Plaintiff directs the Court's attention to the Aroclor 1242/1254 ratio in the controlled environment of Bryant Mill Pond, where the predominant source was one of Plaintiff's paper mill members. The ratio of Aroclor 1242 to 1254 in Bryant Mill Pond is more than 20 to 1, while the ratio of Aroclor 1242 to 1254 in the sediments in the Kalamazoo River is much lower, between 4 to 1 and 6 to 1.

Because there is no evidence to show that Allied is typical

of all of KRSB's *837 members, the Court is reluctant to accept Dr. Brown's assertion that the PCB levels in Bryant Mill Pond is typical of the PCB discharges of all four paper companies.

Moreover, although Plaintiff asserts that its members contributed only minor amounts of Aroclor 1254 to the river, Plaintiff has offered the Court no evidence to enable the Court to determine the nature or extent of its members' release of Aroclor 1254. There is no question that Plaintiff's members contributed some quantities of Aroclor 1254 to the river as Aroclor 1254 was found in each of the Plaintiff's members' landfills, lagoons and/or clarifiers.¹²¹

Even if Plaintiff's comparison of the Aroclor 1242/1254 ratio in Bryant Mill Pond to the 1242/1254 ratio in the river might suggest releases of Aroclor 1254 by entities other than the KRSB members, it does not suggest any contribution of 1254 by Rockwell. There are other sources of Aroclor 1254 to the river, including plaintiff's member mills, the Auto Ion site upstream of Rockwell, the Publicly-Owned Treatment Works for the cities of Allegan, Otsego, Plainwell and Kalamazoo, upstream of Rockwell, as well as existing background levels of 1254.¹²² It is well established that the ratio of Aroclor 1242 to 1254 in the river sediments upstream and downstream of Rockwell are approximately the same. If Rockwell had released significant quantities of PCBs to the river, those PCBs would have increased the ratio of Aroclor 1254 to Aroclor 1242. Sediment samples from the length of the river evidenced no increase in concentration of 1254 below the Rockwell facility.¹²³ In fact, the highest concentrations of 1254 are upstream of the Rockwell facility.¹²⁴ In sediment samples taken upstream of Rockwell and downstream of Rockwell, a comparison of the gas chromatographic "fingerprints" indicates that the ratio of Aroclor 1242 to Aroclor 1254 is relatively constant, averaging between four and six parts Aroclor 1242 to one part Aroclor 1254 (4:1 to 6:1), indicating again that there was no measurable, independent release of PCBs from the Rockwell plant.¹²⁵

If the only evidence before the Court were the gas chromatographs, the Court might find that that evidence, standing alone, was not sufficiently precise to reflect small, but still significant contributions to the river. The gas chromatographs, however, do not stand alone. They are confirmed by the other evidence in this case. As noted above, the evidence from the Rockwell plant, tends to show a very small contribution of PCBs. The minimal nature of Rockwell's PCB contribution is also confirmed by 300 samples of river sediment taken from between the Rockwell plant and Lake Allegan.

At the conclusion of the Phase I trial, this Court opined that there was insufficient evidence of sampling from depositional areas where PCBs from Rockwell's oils would be expected to have come to *838 rest, to support Mr. Barrick's conclusion that Rockwell's introduction of Aroclor 1254 to the river had no impact. After the Phase I trial Rockwell arranged for further examination of the river environment by a geologist, a geomorphologist, and Mr. Barrick. Depositional areas of the river in which oils would be expected to accumulate downstream of Rockwell were identified. Mr. Barrick then conducted sampling in these depositional areas.¹²⁶

Mr. Barrick analyzed 300 river sediment samples between Rockwell and Lake Allegan.¹²⁷ Very few of the 300 samples collected downstream of Rockwell had elevated levels of 1254; the highest absolute concentrations of Aroclor 1254 are *upstream* of Rockwell; and there was no increase in absolute concentrations of Aroclor 1254 at or near Rockwell.¹²⁸ In addition, Mr. Barrick's analysis showed no correlation between the observable presence of oil and concentrations of Aroclor 1254. Higher concentrations of Aroclor 1254 were found in the samples having the *least* petroleum odor, tending to show that the Aroclor 1254 in these sediments came from non-petroleum sources upstream of Rockwell.¹²⁹

In one area 1.7 miles downstream of Rockwell, one core, BR-27, showed elevated levels of 1254: Aroclor 1254 increased from the surface at concentrations of 190 ppb to a location 2½ to 3 feet below the surface where the concentrations increased to 10 ppm, and then below that they decreased.

Plaintiff contends that BR-27 and elevated Aroclor 1254 detections in at least a half dozen sediment samples within 1.7 river miles of Rockwell's Allegan facility¹³⁰ confirm that Rockwell's PCB discharges made a significant contribution to the PCBs currently in river sediments.

According to Mr. Barrick, the sample at BR-27 was an anomaly. What makes BR-27 unique is not just the amount of 1254, but the high ratio of 1254 to 1242.¹³¹ Its fingerprint was unlike any other samples upstream or downstream.¹³² Barrick attributes the "anomalous" BR-27 sample to some unknown local source or dumping in that area.¹³³

The additional sampling and analysis conducted by Rockwell's consultant more than adequately addresses the Court's previous concern about the representative nature of the sampling. The Court concludes that the sampling of the river and the analysis by Mr. Barrick reflect sound scientific methodology and yield reliable results. This

Court is satisfied that BR-27 does not confirm a significant contribution of Aroclor 1254 by Rockwell. If Rockwell had been a significant source of 1254 to the river, there would be a number of findings like those at BR-27, showing an elevated ratio of 1254 to 1242. It is implausible that a discharge from Rockwell would be reflected in only one sample location (BR-27), while no evidence of such a discharge is seen in any of the other 299 sediment samples between Rockwell and Lake Allegan.

The absence of an increase in 1254 downstream of Rockwell constitutes credible and persuasive evidence that the former Rockwell Allegan facility is, at best, ***839** an inconsequential source of PCBs to the Kalamazoo River.

By contrast, the PCB contribution by Plaintiff's members is very large. Plaintiff has admitted that its members are responsible for most of the Aroclor 1242 in the river. Assuming Plaintiff is responsible for all of the 1242 and none of the 1254, and assuming the accuracy of the MDEQ's estimate that there are 350,000 pounds of PCBs in the river sediments, at a 4:1 ratio of 1242 to 1254, Plaintiff's members would be responsible for 280,000 pounds of PCBs. At a 6:1 ratio, Plaintiff's members would be responsible for 300,000 pounds.

VI. Cooperation

The final Gore factor the parties contend is significant to the Court's analysis in this allocation action is "the degree of cooperation by the parties with Federal, State, or local officials to prevent any harm to the public health or the environment." *See Meyer*, 932 F.2d at 571.

As evidence of Rockwell's recalcitrance, Plaintiff focuses on evidence that Rockwell historically engaged in improper oil disposal practices, and evidence that Rockwell and the EPA have had disagreements over the Rockwell Superfund Site, to the extent that the EPA has retaken control over the Rockwell Superfund Site for purposes of conducting the remedial investigation.

The Court does not find that the evidence of Rockwell's historical disposal practices is of much significance in this action. The paper companies had similar histories of discharging suspended solids directly to the Kalamazoo River in excess of their MWRC permits. Historical discharge practices is not a factor that weighs against one party more than another.

There is also no evidence that Rockwell has refused to cooperate with the MDNR or the EPA on the site at issue in this case, as Rockwell has not been named a PRP. As to the disagreements between Rockwell and the EPA over the Rockwell Superfund Site, the Court finds that such disagreement has little relevance to this action. PCBs are not the focus of that action. To the extent the issue of PCBs has come up in connection with Rockwell's own Superfund Site, the issue is minuscule compared with the continued release of PCBs from Plaintiff's members' OUs where the level of PCBs is higher and the continued release of PCBs is well documented and continuing.

Finally, the Court notes that in June 1999 the MDEQ advised that the data submitted by KRSG was insufficient to develop an appropriate understanding of contaminant distribution across the study area.¹³⁴ The MDEQ expressed concern that KRSG's sampling techniques may have introduced a bias into the results by sampling more in free-flowing reaches of the river where PCB concentrations are low, and less in impounded areas where PCB concentrations are higher. The MDEQ stated that it currently did not have "sufficient information regarding sediment volume and PCB mass from the site to develop appropriate remedial options."¹³⁵

Dr. Brown testified in November 1999 that the additional work requested by the MDEQ was scheduled to begin the following week.¹³⁶ Earlier, Dr. Brown testified that he had been instructed by KRSG not to calculate the amount of PCBs in the Kalamazoo River on a mass basis and not to calculate the mass contributions of PCBs by any of KRSG's members.¹³⁷ It appears to this Court that KRSG has avoided or delayed undertaking a thorough analysis of its own contribution of PCBs as part of its strategy in this suit of minimizing ***840** the extent of its members' PCB contributions.

Because the Court finds a lack of full cooperation by both parties, the Court concludes that the cooperation factor does not weigh in favor of one party more than another.

Conclusion

In resolving Plaintiff's contribution claim against Rockwell, the Court may allocate response costs using such equitable factors as the court determines are appropriate. 42 U.S.C. § 9613(f). In this action the Court finds that the most important Gore factor is the quantity of PCBs released.

The Court recognizes that this case presents the not uncommon situation where companies have disposed of waste without knowing its contents. *See B.F. Goodrich*, 99 F.3d at 526. This is true of the KRSG members as well as Defendant Rockwell. In such cases, because the parties lack direct evidence of the fact that others have dumped hazardous wastes, or of the amount of hazardous wastes that were dumped, the Court must rely on circumstantial evidence in order to accomplish the broad, remedial purpose of CERCLA. *Id.*

Although Plaintiff is not required to prove its case with direct evidence or with mathematical precision, it still has the burden of proving its equitable right to contribution by a preponderance of the evidence. *Id.*

Because this Court has determined that quantity is the most important allocation factor in this case, the allocation analysis must begin with an estimate of the quantity of hazardous wastes at issue, and then proceed to a determination of the parties' relative contributions to that total amount.

Plaintiff has produced almost no evidence to enable the Court to begin its analysis. The figures Plaintiff has provided are not consistent or helpful. The Court is left with little to begin with beyond the undisputed fact that the recycling and deinking of office paper, which included carbonless copy paper from the mid-1950s to the mid-1970s, is the major cause of PCB contamination at the Site. Plaintiff's landfills are a continuing source of PCBs to the river. The PCB concentration in those landfills frequently exceeds 100 ppm. Based upon the varied estimates presented and Plaintiff's failure to

present any evidence contradicting or clarifying the rough estimates, the Court concludes that KRSG's members are responsible for releasing hundreds of thousands of pounds of PCBs to the Site.

Balanced against Plaintiff's members' overwhelming contribution of PCBs, is the evidence regarding Rockwell's contribution. For all the detail Plaintiff has presented on Rockwell's historical release of oils to the river, Plaintiff has presented little credible evidence on the quantity of PCBs contained in that oil. Given the low levels of PCBs on the Rockwell property, and the fact that the river sediments and the fish tend to show no significant contribution by Rockwell, the Court finds that Rockwell's PCB contribution was very minimal, particularly in contrast to the contribution by Plaintiff's members. Rockwell's PCB contribution did not exceed background levels and would not in itself have resulted in a need for remediation of the Kalamazoo River.

Having considered the equities in this case, the Court concludes that Rockwell should not be required to contribute to the remediation of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. The PCB releases by Plaintiff's members are more than sufficient to justify imposing on Plaintiff the entire cost of response activities relating to the NPL Site.

All Citations

107 F.Supp.2d 817, 51 ERC 1396

Footnotes

¹ Plaintiff KRSG's claims against Defendants Benteler Industries, Inc., Upjohn Company, Menasha Corporation, and two of Eaton's facilities were dismissed pursuant to orders granting summary judgment dated February 21, 1997, March 6, 1998, and June 30, 1998. Plaintiff's claims against Wells Aluminum Corporation and Hercules, Inc. were dismissed pursuant to stipulations and orders dated January 20, 1998, and July 16, 1998. Plaintiff's claims against Rock-Tenn Company, were dismissed on September 28, 1998, pursuant to a settlement agreement between the parties.

² AOC, at 2, Tr. Ex. 8803.

³ MDEQ 3/19/97 Briefing Report, Tr. Ex. 8810.

- ⁴ AOC at 2, Tr. Ex. 8803.
- ⁵ *Id.* at 3–4.
- ⁶ *Id.* at 4–5.
- ⁷ *KRSG v. Rockwell*, 12/8/98 Opinion at 41–42.
- ⁸ *Id.*
- ⁹ Dr. Mark P. Brown testimony, 11/9–10/99 at 20, 30–31; Blasland Bouck & Lee Costs, Tr. Ex. 4228.
- ¹⁰ Brown testimony 11/10/99 at 102–03; Lettinga & Associates September 1999 Invoice, Tr. Ex. 5650.
- ¹¹ Versar, Inc., *PCBs Involvement in the Pulp and Paper Industry*, (Feb.1977) at 2. Tr. Ex. 8017.
- ¹² *Id.*
- ¹³ Richard B. Valley, *Sources of PCB Contamination in the Kalamazoo River*, (July 23, 1990), at 1, Tr. Ex. 8804.
- ¹⁴ *Id.* at 3.
- ¹⁵ Brown testimony, 8/10/98 at 77–79.
- ¹⁶ Robert C. Barrick testimony, 11/10/99, at 27–28.
- ¹⁷ Results from MDNR Industrial Wastewater surveys of March 22–23, 1976, and June 9–10, 1986, Tr. Exs. 5012, 5014, 5025 & 5027.

- ¹⁸ Shafer letter of November 30, 1993, at 2, Tr. Ex. 1267.
- ¹⁹ Barrick testimony, 11/10/99, at 44, 88–89.
- ²⁰ Dr. Kenneth Z. Crumrine testimony, 11/8/99, at 50–51, 75–92, 99; Tr. Exs. 1239, 1241, 1128, 1407, 1408, 1410 & 1411.
- ²¹ MWRC Report of Survey at Rockwell, March 9–11, 1965, Tr. Ex. 1064.
- ²² Crumrine testimony, 11/8/99, at 76.
- ²³ Dr. Crumrine estimated that Rockwell used 40,000 gallons of hydraulic fluid and 20,000 gallons of cutting fluid per year. He calculated a total usage of 1,920,000 gallons of oil over the 32 year period. Crumrine testimony, 11/8/99, at 85–88.
- ²⁴ Crumrine testimony, 11/8/99 at 94–102.
- ²⁵ Crumrine testimony, 11/8/99, at 63–73, 169–71.
- ²⁶ *Id.* at 92–93.
- ²⁷ Barrick testimony, 11/10/99, at 101.
- ²⁸ *Id.*
- ²⁹ *Id.* at 102–104.
- ³⁰ *Id.* at 102–104.

- ³¹ See Versar Report, at 2–3, Tr. Ex. 8017.
- ³² Barrick testimony, 11/10/99, at 102.
- ³³ *Id.* at 113.
- ³⁴ *Id.* at 114–15.
- ³⁵ *Id.* at 112–115.
- ³⁶ Crumrine testimony, 11/8/99, at 178–79.
- ³⁷ *Id.* at 179.
- ³⁸ Hanson dep. at 28–30 (Georgia–Pacific); Gilman 6/20/97 dep. at 30–31, 107–108 (Allied); Huisman dep. at 24–25 (James River); Lawton dep. at 72–75 (Simpson); Brown Company (predecessor of James River) memoranda of 6/14/76 & 6/21/76, Tr. Ex. 8012 & 8013.
- ³⁹ Versar Report, Tr. Ex. 8017.
- ⁴⁰ Brown testimony, 8/10/98, at 112–43; MDEQ August 1997 Information Packet re Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, Tr. Ex. 8811; EPA April 17, 1998 Action Memorandum, Tr. Ex. 8812; EPA May 28, 1998 Addendum to Action Memorandum, Tr. Ex. 8813.
- ⁴¹ Brown testimony, 8/10/98, at 91–92.
- ⁴² Technical Memorandum 15, pp. 1–1—1–6, Tr. Ex. 8715.
- ⁴³ Allied 1960 Document for Distributors, at 3, Tr. Ex. 8236.

- 44 Valley Report, at 4, Tr. Ex. 8804.
- 45 Brown testimony, 8/11/98, at 136–37.
- 46 Falvey dep. at 11–23.
- 47 Falvey dep. at 39–43.
- 48 Falvey dep. at 27–30.
- 49 Chart of suspended solids—pounds/day, Tr. Ex. 8232.
- 50 Kalamazoo Inter–Office Correspondence, January 20, 1958, Tr. Ex. 8202; MWRC correspondence and memoranda of August 2, 1961, May 28, 1965, June 16, 1965, July 14, 1970, November 19, 1975, and March 21, 1983, Tr. Exs. 8205, 8207, 8208, 8209, 8214, & 8222.
- 51 EPA May 28, 1998, Addendum to Action Memorandum, at 2, Tr. Ex. 8813.
- 52 Draft Technical Memorandum 7, at 34 and Table 3–10, Tr. Ex. 8719.
- 53 *Id.* at 35; Brown testimony, 8/11/98, at 117–119.
- 54 Brown testimony, 8/11/98, at 135; Technical Memorandum 15, Table 3–10, Tr. Ex. 8715.
- 55 Allied Paper Mill Outfall Data, MWRC, January 1973, at KB00203511, Tr. Ex. 8235.
- 56 Allied May 11, 1976 letter to MDNR, Tr. Ex. 8216. *See also* Falvey dep. at 135; Harvey dep. at 133; Brooks dep. at 97–98; Cornelius dep., Sept. 8, 1997, at 36–37.
- 57 EPA April 17, 1998, Action Memorandum, at 2, Tr. Ex. 8812.

- ⁵⁸ EPA Action Memorandum and Addendum re Removal Action, Tr. Exs. 8812 & 8813; Cornelius dep., 10/12/99, at 15–20.
- ⁵⁹ 1981 Versar Report on PCB Inspection of Allied’s facility, Tr. Ex. 8220; 1982 EPA Complaint, Tr. Ex. 8221.
- ⁶⁰ Technical Memorandum 15, p. 1–1, Tr. Ex. 8715.
- ⁶¹ Valley Report, at 4, Tr. Ex. 8804.
- ⁶² Hanson dep. at 27–30.
- ⁶³ Technical Memorandum 15, at 1–1 and 1–2, Tr. Ex. 8715.
- ⁶⁴ Technical Memorandum 15, at 1–1 and 1–2, Tr. Ex. 8715; Cornelius dep. 10/12/99, at 26–31.
- ⁶⁵ Technical Memorandum 9, at 39, Tr. Ex. 8738; Cornelius dep., 9/8/97, at 26–29, 102–114; Cornelius dep., 10/12/99, at 26–31.
- ⁶⁶ Cornelius dep., 10/12/99, at 34.
- ⁶⁷ Technical Memorandum 15, at 2–5, Tr. Ex. 8715; Technical Memorandum 6, at 29–31 & Table 3–9, Tr. Ex. 8725; Cornelius dep., 10/12/99, at 35–38.
- ⁶⁸ Brown testimony, 8/11/98, at 132–33; Technical Memorandum 15, Table 3–2, Tr. Ex. 8715.
- ⁶⁹ Brown testimony, 8/11/98, at 133; Technical Memorandum 15, at 3–1—3–2, Tr. Ex. 8715.
- ⁷⁰ Brown testimony, 8/11/98, at 126–27; Technical Memorandum 9, p. 24, and Table 3–11, Tr. Ex. 8738.

- ⁷¹ Brown testimony, 8/11/98, at 126–28; Cornelius dep., 9/8/97, at 26; Technical Memorandum 9 at 25, 39, Tr. Ex. 8738.
- ⁷² Technical Memorandum 9, at 25, Tr. Ex. 8738; Brown testimony, 8/11/98, at 126; Cornelius dep., 9/8/97, at 26, 103–104.
- ⁷³ Brown testimony, 8/11/98, at 127; Technical Memorandum 9, at 24 and Table 3–9, Tr. Ex. 8738.
- ⁷⁴ Brown testimony, 8/11/98, at 128–30; Technical Memorandum 6, Table 3–9, Tr. Ex. 8725.
- ⁷⁵ Cornelius dep., 10/12/99, at 41–43, 46–47. Brown testimony, 11/10/99, at 58–59.
- ⁷⁶ Lawton Dep. at 72–75.
- ⁷⁷ Technical Memorandum 15, p. 1–2, Tr. Ex. 8715.
- ⁷⁸ Valley Report, at 4, Tr. Ex. 8804.
- ⁷⁹ Hamilton Paper Company Report on Waste Disposal, 1947 to July 1960, Tr. Ex. 8600.
- ⁸⁰ Brown testimony, 8/11/98, at 134–35; Technical Memorandum 15, Table 3–5, Tr. Ex. 8715.
- ⁸¹ MWRC Wastewater Outfall Reports, Tr. Exs. 8617 & 8619.
- ⁸² MDEQ July 1997, Proposed Plan Fact Sheet, 12th Street Landfill, at 3, Tr. Ex. 8616; Brown testimony, 11/10/99, at 59–61.
- ⁸³ MDEQ July 1997, Proposed Plan Fact Sheet, 12th Street Landfill, at 4, Tr. Ex. 8616; Brown testimony, 8/11/98, at 131–32; Technical Memorandum 8, at 4–6 and Table 3–8. Tr. Ex. 8615.

- ⁸⁴ Cornelius dep., 9/8/97, at 30–33, 119–128; Lawton dep. at 63–72; 1989 letter re PCB testing of landfill, Tr. Ex. 8611; Technical Memorandum 8, at 3–12 to 3–13, 6–1 to 6–2, Table 3–8 Tr. Ex. 8615; MDEQ July 1997 Proposed Plan Fact Sheet, Tr. Ex. 8616; Brown testimony, 8/11/98, at 132.
- ⁸⁵ Cornelius dep., 10/12/99, at 49–51.
- ⁸⁶ Ferguson dep. at 14–16; Nitz dep. at 38–39.
- ⁸⁷ James River June 9, 1972 interoffice correspondence, Tr. Ex. 8000; Ferguson dep. at 18.
- ⁸⁸ Zinkus dep. at 19.
- ⁸⁹ Ferguson dep. at 14–16.
- ⁹⁰ Huisman dep. at 21–22; Nitz dep. at 30–33; James River letter of 10/19/81 re PCB Data, Tr. Ex. 8022.
- ⁹¹ Nitz dep. at 38–39.
- ⁹² 1976 lab reports re PCBs in Brown Company effluent, Tr. Ex. 8007, at KJ 01000022.
- ⁹³ Brown Company memoranda of June 14 and June 21, 1976, Trial Exs. 8012 & 8013.
- ⁹⁴ Brown Company August 1976 lab report, Tr. Ex. 8015. *See also* Brown Company September 1976 lab report, Tr. Ex. 8016.
- ⁹⁵ Huisman dep. at 99–101, 122–24.
- ⁹⁶ Brown Company 4/7/77 inter-office correspondence and lab report, Tr. Ex. 8018.
- ⁹⁷ Brown Company 6/21/76 inter-office correspondence, Tr. Ex. 8013.

- ⁹⁸ MDNR 8/18/87 letter to James River re PCB sampling data, Tr. Ex. 8023.
- ⁹⁹ April 2, 1976 lab report on PCB sample, Tr. Ex. 8009; Huisman dep. at 53–67, 43–49, 102–106.
- ¹⁰⁰ Barrick testimony, 8/14/98, at 118–21; Brown Company lab reports, comparing PCB levels in clarifier influent, effluent and paper residuals/vacuum filter solids, Tr. Exs. 8008, 8015, & 8016; Brown Company Inter–Office Correspondence of 2/17/76 re PCB testing of effluent, Tr. Ex. 8008.
- ¹⁰¹ Valley Report, Appendix A, at i–ii, Tr. Ex. 8804.
- ¹⁰² *Id.* at i.
- ¹⁰³ March 1997 MDEQ Briefing Report prepared by Scott Cornelius, Tr. Ex. 8810.
- ¹⁰⁴ Brown testimony, 8/11/98, at 106–07.
- ¹⁰⁵ *Id.* at 107–08.
- ¹⁰⁶ *Id.* at 108–109.
- ¹⁰⁷ *Id.* at 109.
- ¹⁰⁸ EPA May 28, 1998 memorandum, at 4–5, Tr. Ex. 8813. In 1998 the U.S. Department of Interior’s Fish and Wildlife Service reported that bald eagles who prey on the fish in the river had not been able to reproduce successfully for at least the past seven years. A bald eagle egg collected in 1994 contained PCBs at 102 ppm. EPA Action Memorandum and Addendum to Action Memorandum, April 17, 1998, p. 10 and May 28, 1998, at 4, Trial Ex. 8812 & 8813.
- ¹⁰⁹ Brown testimony, 11/9/99, at 41–42.

¹¹⁰ *Id.* at 75.

¹¹¹ *Id.* at 75.

¹¹² *Id.* at 76.

¹¹³ *Id.*

¹¹⁴ *Id.* at 77.

¹¹⁵ Barrick testimony, 11/10/99, at 83–86; Ratio of PCB components in carp fillet, Tr. Ex. 5643; Ratio of PCB components in whole sucker, Tr. Ex. 5644.

¹¹⁶ Brown testimony, 11/9/99, at 82.

¹¹⁷ *Id.* at 77–78, 82.

¹¹⁸ *Id.* at 70–71.

¹¹⁹ Barrick testimony, 11/10/99, at 87–88; Brown testimony, 11/9/99, at 73.

¹²⁰ Barrick testimony, 11/10/99, at 88.

¹²¹ Allied: Draft Technical Memorandum 7, Table 3–10, Tr. Ex. 8719; Technical Memorandum 15, Table 3–2, Tr. Ex. 8715; Brown testimony, 8/11/98, at 120–21; Cornelius dep., 9/8/97, at 84–86; Georgia–Pacific: Technical Memorandum 9, Table 3–11, Tr. Ex. 8738; Brown testimony, 8/11/98, at 130–33; Technical Memorandum 6, Table 3–9, Tr. Ex. 8725; Simpson–Plainwell: Cornelius dep., 9/8/97, at 123–25; Brown testimony, 8/11/98, at 132; Technical Memorandum 8, at 3–12–3–13 & Table 3–8, Tr. Ex. 8615; James River: MDNR 8/18/87 letter to James River re PCB sampling results, Tr. Ex. 8023.

¹²² Brown testimony, 11/9/99, at 58–61, 62–64, 64–69, 76.

- ¹²³ See Comparison of the ratios of Aroclor 1242:1254 concentrations in Kalamazoo River and Portage Creek, Tr. Ex. 5637; Comparison of Aroclors 1242:1254 ratios in Portage Creek and other locations downstream to Lake Allegan Dam, Tr. Ex. 5638.
- ¹²⁴ Barrick testimony, 11/10/99, at 76; Comparison of the ratios of Aroclor 1242:1254 concentrations in Kalamazoo River and Portage Creek, Ex. 5637.
- ¹²⁵ Barrick testimony, 11/10/99, at 70–71; Barrick testimony, 8/14/98, at 105–110; Illustrative charts comparing PCB fingerprints, Tr. Exs. 8919, 8920, & 8927.
- ¹²⁶ Barrick testimony, 11/10/99, at 33–36; Aerial photo showing probable depositional areas below Rockwell Facility, Tr. Ex. 5633.
- ¹²⁷ Barrick testimony, 11/10/99, at 29–32.
- ¹²⁸ Barrick testimony, 11/10/99, at 78.
- ¹²⁹ *Id.* at 52–54; Odor and/or sheen presence compared with PCB concentration in samples at different depths in sediment core RR–11, Tr. Ex. 5641.
- ¹³⁰ Between the Rockwell facility and BR–27, there were also samples with concentrations of Aroclor 1254 at levels of 4.7 ppm, 6.2 ppm, 4.5 ppm. Brown testimony, 11/10/99, at 142–46.
- ¹³¹ Barrick testimony, 11/10/99 at 74.
- ¹³² *Id.* at 75.
- ¹³³ *Id.* at 75–76.
- ¹³⁴ June 11, 1999 letter from Scott Cornelius of the Superfund Section of MDEQ’s Environmental Response Division to Dr. Brown, Tr. Ex. 5507.

¹³⁵ *Id.*

¹³⁶ Brown testimony, 11/9/99, at 50.

¹³⁷ Brown testimony, 8/11/98, at 104–05.