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S.C. SUPREME COURT

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF SOUTH CAROLINA
COLUMBIA DIVISION

Clyde Marcus Jones, II; Dennis Phillips, and Deborah Phillips, on behalf of themselves and all others similarly situated,

Plaintiffs,

v.

Duke Energy Corporation and Duke Energy Carolinas, LLC,

Defendants.

Civil Action No.: 3:24-cv-1281-MGL

FIRST AMENDED CLASS ACTION COMPLAINT AND DEMAND FOR JURY TRIAL

Plaintiffs Clyde Marcus Jones, Dennis Phillips, and Deborah Phillips, on behalf of themselves and all others similarly situated (collectively "Plaintiffs"), bring this Class Action Complaint and Demand for Jury Trial (the "Complaint") against Duke Energy Corporation, individually and as successor in interest to Catawba Power Company, Southern Power Company, Wateree Power Company, Great Falls Power Company, Western Carolina Power Company, Cincinnati Gas and Electric, and the Vanguard Group, Inc., and against Duke Energy Carolinas, LLC (collectively "Defendants" or "Duke Energy Defendants"). Plaintiffs hereby allege as follows:

NATURE OF THE ACTION

1. This is a civil action for compensatory and punitive damages owed to Plaintiffs and the Class as a result of the Duke Energy Defendants' repeated and continuous infringement of Plaintiffs' property rights by Defendants' dissemination of a group of toxic chemicals known as Polychlorinated Biphenyls ("PCBs").

2. PCBs are man-made, non-flammable chemicals with a high boiling point. Throughout the late nineteenth and early twentieth century, and due to their chemical properties, PCBs were used in many applications.

3. By the late 1960s, however, evidence had emerged linking PCB exposure to serious negative health effects in humans.

4. By the 1970s, the United States Environmental Protection Agency ("EPA") deemed PCBs a probable known human carcinogen and banned the manufacture of PCBs in the United States.

5. Even prior to that time, industrial users of PCBs knew or should have known of their dangers.

6. In addition to cancer, PCBs have been shown to pose substantial health risks, including adverse effects on the immune system, the reproductive system, neurological development, decreased thyroid hormone levels, and elevated blood pressure and cholesterol levels. *https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls#release*, last accessed November 19, 2024.

7. Once released, PCBs remain in the environment for long periods of time. They can accumulate in the environment and contaminate the bodies of fish and other small animals, causing people who eat such fish or other animals to be exposed to the toxic chemicals. *https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls#release*, last accessed November 19, 2024.

8. From 1923 until 2016, the Duke Energy Defendants operated the "oldest

continuous environmental program of any utility in the US, and one of the first in North America"[1] to eradicate mosquito populations on lakes, rivers, and waterways in South Carolina under Duke Energy's control ("the Duke Energy Mosquito Control Program").

9. The Duke Energy Defendants created Lake Wateree in 1919 and thereafter were directly responsible for its management and maintenance, including on behalf of waterfront property owners.

10. Plaintiffs and the Class are property owners with waterfront property located on Lake Wateree. As such, Plaintiffs and the Class hold littoral and/or riparian rights relating to Lake Wateree.

11. During the course of the Duke Energy Mosquito Control Program—including for decades after PCBs were proven to cause cancer and a number of other adverse health effects—the Duke Energy Defendants intentionally disseminated millions of gallons of PCB-laden motor oil and transformer oil into South Carolina waterways, including Lake Wateree.

12. After PCBs were banned in the United States, the Duke Energy Defendants hid their use of these substances from the public and thereafter engaged in studies that artificially manipulated the scientific data to lead the public and, specifically, waterfront homeowners to believe contamination was not an issue.

13. As a direct result of Defendants' actions in spraying harmful PCBs, Lake Wateree's waters and waterbeds were inundated with harmful PCBs, which thereafter accumulated, invading the area's biological, aquatic, and ecological environment and encroaching upon Plaintiffs' property rights.

[1] Duke Energy Mosquito Control Program in its 90th year, Duke Energy | News Center. Available at: https://news.duke-energy.com/releases/duke-energy-mosquito-control-program-in-its-90th-year (last accessed: November 20, 2024).

14. Because the Duke Energy Defendants hid their use of PCBs or misstated the impact of these harmful substances through self-serving studies, homeowners were not aware of the dangers to their properties or to their rights as homeowners, including the rights to use and enjoy the water touching their properties.

15. Plaintiffs now seek redress for this invasion and infringement upon their properties and property rights by dangerous toxic chemicals.

16. Plaintiffs file this class action on behalf of all waterfront residents of Lake Wateree, each of whom hold littoral and/or riparian rights in their properties and who experienced and will continue to experience interference and infringement with their right to peaceful enjoyment of their properties, permanent diminution in value, as well as other injuries caused by Defendants' conduct.

JURISDICTION AND VENUE

17. At all times relevant to this complaint, Plaintiff Clyde Marc Jones has been a citizen of Kershaw County, in the State of South Carolina, with a primary address in Camden, South Carolina on Lake Wateree.

18. At all times relevant to this complaint, Plaintiffs Dennis and Deborah Phillips have been citizens of Kershaw County, in the State of South Carolina, with a primary address in Camden, South Carolina on Lake Wateree.

19. At all times relevant to this Complaint, Defendant Duke Energy Corporation ("Duke Energy") has been a for-profit corporation organized and headquartered in the state of North Carolina at 526 S. Church St., Charlotte, NC 28202, having a principal place of business located at 550 S. Tryon St., Charlotte, NC 28202, and has been the parent and owner of Defendant Duke Energy Carolinas, LLC, and responsible for providing electricity and related services to 8.4

million customers across the southeast through its wholly owned subsidiaries, including Defendant Duke Energy Carolinas, LLC.

20. At all times relevant to this Complaint, Defendant Duke Energy Carolinas, LLC ("Defendant DEC") has been a for-profit corporation organized and headquartered in the state of North Carolina at 526 S. Church St., Charlotte, NC 28202, having a principal place of business located at 550 S. Tryon St., Charlotte, NC 28202.

21. Defendant DEC is Defendant Duke Energy's wholly owned subsidiary operating in North and South Carolina and is directly responsible for providing electric power and related services to millions of customers across South Carolina, including surrounding Lake Wateree.

22. Defendant DEC is directly responsible for managing, maintaining, and ensuring the safety and satisfactory operation of several of Defendant Duke Energy's assets, including Lake Wateree, a reservoir owned by Defendant Duke Energy and operated by Defendant DEC.

23. Since the early 1900s, the Duke Energy Defendants (and their predecessors) have owned and operated power facilities throughout South Carolina and have been charged with the responsibility of maintaining and treating significant portions of land and water within the state of South Carolina, including those areas that form the basis of this dispute. The Duke Energy Defendants' contacts with South Carolina have been systemic and continuous.

24. Defendant DEC has continuously done business in South Carolina for the entire tenure of the acts giving rise to these claims, including the intentional disposal and introduction of dangerous PCBs into South Carolina waters and the failure to remediate this contamination.

25. In addition, throughout the relevant timeframe of this complaint, the Duke Energy Defendants have, collectively and individually, been responsible for putting forth representations about Defendants' programs for treating and maintaining bodies of water used by Defendants for

daily operations, as well as the Duke Energy Defendants' commitment to environmental stewardship.

26. As set forth below, the Duke Energy Defendants, during the relevant timeframe, have put forth and disseminated studies and statements about Lake Wateree and their program to eradicate mosquitos from Lake Wateree, using purposefully misleading statements and information that downplayed or otherwise denied that the program created any risk of harm to Lake Wateree.

27. The acts complained of in this action are uniquely related to South Carolina, involve application of South Carolina law, and courts of South Carolina are best situated to discern appropriate remedies.

28. This civil dispute is brought under the laws of South Carolina, and the injuries Defendants committed against the entire plaintiff class involve violations of Plaintiffs' rights as South Carolina landowners within the borders of South Carolina.

29. This Court has subject matter jurisdiction because Defendant Duke Energy is a citizen of a different state from at least two-thirds of the Plaintiff class, with headquarters in Charlotte, North Carolina, and this controversy seeks over $5,000,000 in damages, including damages for diminution in property value for over 2,600 water-front homeowners surrounding Lake Wateree. *See* 28 U.S.C. § 1332(d).

30. Personal jurisdiction over Defendants is proper because the Duke Energy Defendants transact substantial and pervasive business in the State of South Carolina, and own and are directly responsible for the daily operation and management of Lake Wateree.

31. Venue is proper in this Court because a substantial part of the events or omissions giving rise to the alleged claims occurred in Kershaw County, South Carolina where Defendants

do substantial business, including managing, operating, and maintaining Lake Wateree.

STATEMENT OF FACTS

A. The Rise of PCBs

32. PCBs were invented in the late 1800s and were used for decades as lubricants, coolants, and in other manufacturing and industrial applications because of their ability to withstand heat, and their chemical stability.

33. Once created, PCBs are essentially indestructible and remain permanently in the environment wherever they are used.

34. Because of their vast potential for industrial application, beginning in the 1930s companies in the United States started manufacturing PCBs.

35. Monsanto became the predominant manufacturer of PCBs, selling them under the trade name Aroclor.

36. In 1944, Public Health Reports published one of the first studies linking acute toxicity in lab animals to PCBs. According to the report, conducted by the Industrial Hygiene Research Laboratory of the National Institutes of Health, "[t]wo conspicuous pathologic findings were observed – liver damage in all series of experiments and skin changes in the animals receiving subcutaneous injections or applications of the material to the skin." [2]

37. During hearings in the 1950s about the use of certain chemicals in food products, Dr. James O. Clarke, the director of the Division of Program Research at the United States Food and Drug Administration discussed the potential dangers of using chlorinated hydrocarbons. While the hearings specifically focused on Dichlorodiphenyltrichloroethan ("DDT"), Dr. Clarke was

[2] Public Health Rep. 2018 Nov.; 133(6): 721-725 ("From Industrial Toxins to Worldwide Pollutants; a Brief History of Polychlorinated Biphenyls"), quoting the United States Surgeon General.

unequivocal, finding: "Without exception, every one of the chlorinated cyclic hydrocarbon insecticides[3] is a liver poison…"

38. Dr. Clarke continued:

> The extremely stable nature of the [chlorinated hydrocarbon] group of insecticides poses another problem. **In amounts normally used for growing crops, severe poisoning of the soil has persisted for the entire duration of reported observations** (7 years) and as no means are available to destroy these compounds, millions of acres of farmland may ultimately have to be withdrawn from cultivation since these substances not only inhibit the growth of many plants but also may be absorbed into the food portions in dangerous concentrations. [4] (emphasis added)

39. From these same studies in the 1950s, the American Public Health Association's Committee on Chemicals Introduced in Foods issued a warning against widespread use of chlorinated hydrocarbons, finding: "These compounds possess a high order of toxicity, and their uncontrolled or unwise use is not desirable." [5]

40. Evidence against the use of PCBs continued to mount, including an incident in 1968 when more than 1,000 people in Japan were poisoned by PCB contaminated rice.

41. In 1971, the United States created a task force on PCBs. In a report issued in 1972, the task force determined that the use of PCBs should be restricted to "essential" or "non-replaceable" uses involving minimal direct human exposure.[6]

42. This 1972 report set forth a list of various PCB sources in the environment, among them, municipal and some industrial sewers, accidental spills, improper waste disposal practices,

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[3] PCBs are considered chlorinated hydrocarbons. *See* M. Friend and J.C. Franson, Polychlorinated Biphenyls, Information and Technology Report 1999-0001, https://pubs.usgs.gov/itr/1999/field_manual_of_wildlife_diseases.pdf#page=315.

[4] *Id.*

[5] *Id.* quoting Bing FC, Clarke JC, Darby WJ, et al. Report of the Committee on Chemicals Introduced in the Production of Foods, Am. J. Public Health, 1950; 40: 121-126.

[6] *See* Interdepartmental Task Force on PCBs. Washington, DC, Departments of Agriculture, Commerce, Health, Education, and Welfare, and Interior, and US Environmental Protection Agency; 1972.

and direct application as pesticides. The report suggested, however, that by 1972 no entities were directly applying PCBs as pesticides.

43. By 1977, the evidence connecting PCB exposure to severe negative health effects was irrefutable, and the Duke Energy Defendants knew or should have known about these severe health effects.

44. The EPA banned further production of PCBs in the United States in 1979.

B. PCB Use in South Carolina

45. The first report of PCBs in the ecological environment of South Carolina arose out of an industrial spill near Lake Hartwell in 1976.

46. Around this timeframe, researchers began studying PCB contamination in several of South Carolina's reservoirs.

47. Developed by the Duke Energy Defendants in 1919 through damming the Wateree River, Lake Wateree is one of South Carolina's oldest man-made reservoirs extending over twenty-one square miles, and including more than one hundred and eighty-one miles of shoreline.[7]

48. During the relevant timeframe, the Duke Energy Defendants have owned, operated, and controlled Lake Wateree and been responsible for its management and maintenance along with several other lakes and bodies of water on or near the Catawba and Wateree Rivers.[8]

49. By creating and undertaking to control Lake Wateree, the Duke Energy Defendants assumed responsibility for maintaining this body of water, including the application of any substances on the water and the implementation of mitigation programs and remediation programs

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[7] *See Loving Lake Wateree*, https://lakewateree.com ("WHOA is a community organization dedicated to maintaining the high standard of living on Lake Wateree"). (last accessed Nov. 19, 2024).

[8] *See Catawba-Wateree Shoreline Management Plan*, https://wwww.duke-energy.com/community/lakes/services/cw-shoreline-management-plan (last accessed Nov. 19, 2024).

using due and reasonable care in accord with best practices.

50. According to the Duke Energy Defendants, the Catawba-Wateree project, of which Lake Wateree is a part, "is the backbone of Duke Energy's generation fleet, providing 819 megawatts of renewable hydropower and cooling water to more than 8,000 megawatts of fossil and nuclear generation."[9]

51. According to their re-licensing agreement, the Duke Energy Defendants specifically promised Lake Wateree homeowners that Defendants were responsible for the fish and wildlife habitat, water quality, and conservation of the land surrounding the lake, including shoreline management.[10]

52. The Duke Energy Defendants further acknowledged "the reservoirs [of the Catawba-Wateree project] provide the region with public water supplies, opportunities for public recreation, and wildlife habitat."[11]

53. Class members enjoy special riparian and littoral rights including rights to make use of the water abutting their property and have the right to title up to the high-water mark.

54. Based upon Defendants' s responsibility to manage and maintain Lake Wateree, the Duke Energy Defendants have a direct responsibility to Lake Wateree water-front homeowners.

55. These homeowners rely upon the Duke Energy Defendants to properly manage Lake Wateree, including the condition of the water, surrounding ecosystems, and environmental stewardship of the reservoir and its perimeter.

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[9] *See* Catawba-Wateree Relicensing, available at: https://www.duke-energy.com/community/lakes/hydroelectric-relicensing/catawba.

[10] *See* Lake Wateree Perspective of the Catawba-Wateree Relicensing Agreement, available at: https://www.duke-energy.com/-/media/pdfs/community/wateree-agreement.pdf?rev=d3ee54ead58f4919960633f9b2c0a3f2 (last accessed Nov. 19, 2024).

[11] *Id.*

56. By the early 1990s, information came to light indicating that bodies of water in South Carolina, including Lake Wateree, had been contaminated by PCBs.

57. This information included dangerous levels of PCBs found in fish tissue samples, often used as a proxy for the impacts on human tissue.

58. In 1993, to address concerns over the levels of contamination in the reservoir, the Duke Energy Defendants conducted their own study ("the Duke study") of fish in the Catawba River, including Lake Wateree.

59. The Duke study failed to identify contamination at excessive levels. Unlike comparable studies, however, the Duke study set contamination levels at .35 parts per million (ppm) for Aroclor 1260 – levels far exceeding the .05 ppm detection limits employed in other studies.

60. The Duke study thus concealed the impacts of the Duke Energy Defendants' Mosquito Control Program on the water and ecological and aquatic health of Lake Wateree and led property owners to believe that the Duke Energy Defendants were appropriately responding to PCB levels in both Lake Wateree and its flora, fauna, and aquatic life.

61. In 2009, the EPA performed a national study evaluating levels of PCBs in aquatic life and detected potentially harmful levels of PCBs in South Carolina waterways.

62. As a result of this study, South Carolina's Department of Health and Environmental Control ("SCDHEC") and North Carolina's Department of Environmental Quality ("NCDEQ") implemented heightened monitoring of these waterways.

63. Since at least 2009, Lake Wateree has also been continuously subject to SCDHEC's restrictive consumption guidance based upon unsafe levels of PCBs detected in multiple species of fish within the water.

64. As of the date of this filing, SCDHEC has issued fish consumption restrictions for six (6) species of Lake Wateree fish.

65. While this list of species is routinely updated, and changes regularly, SCDHEC has consistently advised against regular consumption of fish from Lake Wateree.

66. These perpetual consumption advisories confirm the continued presence of PCBs in Lake Wateree through the positive presence of PCBs in the tissues of these fish.

67. At no point, however, did the Defendants acknowledge the possible connection between their actions and the advisories and at no point did the advisories prompt the Defendants to warn the class members and the public of the dangers they knew to be associated with their intentional contamination of Lake Wateree.

68. In addition, at no point, despite knowledge of the Duke Energey Defendants' role in the contamination, did Defendants appropriately mitigate or remediate the harm.

69. Despite these advisories and studies, the Duke study, coupled with statements from the Duke Energy Defendants in press releases and filings with the Federal Regulatory Energy Commission ("FERC") and Defendants' commitments to Lake Wateree homeowners obfuscated the nature of the injury and concealed the cause, leading to misinformation about the impact of PCBs in Lake Wateree and whether the water has been appropriately managed by the Duke Energy Defendants.

70. At the same time, fishing, boating, and general use of waterfront property is a specific right for waterfront property owners.

71. Once introduced, PCBs will remain in the environment, poisoning the soil and waterways, and absorbing into the tissue of aquatic and biological life, which the Duke Energy Defendants knew or should have known.

72. Yet the contamination at issue in this case is not the result of some long-abandoned industrial application, or an unintended spill from decades past. Rather, it is the result of a concerted campaign by the Duke Energy Defendants that was done with knowing disregard for the long-term effects of PCBs.

C. Duke Energy Mosquito Control Program

73. In 2013 Defendant Duke Energy reported that its Mosquito Control Program, which began in 1923, was the "oldest continuous environmental program of any utility in the US, and one of the first in North America."[12]

74. Their program continued for 93 years before being terminated in 2016.

75. In the early 1900s, as power companies created impoundments, malaria became epidemic around the new reservoirs.

76. Creating reservoirs to support hydroelectric stations necessarily required the creation of large bodies of stagnant water where mosquito populations thrived.

77. Controlling malaria was therefore a major planning consideration for utility providers constructing hydroelectric plants and required those providers, including the Duke Energy Defendants, to create solutions to the threat of malaria presented by reservoirs.

78. The Duke Energy Defendants therefore undertook the Mosquito Control Program on bodies of water they created or under their control. During the 1970s, the Duke Energy Defendants chose to implement this program by applying a mixture of No. 2 fuel oil and transformer oil directly to the water sources.

79. These substances contained PCBs.

80. One of the reservoirs treated with PCBs in this manner was Lake Wateree.

[12] *See* Footnote 1.

81. In a 1970 workshop on mosquito control in North Carolina, a representative of the Duke Energy Defendants estimated that 2,500 miles of shoreline, including Lake Wateree, were being treated annually in North Carolina and South Carolina beginning in April and ending in October, with treatments occurring every 8 days.

82. According to the Duke representative, George Swearingen, the reason that burned cylinder oil and transformer oil were used was because of its residual film on the water, which allowed workers to discern treated areas from non-treated areas.

83. Mr. Swearingen also indicated that part of the Duke Energy Defendants' plan in maintaining the shorelines and keeping them clean was providing property to homeowners adjoining the lakes. By establishing relationships with property owners, the Duke Energy Defendants' realized substantial financial benefits in uncompensated maintenance and upkeep of the shoreline.

84. At that same workshop, a representative of the North Carolina State Board of Health confirmed that two electric companies were using a mixture of No. 2 fuel oil and used transformer oil to control mosquito populations at a rate of ten to fifteen gallons per acre.

85. The goal of this workshop was clear. In his opening statements, Dr. J. Lawrence Apple, the Director of the Institute of Biological Sciences at North Carolina State University's School of Agriculture and Life Sciences stated:

> I doubt if man has ever gone through a period of more critical self-examination of human values than the 1970's promises us. I think whether agree or disagree with the trend of events at the present time, it is unmistakably clear that man's inherent rights are being idealized as never before. Does each individual have the right to a clean, undisturbed, natural – yet healthful – environment…All of us, I think would hope that utopia is possible.
>
> ***
> The subject of this workshop is involved in that paradox. We do not like the discomforts and diseases that mosquitoes might bring, but in effecting mosquito

control other conditions may be created which are also undesirable.

Proceedings Workshop on Mosquito Control in North Carolina, May 4, 1970, at p. 1.

86. Later in that same workshop, representatives of the United States military confirmed the trend in phasing out persistent compounds when implementing mosquito prevention.

87. Yet, following this workshop, the Duke Energy Defendants continued to utilize PCBs in their Mosquito Control Program.

88. Two brothers, Buster Beckham and Henry Beckham, who helped administer the program on behalf of the Duke Energy Defendants, specifically recall placing 55-gallon barrels of motor oil and transformer oil into an aluminum boat and administering these substances around the shoreline of Lake Wateree between 1968 and 1973. (*See* **Exhibits A and B**, **Beckham Affidavits**).

89. This resulted in the dumping of more than 500 gallons of these substances into Lake Wateree on a weekly basis during the timeframe of the program. (*Id.*).

90. At all times relevant to this complaint, the Duke Energy Defendants consciously chose to use transformer and fuel oil to implement the Mosquito Control Program.

91. In addition, at no point was the application of these fuels appropriate, considering best disposal practices for transformer and fuel oil.

92. The representatives, agents, and authorized individuals of the Duke Energy Defendants were charged with knowledge of the chemical composition of the oils and fuels used in the program.

93. Further, the Duke Energy Defendants were charged with knowledge of the appropriate disposal method for fuels, transformer oils, and other materials containing PCBs and

harmful chemicals and additives.

94. At all times relevant to this complaint, the Duke Energy Defendants knew or should have known the oils used in the Mosquito Control Program contained high levels of PCBs, which, once disseminated directly into water, would result in significant and permanent pollution to the waterways, sediment, and adjoining land where the Duke Energy Defendants executed the program.

95. Moreover, the Duke Energy Defendants knew or should have known that disposing of used transformer oil and fuel oil directly into a reservoir contradicted best management practices for the disposal of PCBs and was likely to result in contamination.

96. At all times relevant, alternative methods to these substances existed to eradicate mosquito populations.

97. Beginning as early as the 1950s, many entities charged with controlling mosquito populations abandoned their traditional use of kerosene, used oil, and fuel products, and replaced these products with government approved insecticides.

98. Yet, at least through the late 1970s, the Duke Energy Defendants knowingly chose to use spent transformer oil and fuels as one of their methods to eradicate mosquitos in South Carolina.

99. This use of spent fuel oil allowed the Duke Energy Defendants to perpetuate the Duke Energy Mosquito Control Program cheaply and further allowed them to dispose of a nasty byproduct with no additional oversight or regulation.

100. After conducting the self-serving 1993 Duke study, the Duke Energy Defendants continued to issue public statements via their website assuring members of the class and the public that their Mosquito Control Program used only safe and government-approved larvicide that

attacks only mosquito larvae[13].

101. In addition, in regulatory filings, and filings with FERC, the Duke Energy Defendants represented that they were responsible for the ecological and aquatic life surrounding their reservoirs, including Lake Wateree.

102. These same filings have listed the very homeowners comprising the Plaintiff Class as "stakeholders".

103. At no point in time have the Duke Energy Defendants mitigated, remediated or otherwise attempted to address the continued presence of PCBs in Lake Wateree.

104. In addition, given the Duke Energy Defendants misstatements and misrepresentations, the homeowners surrounding Lake Wateree had no reason to know that the Duke Energy Defendants had dumped harmful levels of PCBs into the reservoir or that the Duke Energy Defendants' earlier representations about managing the reservoir did not encompass appropriate mitigation or remediation of PCBs.

105. A 2021 peer-reviewed article by James B. Glover and Deke T. Gunderson combined spatial analysis with historic evidence to identify the source of the PCB contamination in the Catawba-Wateree River Basin as the Duke Energy Defendants' direct application of used transformer oil on reservoirs located along the River Basin.[14]

106. Even after its publication, property owners and members of the Class would not necessarily have been privy to this study or its implications.

107. Moreover, to date the Duke Energy Defendants have never publicly advised those

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[13] *Id.*

[14] Glover, James B. and Gundersen, Deke T. (2021) "Widespread Contamination of Polychlorinated Biphenyls in South Carolina and North Carolina (USA): A Legacy of Malarial Eradication and Mosquito Control." *Journal of South Carolina Water Resources*: Vol 8: Iss 1, Article 10, available at: https://open.clemson.edu/jscwr/vol8/iss1/10. (Last accessed Nov. 19, 2024). (Attached as **Exhibit C**).

owning or inhabiting waterfront property at Lake Wateree that the Mosquito Control Program utilized unsafe spent motor and transformer fuels or that the Duke Energy Defendants had failed to implement mitigation or remediation measures after direct application of PCBs to the reservoir.

108. Moreover, the article highlighted the Duke Energy Defendants' 1993 study, which downplayed the contamination in the reservoir and was silent as to the Duke Energy Defendants' role in the contamination.

109. Upon information and belief, the Duke Energy Defendants' decision to use PCB laden fuels and transformer oils over safe alternative larvicides was based in part on cost savings.

110. The PCB contamination in the Catawba and Great Pee Dee River Basins, which includes Lake Wateree, has a specific, traceable chemical signature–an Aroclor number–consistent with the chemical signature of transformer oils utilized in the Duke Energy Mosquito Control Program.

111. Based on the Duke Energy Defendants' deceptive public representations, PCB contamination in the Catawba and Great Pee Dee River Basins and in Lake Wateree has not been linked to a specific pollution event or source.

112. The Duke Energy Defendants have purposefully issued guidance on reducing the presence of mosquitos while touting the narrative that their program utilized only government-approved substances.

113. Despite knowing their role in creating the contamination, the Duke Energy Defendants have further failed to undertake any remediation efforts for Lake Wateree.

114. Based upon the physical properties of PCBs, once disseminated, they essentially anchor into the environment and are impossible to destroy or move.

115. As set forth herein, for years during the Mosquito Control Program and every year

since it has ceased, SCDHEC has issued fish consumption advisories for the waterways affecting Plaintiffs' and the Class Members' properties, finding excessively dangerous levels of PCBs in the fatty tissue of fish in Lake Wateree and confirming that PCBs continue to contaminate the sediment, soil, and waterways.

116. During this same timeframe, the Duke Energy Defendants have had actual or constructive knowledge of the continued contamination of waterways previously subject to the Mosquito Control Program not only because of the fish consumption advisories but by virtue of Defendants' own testing programs to purportedly address PCB contamination in these same waterways.

117. By intentionally dumping PCBs into waters adjoining or including Plaintiffs' properties, Defendants exposed Plaintiffs' and the Class Members' properties to repeated inundation from PCBs used in the Mosquito Control Program and have never addressed or otherwise mitigated or remediated the effects of this program.

118. The Duke Energy Defendants' watered down study, coupled with their statements and representations about appropriate management practices upon Lake Wateree, could not have alerted Plaintiffs or the Class Members about the dangerous PCB contamination impacting the Lake, the need for remediation, or the impact of this contamination on homeowner's rights and properties.

119. Plaintiffs are all property and homeowners with waterfront property on Lake Wateree.

120. As property owners, Plaintiffs were vested with certain fundamental rights, including littoral and riparian rights, and were entitled to enjoy those rights without undue interference or trespass from intruders, including through the invidious release of harmful

chemicals.

CLASS ALLEGATIONS

121. As noted above, Plaintiffs bring this action on behalf of themselves and all others similarly situated as a class under Rule 23 of the Federal Rules of Civil Procedure (Fed. R. Civ. P.), defined as follows:

All persons or entities who currently have ownership of any real waterfront property on Lake Wateree.

Excluded from the Class are:

> Current and former officers and directors of the Defendants; members of the immediate families of the officers and directors of the Defendants; the Defendants' legal representatives, heirs, successors, assigns, any entity in which either of them has or had a controlling interest; any federal, state, or local governmental agencies; Class Counsel or any person retained or working on behalf of Class Counsel in furtherance of the litigation, any judges who have decided or are assigned to decide some or all issues in this case any persons related to a judge in a manner that would disqualify the judge from hearing the case; and any chambers staff working for the assigned judge or other courthouse staff who perform tasks relating to this matter.

122. Plaintiffs reserve the right to expand, limit, modify, or amend this class definition, including the addition of one or more subclasses, in connection with Plaintiff's motion for class certification, or at any other time, based upon, *inter alia*, changing circumstances and/or new facts obtained during discovery.

123. This action is proper for class treatment under Fed. R. Civ. P. Rule 23(a) and (b).

124. *Numerosity*: While the exact number and identities of other Class Members are unknown to Plaintiffs at this time, Lake Wateree spans approximately 12,360 acres over territory encompassing Fairfield, Kershaw, and Lancaster counties in South Carolina, and is bordered by roughly 2,600 properties consisting of hundreds if not thousands of property owners, whose joinder

in this action would be impracticable. The disposition of their claims through this class action will benefit all Class Members, the parties, and the courts.

125. *Commonality and Predominance*: There exists commonality in questions of law and a common nucleus of operative fact affecting the Class, in that Defendants' reckless, negligent, and improper conduct as well as the Defendants' physical interference with Plaintiffs' property rights has infringed and caused damage to Plaintiffs' and the Class members' rights in the same or similar fashion as the Class members. Moreover, answers to the questions of law and operative facts will drive resolution of the litigation and are capable of class wide resolution. Such questions are common to all Class members and predominate over any questions affecting individual Class members and include:

a. Whether Defendants negligently, recklessly, and/or knowingly used PCBs in waterways adjoining the Class members' properties;

b. Whether Defendants negligently, recklessly, and wantonly failed to remediate Lake Wateree after knowingly disseminating PCBs into this reservoir;

c. Whether Defendants' use and/or continued use in its Mosquito Control Program of transformer oil, a substance known to contain PCBs, was reasonable;

d. Whether the activity was of such a nature that the Defendants are strictly liable for any attendant damages;

e. Whether PCBs from the Defendants' intentional spraying of transformer oil interfered with Class members' inalienable property rights including littoral and riparian rights;

f. Whether the continued presence of PCBs from Defendants' Mosquito Control Program has impacted the value and use of the Class members' properties

including the use and access to unadulterated natural resources such as fish and other aquatic life;

g. Whether the Plaintiffs have suffered natural resource damages as a result of Defendants' conduct;

h. Whether PCBs from the Defendants' intentional spraying of transformer oil infringed upon the bundle of property rights inherent to the Class members;

i. Whether Defendants' practices in disposing of transformer oil through the Mosquito Control Program violated best management practices for disposal of PCBs;

j. Whether PCBs from the Defendants' intentional spraying of transformer oil resulted in a diminution in value of property owned by the Class members;

k. Whether Defendants' actions constitute a continuing trespass upon the Class members' properties;

l. Whether Defendants should be responsible for remediation, sampling, and monitoring of Lake Wateree;

m. Whether Defendants have misled or misrepresented the presence of PCBs in Lake Wateree such that the Class members would have no opportunity to know that their rights had been infringed upon by Defendants' conduct;

n. Whether Defendants' actions constitute a private nuisance unreasonably interfering with the use and enjoyment of the Class members' properties;

o. Whether the Class members have sustained damages, including natural resource damages, as a result of the Defendants' wrongful conduct;

p. Whether the Class members are easily identifiable based upon property owners with property affixed to impacted waterways;

q. Whether Defendants actively concealed their role in contaminating Lake Wateree;

r. Whether Defendants failed to exercise due and reasonable care in managing the Mosquito Control Program upon Lake Wateree;

s. Whether Defendants were exclusively responsible for the control, management, and maintenance of Lake Wateree;

t. Whether Defendants' undertaking surveys and studies to test Lake Wateree and other impacted waterways for PCB contamination using falsely elevated detection levels was done in an effort to conceal Defendants' role in contaminating Lake Wateree;

u. Whether Defendants knew or should have known that their errant PCB disposal practices would result in permanent contamination to impacted waterways; and

v. The appropriate measure of damages and other relief.

The prosecution of separate actions by Class members would create a risk of establishing inconsistent rulings or incompatible standards of conduct for Defendants, especially when dealing with production, use, and improper disposal of toxic chemicals. Additionally, individual actions may be dispositive of the interest of all members of the Class, although certain Class members are not parties to such actions.

126. *Typicality*: Plaintiffs' claims and defenses are typical of, and are not antagonistic to, the claims of all Class members, in that Plaintiffs and Class members sustained damages arising

out of Defendants' uniform wrongful conduct.

127. *Superiority*: This case is also appropriate for class certification because class proceedings are superior to all other available methods for the fair and efficient adjudication of this controversy given that joinder of all parties is impracticable. The damages suffered by the individual members of the Class may be small in comparison to the burden and expense of individual prosecution of the complex litigation necessitated by Defendants' actions. Thus, it would be difficult and not economical for the individual members of the Class to obtain effective relief from Defendants' misconduct. Even if members of the Class could sustain such individual litigation, it would still not be preferable to a class action, because individual litigation would increase the delay and expense to all parties due to the complex legal and factual controversies presented in this complaint. By contrast, a class action presents far fewer management difficulties and provides the benefits of single adjudication, economy of scale, and comprehensive supervision by a single court. Economies of time, effort, and expense will be fostered, and uniformity of decisions ensured.

128. *Adequacy*: Plaintiffs will fairly and adequately represent and protect the interests of the Class and have retained counsel with substantial experience in litigating complex cases, including class actions. Plaintiffs' claims are representative of the claims of the other members of the Class. That is, Plaintiffs and members of the Class sustained damages as a result of Defendants' uniform conduct. Plaintiffs also have no interests antagonistic to those of the Class, and Defendants have no defenses unique to Plaintiffs. Plaintiffs and their Counsel will vigorously prosecute this action on behalf of the Class and have the financial ability to do so. Neither Plaintiffs nor counsel have any interest adverse to other Class Members. Rather, Plaintiffs share the same interest as all Class Members in remedying Defendants' unlawful conduct.

129. *Ascertainability*: While the exact number and identities of other Class members are unknown to Plaintiffs at this time, Plaintiffs are informed and believe that there are hundreds of Class Members that can be easily ascertained.

130. *Amount in controversy per class member:* Given that this case involves a dispute over diminution in value to water-front property (among other damages) damages to each property in the Class, including for diminution, far exceed one hundred dollars.

131. The prerequisites to maintaining a class action for equitable relief pursuant to Rule 23 Fed. R. Civ. P. are met, as Defendants have acted on grounds generally applicable to the Class, thereby necessitating relief with respect to the Class as a whole.

132. Moreover, class treatment is appropriate because common questions of law or fact, including those questions set forth above, predominate over any individual questions.

COUNT I
NEGLIGENCE/GROSS NEGLIGENCE

133. Plaintiffs reassert and reemphasize all allegations herein stated.

134. The Duke Energy Defendants own and are exclusively responsible for the management and maintenance of Lake Wateree and have held themselves out as providing water management as well as management of the aquatic and ecological life surrounding Lake Wateree.

135. At all times relevant, the Duke Energy Defendants have deemed Lake Wateree homeowners "stakeholders" in the Duke Energy Defendants' managerial responsibility over Lake Wateree and have represented to these owners that the Duke Energy Defendants would manage Lake Wateree in a due and reasonable manner in accordance with applicable standards of care.

136. From 1923 until 2016, the Duke Energy Defendants implemented their Mosquito Control Program upon Lake Wateree.

137. This program involved purposeful dissemination, distribution, and use of toxic

substances containing PCBs directly into waterways touching Plaintiffs' and Class members' properties.

138. During the relevant timeframe, the Duke Energy Defendants understood PCBs would remain permanently in the environment, were probable human carcinogens, and toxic to humans, plants, and animals.

139. During the relevant timeframe, the Duke Energy Defendants knew or should have known that use of harmful motor oils and transformer oils in their Mosquito Control Program contradicted best practices for disposal of PCBs.

140. At all times relevant to this, the Duke Energy Defendants knew or through the exercise of reasonable care should have known that PCBs used in Defendants' Mosquito Control Program had accumulated in soil, groundwater, and wildlife including aquatic life.

141. Rather than address these issues, the Duke Energy Defendants engaged in self-serving studies to purposefully obfuscate the impact of PCB contamination in Lake Wateree.

142. Meanwhile, the Duke Energy Defendants knew that, without mitigation, PCBs would remain in Lake Wateree, causing permanent degradation to important aquatic and ecological resources for which Defendants were specifically responsible.

143. At all times relevant, the Duke Mosquito Control Program was conducted on bodies of water, including Lake Wateree, bordered by water-front properties and it was therefore foreseeable that these properties and their respective owners would be impacted by the Duke Mosquito Control Program and its resultant contamination.

144. The owners included Plaintiffs and the Class members.

145. At all times relevant to this complaint, the Duke Energy Defendants owned, were responsible for, and charged with monitoring and managing Lake Wateree and should have done

so using due and reasonable care.

146. As property owners with waterfront homes on Lake Wateree, Plaintiffs and the Class members were readily identifiable, and Defendants knew or should have known Plaintiffs and the Class members would be directly harmed by the Duke Energy Defendants' administration of PCBs and failure to mitigate or remediate these contaminants.

147. Defendants owed and continue to owe Plaintiffs and Class Members a duty of care. This duty includes the duty not to interfere with Plaintiff and Class members' inalienable property rights.

148. Defendants knew or should have known their use of PCBs permanently contaminated Lake Wateree, forever devaluing Plaintiffs and Class members' properties.

149. As set forth herein, Defendants conduct was unreasonable, negligent, grossly negligent, careless, and reckless in one or more of the following particulars:

a. Improperly using, dumping, and spreading known toxic chemicals into Lake Wateree;

b. Improperly executing a Mosquito Control Program that included toxic PCBs instead of other, less dangerous methods of mosquito prevention;

c. Engaging in improper practices and procedures for disposal of PCBs, which knowingly contaminated Lake Wateree, impeding the rights of private property owners, including littoral and riparian rights;

d. Systematically failing to accurately report to Plaintiffs and Class members, either directly or indirectly, that PCB chemicals found in excessive levels based upon fish tissue samples in Lake Wateree were the result of Defendants' Mosquito Control Program;

e. Systematically failing to warn, either directly or indirectly, of the negative impact on property values and the value of natural resources from PCB contamination, caused by Defendants' intentional acts;

f. Failing to properly maintain records and properly investigate the levels of contamination caused by Defendants' intentional dumping of PCBs into the environment and Lake Wateree;

g. Failing to remediate reservoirs contaminated by PCBs;

h. Failing to timely replace outmoded or faulty techniques for disposal and dumping of dangerous PCBs;

i. Failing to comply with the South Carolina Pollution Control Act, S.C. Code Ann. §48-1-10 (1976) *et seq.*;

j. Failing to comply with the South Carolina Constitution Article I, Section 13, which forbids the taking of property without just compensation;

k. Knowingly concealing the source of PCB contamination;

l. Failing to remediate the damage caused and perpetuated through Defendants' mismanagement of the waterways;

m. Committing the foregoing acts systematically and individually against Plaintiffs and the Class members; and

n. Committing the foregoing acts recklessly and with disregard to the sanctity of Plaintiffs' and Class members' property rights.

150. In view of the widespread information available about the harmful effects of PCBs and the propensity of PCBs to bioaccumulate, Defendants' continued mismanagement of waterways under their control, and Defendants' efforts to distance themselves from prior bad

practices, amounts to the complete absence of care.

151. As a result of the Duke Energy Defendants' systematic negligence in designing, maintaining, managing, and executing their Mosquito Control Program and spreading, disposing, failing to warn, and failing to mitigate, Defendants have caused permanent harm to Plaintiffs and the Class members, including diminution of property values, and degradation of natural resources.

152. Plaintiffs and the Class members will continue to suffer damages including great financial loss; the loss of the use and enjoyment of their property; natural resource damages; infringement upon their inalienable property rights; and the diminution in value of their property.

153. Plaintiffs and the Class are therefore entitled to judgment against Defendants and for a finding of actual, consequential, compensatory, and punitive damages, as well as all other damages in law or equity as this court deems proper.

COUNT II
STRICT LIABILITY FOR ULTRAHAZARDOUS ACTIVITY

154. Plaintiffs reassert and reemphasize all allegations herein stated.

155. As alleged, the Duke Energy Defendants handled, distributed, and disposed of PCBs into Lake Wateree, a man-made reservoir adjoining Plaintiffs' and Class members' properties and, at all times relevant, the Duke Energy Defendants knew or should have known that these PCBs were interfering with and infringing upon Plaintiffs' and Class members' property rights and natural resource rights.

156. Throughout the Mosquito Control Program, the Duke Energy Defendants rid themselves of toxic transformer oil and other used oils— knowing these oils were hazardous and laden with PCBs — by spreading that waste directly into Lake Wateree, which adjoined Plaintiffs' and Class members' properties.

157. PCBs are hazardous substances. South Carolina law recognizes the ultrahazardous

nature of PCBs and the deleterious effect these chemicals have on property.[15]

158. The Duke Energy Defendants or their agents were responsible for the toxic and dangerous products disposed of, used, and purposefully dumped during the Mosquito Control Program, and received substantial financial benefits from that dumping and disposal.

159. Upon information and belief, while promoting that Defendants were administering the oldest continuous Mosquito Control Program in the United States, the Duke Energy Defendants were simultaneously ridding themselves of massive amounts of toxic waste in contravention of known disposal methods and best practices.

160. Moreover, and upon information and belief, Defendants received important permissions, licensure, and regulatory approvals as a result of the Mosquito Control Program, which was undertaken at a time when the Duke Energy Defendants were expanding their hydro-electric resources through the creation of reservoirs including Lake Wateree.

161. As a result of Defendants' ultrahazardous activities, Plaintiffs and the Class have suffered and will continue to suffer damages including great financial loss; the loss of the use and enjoyment of their property; natural resource damages; infringement upon their inalienable property rights; and the diminution in value of their property.

162. Plaintiffs and the Class are therefore entitled to judgment against the Duke Energy Defendants and for a finding of actual, consequential, compensatory, and punitive damages, as well as all other damages in law or equity as this court deems proper.

COUNT III
TRESPASS

163. Plaintiffs reassert and reemphasize all allegations herein stated.

[15] *See e.g.* S.C. Code Regs. § 61-79.261.A.8

164. At all times relevant, the Duke Energy Defendants have known or should have known that PCBs are carcinogenic and bioaccumulate in organic matter.

165. Further, for decades the Duke Energy Defendants knew that PCBs were in the byproduct they sprayed into Lake Wateree, which directly adjoined Plaintiffs' and the Class Members' waterfront properties.

166. As set forth herein, Defendants are the source of and are responsible for repeatedly exposing and contaminating Lake Wateree and its aquatic and ecological life with harmful PCBs.

167. At all times relevant, Plaintiffs and Class members have been property owners with waterfront properties on Lake Wateree. Plaintiffs and Class members therefore hold littoral and riparian rights over Lake Wateree.

168. Once introduced, these invidious chemicals bioaccumulate and thus permanently infringe on Plaintiffs' and Class members' property rights, including their riparian rights, and their rights of access to natural resources.

169. At no time did the Duke Energy Defendants receive voluntary and informed permission from Plaintiffs or Class members to interfere with their respective rights, including rights associated with natural resources, through the administration of toxic chemicals.

170. Defendants' conduct and unauthorized dissemination has invaded and interfered with Plaintiffs' and Class members' possessory interests in their properties including the right of access to unimpaired natural resources and will continue to do so.

171. These dangerous chemicals were intentionally dumped into waterways where Plaintiffs and the Class enjoyed property rights, which have been interrupted and infringed upon, and thus the Defendants' actions constitute an unreasonable invasion.

172. Upon information and belief, without intervention, these chemicals will never

dissolve or biodegrade and will continuously interfere with Plaintiffs' and the Class members' possessory interests in their properties.

173. Defendants' conduct amounts to an unauthorized interference upon Plaintiffs' and Class members' property rights without legal authority, and without the informed permission of Plaintiffs or Class members.

174. As a proximate result of Defendants' continuing trespass, the property rights of Plaintiffs and the Class members have been injured and continue to be injured, causing injury to property, diminution in value, loss of use, financial and economic loss, natural resource damages, and an increased risk of exposure to PCBs.

175. Plaintiffs and the Class are therefore entitled to judgment against Defendants and for a finding of actual, consequential, compensatory, and punitive damages, as well as all other damages in law or equity as this court deems proper.

COUNT IV:
NUISANCE

176. The Plaintiffs reassert and reemphasize all allegations herein stated.

177. As set forth herein, Lake Wateree has been contaminated by PCBs from the Duke Energy Defendants' disposal of fuels, transformer oils, and other substances during the course of Defendants' Mosquito Control Program.

178. This contamination poses a significant risk of harm and has resulted in a continuous and ongoing interference with Plaintiffs' and the Class members' property rights including rights to natural resources.

179. Defendants' illicit disposal of PCBs into the environment connected to Plaintiffs' and Class members' properties was done with knowledge or with reckless disregard for the potential harm caused by PCBs.

180. South Carolina law prohibits Defendants from interfering with Plaintiffs' and the Class members' property rights, including riparian and littoral rights traceable to the title.

181. The Defendants' actions, which substantially and unreasonably interfered with Plaintiffs' and Class members' possession of their own real properties, were unreasonable, unwarrantable, and/or unlawful.

182. As a result of Defendants' illicit use of PCBs to effectuate the Mosquito Control Program, Defendants have created a private nuisance as to Plaintiffs' and the Class members' property rights.

183. Furthermore, Defendants' conduct has caused and will continue to cause into the foreseeable future, damages including loss of use and enjoyment, diminution in value, economic and financial loss, loss of natural resources, and other personal and emotional injuries.

184. Plaintiffs and the Class are therefore entitled to recover compensatory damages, consequential damages, punitive damages, attorneys' fees and costs, and any other relief the Court deems appropriate.

COUNT V:
UNJUST ENRICHMENT

185. The Plaintiffs reassert and reemphasize all allegations herein stated.

186. The Duke Energy Defendants were aware or should have been aware that by treating Lake Wateree with PCBs, it was using a hazardous industrial byproduct.

187. Upon information and belief, in order to dam and/or receive and continue to receive necessary licensure or permitting for the Catawba-Wateree, the Duke Energy Defendants agreed to implement a Mosquito Control Program upon certain man-made bodies of water under its control, including Lake Wateree.

188. By spraying this hazardous byproduct onto the water, the Duke Energy Defendants

not only attached themselves to a program that they falsely represented as having great public benefit, bolstering their reputation, but Defendants were able to dispose of a hazardous byproduct for free.

189. During this interim, Plaintiffs and the Class Members provided financial benefits to Defendants including by maintaining their own homes and the shoreline of Lake Wateree at no added cost to Duke Energy.

190. As such, any benefits conferred by Plaintiffs and the Class, and any benefits realized by Defendants, including any access, payment or indirect benefit for the program, and any savings by improper disposal of hazardous byproduct, are unjust benefits and the retention of the same unjustly enriches the Duke Energy Defendants.

191. The Duke Energy Defendants should be disgorged of any monetary benefits obtained through implementation of this program on Lake Wateree and of any financial benefit conferred upon them by Plaintiffs and the Class.

JURY TRIAL DEMANDED

192. Plaintiffs respectfully demand a trial by jury on each count raised in this complaint.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs, on behalf of themselves and all others similarly situated, respectfully request the following relief:

A. An Order that this action be maintained as a class action and appointing Plaintiffs as representatives of the Class and appointing the undersigned as Class Counsel in this action;

B. An Order that Plaintiffs and the Class are entitled to recover from Defendants the general and special damages, in amounts to be determined by the jury, to have been sustained by each of them respectively, including, but not limited to, financial losses, natural resource

damages, loss of use and enjoyment, diminution in value, as well as reimbursement of the costs of inspection, analysis, containment, and remediation, attorney's fees and costs, and all such damages and other relief provided by statute;

C. An Order that Plaintiffs and the Class are entitled to recover punitive damages in an amount to be determined by the jury from Defendants for Defendants' intentional, reckless, or willful conduct;

D. An Order directing Defendants to provide funds to effectively monitor, analyze, and remediate continuing contamination throughout the impacted area;

E. An Order that Plaintiffs are entitled to recover the costs of this suit from Defendants, including but not limited to any expert witness fees, together with reasonable attorney's fees; and

F. That the Court grant such other, further or different relief as may be deemed just and proper.

Respectfully submitted,

WYCHE, P.A.

s/Jessica L. Fickling
Jessica L. Fickling (Fed. ID No. 11403)
Jim May (Fed. ID No. 11355)
M. Lucy Dinkins (Fed. ID No. 11961)
P.O. Box 12247
Columbia, SC 29211-2247
P: (803) 254-6542
jfickling@wyche.com
jmay@wyche.com
ldinkins@wyche.com

[SIGNATURE CONTINUES ON FOLLOWING PAGE]

SAVAGE, ROYAL & SHEHEEN, LLP

Vincent A. Sheheen (Fed. ID No. 7016)
Austin M. Sheheen (Fed. ID No. 13938)
P.O. Drawer 10
Camden, S.C. 29021
P: (803) 432-4391
vsheheen@thesavagefirm.com
asheheen@thesavagefirm.com

SPEIGHTS & SOLOMONS, LLC

A. Gibson Solomons, III (Fed. ID No. 7769)
Post Office Box 685
Hampton, SC 29924
P: (803) 943-4444
gsolomons@speightsandsolomons.com
Attorneys for Plaintiffs

Dated: December 11, 2024

EXHIBIT A

STATE OF SOUTH CAROLINA)
)
COUNTY OF KERSHAW)
)

AFFIDAVIT of WILLIAM BECKHAM

I William Beckham, being an adult over the age of eighteen (18) and of sound mind and body and with personal knowledge of the matters set forth herein do hereby aver as follows:

1. I am a citizen and resident of Kershaw County, South Carolina and have been for most of my life.

2. I was born on December 31, 1946 and am 77 years old.

3. I have personal knowledge of Lake Wateree. My family owned one of the first cabins on the Lake after the dam was constructed.

4. I would spend summer Sundays during my childhood at my family's cabin at Beaver Creek on Lake Wateree.

5. In 1965, when I was in high school, I was hired by Duke to administer the mosquito program on Lake Wateree.

6. I was one of a handful or so of summer associates and was paid $2.60 per hour, which I believe was more than minimum wage at the time.

7. Mr. George Swearingen was one of my first supervisors.

8. Mr. Swearingen was my supervisor during the summers of 1966 and 1967.

9. In my job, I was told to load two 55-gallon barrels of a substance onto a 15 to 18 foot aluminum boat and then put that substance into the water around and in the Lake focusing on areas of stagnant water.

10. We were supposed to go from dam to dam and pay specific attention to areas where the water appeared stagnant.

11. It would take all day to put out the 110 gallons.

12. When I showed up for work, the barrels had already been filled and were housed at a Lake Wateree shoreline property owned by Duke Energy.

13. My family's property was adjacent to the Duke Energy property.

14. My supervisors specifically told me to put the substance in the barrels into the water throughout the lake.

15. I recall that the substance in the barrels smelled like motor oil, and was brown to golden-brown in color.

16. I also recall sometimes that the substance in the barrels would have sludge-like thick pieces. When we saw these pieces, they would be almost black in color.

17. Treating the whole lake took about a week, and we would treat the lake every week during the summer for about ten (10) weeks.

18. We distributed about 500 gallons of used oil per week.

19. I worked this job every summer from 1965 through 1967 and would come back periodically after that as needed.

20. My brother was hired to do the same job, which he worked for four consecutive summers in the 1970s.

FURTHER AFFIANT SAYETH NAUGHT.

William Beckham

Signed before me this 25th day of March, 2024

Notary Public
My Commission Expires: 9/1/33

EXHIBIT B

STATE OF SOUTH CAROLINA)
)
COUNTY OF KERSHAW)
)

AFFIDAVIT of HENRY BECKHAM

I Henry Beckham, being an adult over the age of eighteen (18) and of sound mind and body and with personal knowledge of the matters set forth herein do hereby aver as follows:

1. I am a citizen and resident of Horry County, South Carolina and grew up in Kershaw County, South Carolina.

2. I was born on February 5, 1951, and am 73 years old.

3. I have personal knowledge of Lake Wateree. My family owned one of the first cabins on the Lake after the dam was constructed.

4. I would spend summer Sundays during my childhood at my family's cabin at Beaver Creek on Lake Wateree.

5. In 1968, when I was in high school, I was hired by Duke to administer the mosquito program on Lake Wateree.

6. At the time, my older brother William Beckham, was still working part-time for Duke administering the same program.

7. It was through William that I learned about the job opportunity.

8. I was one of a handful or so of summer associates and was paid more than the minimum wage at the time.

9. Mr. George Swearingen was one of my supervisors.

10. Mr. Swearingen was my supervisor during the summers of 1968, 1969, 1970, 1971, 1972, and 1973.

11. In my job, I was told to fill two 55-gallon barrels full of motor oil and burnt transformer oil into an aluminum boat and then spray that mixture all around the lake, focusing on areas of stagnant water.

12. The loading and filling station was located in Beaver Creek, Lake Wateree at a property owned and operated by Duke Energy.

13. At this property, there was a large container, which I estimate as thousands of gallons, filled with the mixture of motor oil and burnt transformer oil from which we filled the 55-gallon barrels.

14. We were supposed to spray the shoreline of the entire lake with specific attention to areas where the water appeared stagnant, especially coves and shallow areas.

15. It would take all day to put out the 110 gallons.

16. My supervisors specifically told me that the material I was instructed to spread across the lake contained burnt or used transformer oils.

17. Treating the lake took about five days, and we would treat the lake every week during the summer.

18. We distributed about 500 gallons of the burnt transformer oil mixture per week.

19. I worked this job every summer from 1968 through 1973.

FURTHER AFFIANT SAYETH NAUGHT.

Henry Beckham

Signed before me this day of 7-11-, 2024

Ryan Cooper, Ryan Cooper
Notary Public
My Commission Expires: 12/29/2031

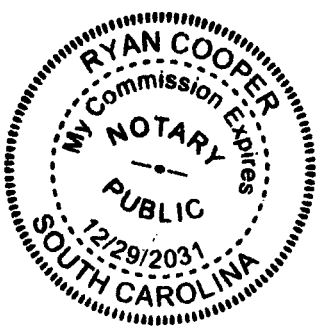


EXHIBIT C

Journal of South Carolina Water Resources, Volume 8, Issue 1, Pages 83–97, 2021

Widespread Contamination of Polychlorinated Biphenyls in South Carolina and North Carolina (USA): A Legacy of Malarial Eradication and Mosquito Control

James B Glover[1] and Deke T. Gundersen[2]

AUTHORS: [1]South Carolina Department of Health and Environmental Control (retired), Tucson, AZ, USA. [2]Pacific University Oregon, 2043 College Way, Forest Grove, OR, 97116, USA.

Abstract. The South Carolina Department of Health and Environmental Control (SCDHEC) has been conducting fish tissue monitoring for Polychlorinated Biphenyls (PCBs) since 1974 and, based on the results, restrictive fish consumption advice has been in place at two reservoirs in South Carolina for several decades. But in 2009, widespread contamination was reported in fish from the Catawba-Wateree and Yadkin-Pee Dee River Basins. Therefore, beginning in 2010, additional monitoring of fish tissue for PCBs in the rivers and reservoirs of these two basins was initiated. Results from a spatial analysis, combined with evidence from historic literature, suggests that the source of the PCB contamination, in part, is from past direct application of used transformer oil on reservoirs located along the two rivers, the origins of which were hydroelectric projects in both basins. The use of used motor oil for mosquito control and malaria eradication was widespread in the first half of the twentieth century, and results suggest that for some utility operations, PCB oil was utilized to augment these programs. The global ramifications of these findings are not yet known, but they should encourage reconsideration of origin, transport, and fate of PCBs in other regions, particularly where a known source of environmental contamination is not obvious.

INTRODUCTION

Polychlorinated Biphenyls (PCBs) were discovered in the late 1880s with commercial production by the company Monsanto beginning in 1927 (Cairns et al. 1986). Because they are chemically stable, are of low flammability, and are poor conductors of electricity they had many industrial applications, especially as a cooling oil for electric transformers and capacitors. They were also widely used in paints and resins, carbon paper production, and hydraulics. The toxicity of PCBs to humans was acutely seen when families in Kyushu, Japan, exhibited disfiguring dermatitis and liver and kidney damage after consuming PCB-contaminated rice oil (Saeki et al. 1971). PCBs are considered a probable human carcinogen by the US Environmental Protection Agency (EPA), and US production ceased in the late 1970s (Eisler 1986). However, because of their chemical stability and widespread use, PCBs remain in the environment and continue to be found in elevated levels in soil and in the tissue of fish and other animals.

Structurally, PCBs were produced by the chlorination of biphenyl rings resulting in 209 possible configurations, which are generally referred to as congeners. These congeners can be grouped based on the number of chlorine atoms, regardless of position, into 10 possible classes called homologs (e.g., tetrachlorobiphenyls). Aroclor was the brand name given to PCB mixtures by the company Monsanto, which produced most of the PCBs in the United States (Cairns et al. 1986). The trade name Aroclor was followed by a four-digit numeric value (e.g., Aroclor 1260), with the first two digits indicating the number of carbon atoms and the last two indicating the approximate percentage, by mass, of the chlorine content.

South Carolina waterways are ecologically diverse, containing mountainous, piedmont, and coastal ecoregions (Griffith et al. 2002). Many waterways are self-contained within the boundaries of the state while some originate in, or are shared by, Georgia, North Carolina, and a small portion of Virginia. Historically, the state of South Carolina has issued fish consumption advisories due to the presence of contaminants in these waterways. There are four distinct regions of South Carolina that contain levels of PCBs in fish tissue that resulted in restrictive consumption advice being issued (SCDHEC 2021) (Figure 1). These regions are Lake

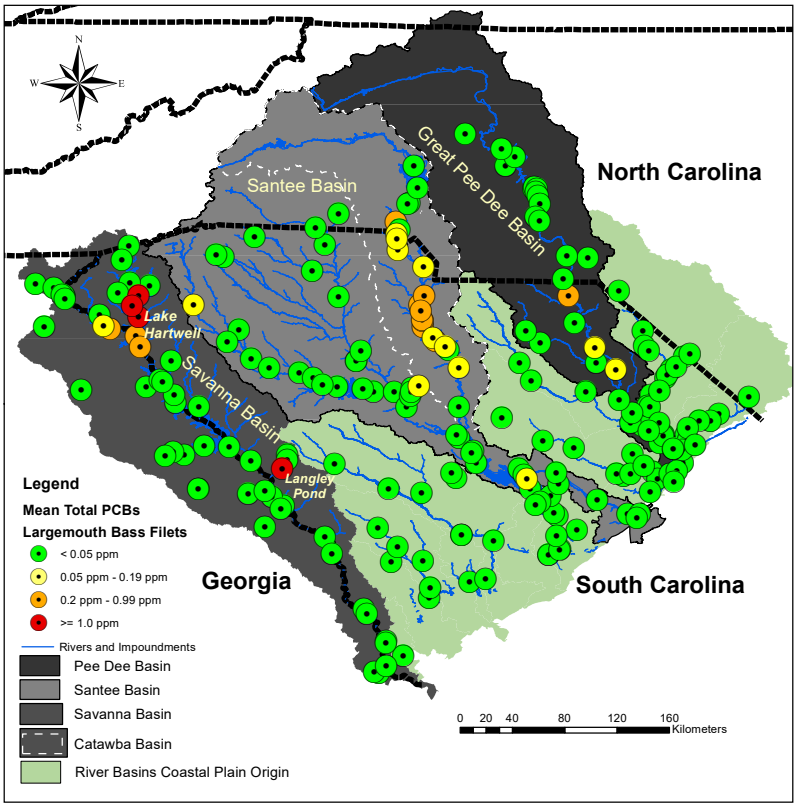


Figure 1. Mean total PCBs (ppm wet weight) in largemouth bass fillets from waters of South Carolina, showing major drainage basins of the state.

Hartwell in northern SC, Langely Pond in Aiken County SC, the Catawba River Basin, and the Great Pee Dee River Basin.

The first report of PCBs in biota of South Carolina was from Lake Hartwell, Pickens County, in 1976 (Bruner and Hill 1977; Aldridge 1978). The source of this contamination was an industrial discharge that emptied into Twelve Mile Creek, which entered Lake Hartwell a short distance downstream. Since then, significant research has been conducted on PCB contamination in this region, and in 1990 the Sangamo Operable Unit Two, the point of contamination, was finalized on the National Priorities List (US EPA Superfund) (Gaymon 1992a). Elevated levels of PCBs in fish tissue were also reported from Langley Pond, Aiken County, South Carolina (Darr 1986). This reservoir was created in the late 1800s and received large amounts of industrial waste, mostly from textile plants, for nearly 100 years. In more recent years, widespread PCB contamination was also discovered in two large river basins of the Carolinas. Fish from the Catawba/Wateree Basin and the Great Pee-Dee/Yadkin Basin have been found to contain levels of PCBs to warrant both South Carolina and North Carolina issuing restrictive consumption advice for certain fish species (SCDHEC 2021; NCDHHS 2021). The rivers and reservoirs of the Catawba/Wateree and the Great Pee-Dee/Yadkin Basins are the focus of this paper.

Low but detectable levels of PCBs were first reported from whole fish samples from the Catawba River Basin in the 1970s (Aldridge 1978). While the Great Pee Dee River was monitored, no detectable levels of PCBs were reported at that time. PCBs were again reported from fish collected in 1986 from a large reservoir, Lake Marion, located downriver from the Catawba River (Marcus 1987). The first large-scale investigation of PCBs and other contaminants in Catawba River fish was conducted by the Duke Power Company in 1993 (Coughlan 1995). Largemouth bass fillets were collected from 26 different locations in both North Carolina and South Carolina, most from reservoirs managed by Duke Power in both states. In this study PCBs were not detected in largemouth bass fillets; however, the detection limits of 0.28 ppm to 0.35 ppm for Aroclor 1260 were much higher than the 0.05 ppm detection limits reported by Aldridge (1978) and Marcus (1987). These detection limits were also much higher than the initial threshold that triggers limited fish consumption advice by the SCHDEC and the North Carolina Department of Health and Human Services (NCDHHS).

Beginning in 1999, the US EPA (2009a) conducted a national probabilistic fish contaminant study of lakes and reservoirs in the US. The results of the study were summarized in a national report in 2009, which revealed PCBs con-

tamination in fish collected from several reservoirs on the Catawba River. This rediscovery of PCBs in South Carolina fish brought renewed awareness of the problem, leading the SCDHEC and the North Carolina Department of Environmental Quality (NCDEQ) to conduct additional monitoring of this basin. The results led to the issuance of restrictive consumption advice for several fish species from the Catawba River chain of reservoirs and certain portions of the river by the SCDHEC and the NCDHHS. Not long after these findings, PCBs were found in fish from the upper Great Pee Dee River in South Carolina. Near this time, the NCDEQ was investigating PCBs in several reservoirs in the Yadkin/Pee Dee Basin, with an Alcoa Plant located on Badin Lake considered a possible source (NCDHHS 2009; Mort 2017). In South Carolina, restrictive fish consumption advisories were already in place for the Great Pee Dee River because of mercury, but the discovery of PCBs prompted an investigation into possible sources for widespread contamination in fish from both the Catawba and Pee Dee Basins. Therefore, the primary objective of the study presented here was to investigate and determine the probable source or sources of PCB contamination in the Great Pee Dee/Yadkin River Basin and the Catawba/Wateree Basin. A secondary outcome of the study was a characterization of the spatial trends of PCBs in fish of South Carolina, including those from waterways that are shared with Georgia and North Carolina.

MATERIALS AND METHODS

DESCRIPTION OF STUDY AREA

Figure 1 shows the area of study as we conceived it, showing a portion of Georgia that shares the Savanna River Basin with South Carolina and the portions of North Carolina. In addition to the Savanna River, the Great Pee Dee River and Santee River Basins are large Atlantic drainages with headwaters that originate in the Blueridge Mountains. There are also many smaller basins self-contained within the political boundaries of South Carolina, all of which originate in or near the coastal plain of the state. Highlighted in Figure 1 is the Catawba River Basin, an upper section of the Santee River Basin. Lake Hartwell and Langley Pond, in which high levels of PCBs have occurred for many years, are labeled and sampling sites are indicated with red points. All the waters of South Carolina, whether self-contained or shared, meander through the landscape of the state and empty into the Atlantic Ocean. Except for the Savanna River, the Atlantic terminus of which is shared with Georgia, the confluence of these waterways with the Atlantic occurs completely within the boundaries of South Carolina.

Like much of the United States below the historic glacial line, South Carolina lacks large lakes and very few, small, natural, lentic waterways. However, over the past 150 years, numerous large and small dams have been erected across rivers and streams, which are referred to by various terms such as lakes, reservoirs, impoundments, and ponds. No large reservoirs, defined as greater than 50 feet in dam height, existed in South Carolina in 1850, but by 1987 there were 92 (US ACE 2021). These dams were mostly erected beginning in the 1900s for various purposes including hydroelectricity production, flood control, drinking water sources, and a source for industrial cooling water. In most cases, over time, they also became important for recreation, with permanent and secondary homes being constructed along their shores. One of the more extensively modified rivers in the Carolinas is the Catawba River, with many hydroelectric reservoirs constructed on the river by what is now Duke Energy. There are 11 such large impoundments on the Catawba, which extends from Lake James in North Carolina to over 400 km downriver to Lake Wateree in South Carolina (Table 1). The Yadkin/Pee Dee River also has several hydroelectric dams that were built in the early twentieth century (Table 1). A series of four reservoirs were constructed beginning in 1917 by the Tallassee Power Company and Alcoa Corporation. For many years these were owned and operated by the Alcoa Corporation, but in 2017 they were acquired by Cube Hydro Carolinas, LLC (Cube Hydro 2021). Between the lowermost point of these reservoirs and the point where the Great Pee Dee River crosses into South Carolina there exists Lake Tillery and Blewett Falls Reservoir. Originally operated by Carolina Power and Light, these two projects are now owned and operated by Duke Energy. Table 1 shows water bodies in the study area where restrictive fish consumption advisories have been issued by the SCDHEC, the NCDHHS, and the GADNR because of PCBs, which were current at the time of this writing.

FISH COLLECTION AND PROCESSING

Glover et al. (2010) and the SCDHEC (2001) described methods utilized in the collection and processing of fish tissue in South Carolina. This involves the collection of fish using standard electroshocking techniques at public water bodies in South Carolina (US EPA 2000a). Largemouth bass were targeted at all sites while certain other species were collected when present, particularly game fish that may be an important part of the local fishery. Specimens were placed on ice and returned to the laboratory where they were processed individually. Standard measures were recorded and a skin-on, scale-off fillet was utilized for most species. For catfish species, skin-off fillets were taken. Using standard US EPA (2000a) methods, fillets were homogenized with dry ice and delivered to the SCDHEC laboratory for analysis.

Fish samples from other agencies, including those from the US EPA, Georgia, and North Carolina, utilized similar collection techniques. More details on specific collection and processing methods can be found in NCDENR (2013) for the state of North Carolina, in Georgia Department of

Table 1. Fish Consumption Advisories for PCBs in Select Basins in South Carolina

Basin	State	Reservoir	Year Built	Fish Consumption Advisory—PCBs*
Catawba	NC	Lake James	1923	No
Catawba	NC	Rhodhiss Res.	1925	No
Catawba	NC	Hickory Res.	1927	No
Catawba	NC	Lookout Shoals Res.	1915	No
Catawba	NC	Lake Norman	1963	STP, HYS (NCDHHS)
Catawba	NC	Mountain Island Res.	1924	BLC, CHC (NCDHHS)
Catawba	NC/SC	Lake Wylie	1904	LMB (NCDHHS); LMB, CHC, BKS (SCDHEC)
Catawba	SC	Fishing Creek Res.	1916	LMB, BLC, CHC, WHB, BKS (SCDHEC)
Catawba	SC	Great Falls Res.	1907	No
Catawba	SC	Cedar Creek Res.	1909	LMB, BLC, CHC, WHB, BKS (SCDHEC)
Catawba	SC	Lake Wateree	1920	LMB, BLC, CHC, WHB, STB, BKS (SCDHEC)
Pee Dee	NC	High Rock Res.	1927	Catfish all species (NCDHHS)
Pee Dee	NC	Tuckertown Res.	1962	No
Pee Dee	NC	Badin Lake	1917	LMB, Catfish all species (NCDHHS)
Pee Dee	NC	Falls Res.	1919	Catfish all species (NCDHHS)
Pee Dee	NC	Lake Tillery	1928	Catfish all species (NCDHHS)
Pee Dee	NC	Blewett Falls Res.	1912	No
Savannah	SC/GA	Lake Hartwell	1959	All Species (SCDHEC); LMB, CHC, STP, HYS (GADNR)
Savannah	SC	Langley Pond	1870	All Species (SCDHEC)

Note. LMB = largemouth bass, HYS = hybrid striped bass, BLC = blue catfish, CHC = channel catfish, BKS = black crappie, WHB = white catfish, STP = striped bass. *No Advisory generally because of lack of data rather than absence of tissue PCBs.

Natural Resources (1992), in US EPA (2000b) for the USEPA National Lakes Study, and in US EPA (2016) for the US EPA Catawba Indian Nation special study.

FISH TISSUE DATASETS

The SCDHEC data served as the primary data source for the state and included fish tissue fillets collected beginning in 1991. Watersheds shared by the two Carolinas include Santee (which contains the Catawba/Wateree), Yadkin/Pee Dee, Little Pee Dee/Lumber, and Waccamaw. For the portions of these watersheds outside of South Carolina, data were provided by the North Carolina Department of Environmental Quality (NCDEQ) in partnership with the North Carolina Department of Health and Human Services (NCDHH). The states of Georgia and South Carolina share the Savannah River Basin, and data collected by the Georgia Department of Natural Resources (GADNR) were also used in this study. A national study on fish tissue contamination was conducted by the US EPA (2009a) in the late 1990s and early 2000s. Of the 500 lakes sampled across the United States, 10 were contained within or flowed into South Carolina. In support of the Catawba Indian Nation, fish tissue PCB data were also obtained by the US EPA (2016) from the Catawba River. Data for largemouth bass fillets from Coughlan (1995) for the Duke Power reservoirs were not used in our analysis because there were high detection limits for Aroclors in that study (0.28 ppm–0.35 ppm). The combined datasets represent 2,075 individual or composite samples analyzed for PCBS and 4,232 fish specimens. There were 44 different species collected and processed from 303 different sampling locations from 1991 to 2016. The dominant species was largemouth bass, with 46% of all samples represented by this species. Channel catfish were the second most dominant species, representing 10.7% of the samples. This large volume of data, over space and time, allowed for a comprehensive assessment of PCBs in fish from the waters of South Carolina and provided insight into possible sources.

For analysis and reporting and display, we used total PCBs reported in parts per million (ppm) wet weight. We report wet weights because most of the data used for this study were only available in this format due to its use for determining fish consumption. To compute total PCB levels for each fish or fish tissue composite sample, individual congeners or Aroclors were summed for each sample. For reporting and display we used the mean of total PCBs for samples from a specific sampling point. EPA methods 8082 and 1656 were utilized for Aroclor analysis of fish tissues, while EPA method 1668 was used for congener-specific anal-

ysis of fish tissues. For additional information on standard operating procedures for laboratory tissue analysis, see SCDHEC (2012) for South Carolina, NCDENR (2013) and Mort (2017) for North Carolina, GADNR (1992) for Georgia, US EPA (2016) for Catawba Indian Nation Special Investigation, and US EPA (2000c) for the US EPA national study on lake fish tissue.

To compare the many samples for which Aroclor-only data were available (mostly in SC) with those sites with congener-only data (in NC), PCB congeners were summed and grouped into their homolog class and then converted to a percentage for each homolog for a given sample. The Agency for Toxic Substances and Disease Registry (ATSDR 2000) listed the approximate composition of each Aroclor as expressed in homolog percentages. For example, Aroclor 1260 was shown to be dominated by hexachlorobiphenyls, while pentachlorobiphenyls are the dominant component of Aroclor 1254. We used the percent homologs for each sampling site and a given species of fish to approximate the most probable Aroclor composition, which allowed sites at some North Carolina reservoirs to be compared to those in South Carolina. We did this for the congener data from the EPA national fish tissue study (US EPA 2009a), although both Aroclor and congener data were analyzed for all fish in this project. Having both Aroclors and congeners for the same sample allowed for additional insight into the extrapolation of Aroclors from congener data.

SPATIAL ANALYSIS

Spatial analysis and display were performed with Esri ArcView 10 (2020). Important data layers included the National Hydrography Dataset, the National Landcover Dataset, and in-house layers created by the SCDHEC, such as fish tissue monitoring locations. For many of the figures presented here, sample sites are represented as points on maps, and colors represent levels of PCBs that correspond to the thresholds that trigger a consumption advisory by the SCDHEC (2021). These categories are "no restrictions" of consumption (<0.05 ppm, Green), "eat no more than one meal per week" (0.05 ppm to 0.19 ppm, Yellow), "eat no more than one meal per month" (0.2 ppm to 0.99 ppm, Orange), and "do not eat any" (≥ 1.0 ppm, Red). Because consumption advisories are given for water bodies and not points, these figures are not intended to represent an advisory but rather to represent spatial trends. Further, the states of Georgia and North Carolina have slightly different means and methods for issuing fish consumption advisories than South Carolina, making this scale not as relevant for these states. However, the first trigger for issuing restrictive consumption advisory in all three states is fish tissue PCB levels of 0.05 ppm or above. Fish consumption advisories for South Carolina, North Carolina, and Georgia may be found at SCDHEC (2021), NCDHHS (2021), and GADNR (2021), respectively.

Largemouth bass fillets were well represented in the dataset across space and time and served as a good surrogate for spatial trends. Channel catfish and blue catfish fillets were also used to evaluate trends, especially where largemouth bass were absent. To provide a more robust spatial coverage and increase sample size, these two catfish species were combined to examine trends. We could not confidently assess temporal trends because of insufficient data over time at specific sample locations.

STATISTICAL ANALYSIS

Testing for differences of PCBs for point data was not possible due to small sample sizes at many locations. To increase sample size, multiple sample sites at individual bodies of water were combined. Tests for differences in PCB levels in largemouth bass in the Catawba River Watershed were conducted for 7 waterways (Mountain Island Reservoir, Lake Wylie, Catawba River, Fishing Creek Reservoir, Cedar Creek Reservoir, Lake Wateree, and Wateree River). Lake Norman was not included in this analysis due to small sample size (n = 2). For catfish, 8 groups were evaluated, which included the above water bodies and Lake Norman. For the Great Pee Dee Watershed, 5 groups were evaluated for both largemouth bass and catfish (High Rock Reservoir, Badin Lake, Falls Reservoir, Lake Tillery, and the Great Pee Dee River in South Carolina). To test for assumptions of normality, Q-Q plots were constructed and Shapiro-Wilk Tests for normality were conducted. For the Catawba River Watershed, both for largemouth bass and catfish, the data were not normally distributed. The nonparametric Kruskal-Wallis Test was thus used, and the post hoc Dunn's test was used to determine which groups differed. For both largemouth bass and catfish data in the Great Pee Dee Watershed, data were found to be normally distributed, and ANOVA tests were used to test for differences in groups. For ANOVA, the post hoc Tukey-Kramer test was used to compare groups. The accepted level of significance for all tests was $p < 0.05$. The data analysis for this paper was generated using the Real Statistics Resource Pack software (Release 7.6) (Zaiontz 2020).

RESULTS

Figure 1 shows the spatial distribution of total PCBs in largemouth bass fillets from waters of South Carolina to include those shared with Georgia and North Carolina. Mean total PCB values for largemouth bass fillets ranged from below detection (< 0.05 ppm) to 6.4 ppm at a site on Lake Hartwell in South Carolina. Of the 171 SCDHEC sampling locations with largemouth bass fillet data, 15% had mean total PCB levels greater than or equal to 0.05 ppm. Of the 145 points in Figure 1 shown in green (mean total PCBs <0.05), 94% had no detectable PCBs found in any of the fish samples analyzed for Aroclors. The maximum value

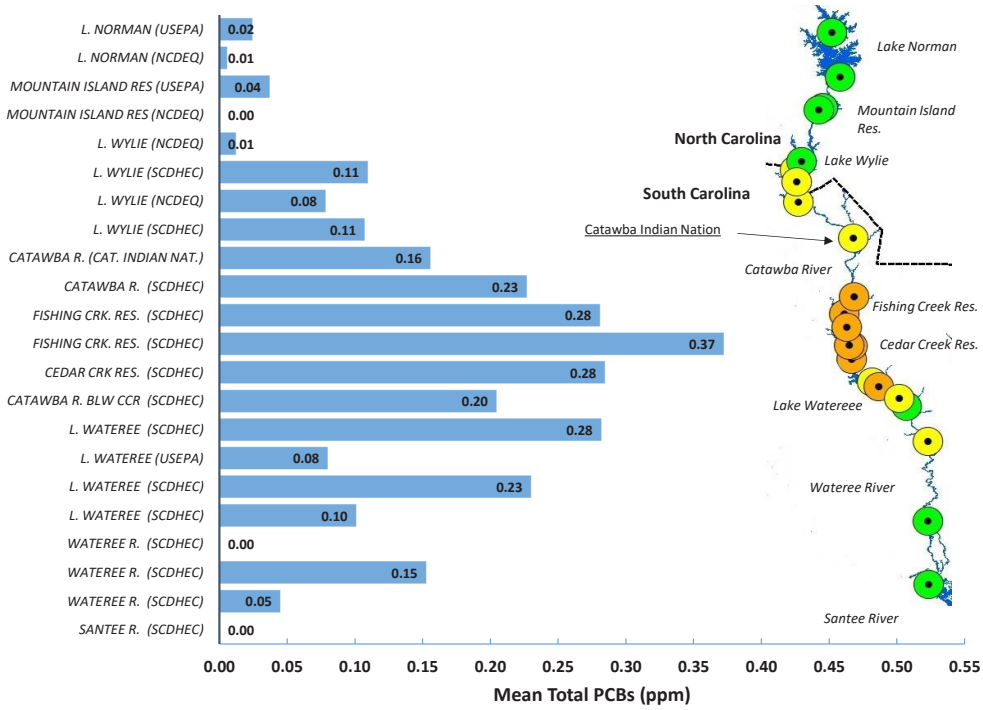


Figure 2. Mean total PCBs (ppm wet weight) in largemouth bass fillets from the Catawba River Basin of the Carolinas (means labeled on each bar). Mean total PCBs for green points <0.05 ppm, yellow points 0.05–0.19 ppm, and orange points 0.20–0.99 ppm.

for a largemouth bass fillet sample was 19.7 ppm, a site on Lake Hartwell in South Carolina, and the maximum mean total PCBs for largemouth bass fillets (n=49 samples) was 6.4 ppm, from a different sampling site on this same reservoir. PCBs in fish tissue at levels that have triggered consumption advisories have been found in four areas: Lake Hartwell (SC/GA), Langley Pond (SC), the Catawba/Wateree River Basin (SC/NC), and the Yadkin/Pee Dee River Basin (SC/NC) (see Table 1 and Figure 1). Shown also as yellow points in Figure 1 are three additional locations where mean PCB levels exceeded 0.05 ppm for largemouth bass fillets, which included Sesquicentennial State Park Lake, a small reservoir in the center of the state, the Saluda River in the western part of South Carolina, and a site toward the coast on the Santee River directly below the dam on Lake Marion. However, these three sites had small sample sizes of individual fish (5, 3, and 2 respectively), and their means were elevated because of a single specimen at each location. Additional data are needed to determine any real trends, and at this time consumption advisories for PCBs have not been issued for these water bodies (SCDHEC 2021).

LAKE HARTWELL AND LANGLEY POND

The highest levels of fish tissue PCBs occurred in Lake Hartwell and Langley Pond, with readings well above 1 ppm mean total PCBs in the fillets of many fish species (Figure 1). Both locations have a long history and record of PCB contamination, and remediation efforts have occurred at both (US EPA 2009b; CH2M Hill Engineers 2016). The source of PCBs in Lake Hartwell was a chemical plant on Twelve Mile Creek, which drains into the lake. Langley Pond was constructed in 1870 as an impoundment of Horse Creek. Large numbers of textile mills occurred in this watershed, releasing industrial waste into the creek for decades, which settled into this downstream impoundment. A complete evaluation of these two sites is beyond the scope of this paper, but further information can be found in other studies (Bruner and Hill 1977; Aldridge 1978; Marcus 1987; Gaymon 1992b; Darr 1986; US EPA 2009b; CH2M Hill Engineers 2016).

CATAWBA/WATEREE WATERSHED

The pattern of PCBs in fish tissue in the Catawba/Wateree Basin is illustrated in Figures 1 through 4. PCBs were present in largemouth bass fillets in Lake Norman and Mountain Island Reservoir, North Carolina, but at relatively low levels (mean total <0.05 ppm). Higher levels (mean total >0.05 ppm) were found in fish from Lake Wylie at the North Carolina-South Carolina border. In South Carolina values were still higher in the Catawba River near the Catawba Indian Nation, which is below the confluence of Sugar Creek. The headwaters of Sugar Creek are in North Carolina, and much of the city of Charlotte occupies this watershed. Levels consistently exceeded 0.2 ppm at Fishing Creek Reservoir and remained elevated in Cedar Creek Reservoir just

downriver. The highest mean PCB levels in largemouth bass fillets for the basin were 0.37 ppm at a site on Fishing Creek Reservoir (n=22 samples) (Figure 2). While PCB values were obtained by several agencies utilizing different laboratories and methods (Aroclors vs. Congeners), the patterns were remarkably consistent for total PCB tissue levels throughout the watershed.

The Kruskal-Wallis test indicated that some waterways in the Catawba Basin were significantly different for mean PCB concentrations in both largemouth bass and catfish fillets ($H=42.7$, $p < 0.001$) and catfish ($H=30$, $p < 0.001$) (Figures 3 and 4). Figure 3 shows the group differences for largemouth bass, with Cedar Creek Reservoir and Fishing Creek Reservoir having the highest levels of PCBs and Lake Norman, Mountain Island Reservoir, and Lake Wylie having the lowest. The post hoc Dunn's test showed that mean PCB values in largemouth bass were not significantly different in Like Wylie and Mountain Island Reservoir, though these two reservoirs were, in general, significantly different ($p < 0.05$) from the others. An exception was that mean PCB levels in largemouth bass in Lake Wylie and the Wateree River were not significantly different ($z=0.87$, $p=0.38$). Figure 4 shows the results for PCBs in catfish from the Catawba River Basin. The patterns were similar between catfish and largemouth bass. The highest levels of PCBs were in fish from waterways beginning at the Catawba River in South Carolina, while they were lower in the 3 upriver reservoirs (Lake Norman, Mountain Island Reservoir, and Lake Wylie). While the patterns were similar for catfish and largemouth bass, results of the Dunn's post hoc test indicated that PCBs in catfish in the Catawba River, Fishing Creek Reservoir, Cedar Creek Reservoir, Lake Wateree, and the Wateree River were not significantly different from each other (Figure 4).

Though evaluations and reporting were conducted only on largemouth bass and catfish, consumption advisories have been issued for several species in these water bodies by the SCDHEC and the NCDHHS (Table 1).

Aroclor 1260 was the dominate PCB mixture in fish from the Catawba/Wateree Basin in both North Carolina and South Carolina (Figure 5). This included samples analyzed by the SCDHEC, the EPA's national fish tissue study (US EPA 2009a), the EPA Catawba Indian Nation special study (US EPA 2016), and the Aroclor samples processed by the NCDEQ. The homolog profile computed from the EPA national fish tissue study (US EPA 2009a) for Lake Norman, Mountain Island Reservoir, and Lake Wateree shows a composition that suggests Aroclor 1260,and strongly resembles that which was given by ATSDR (2000) (Figure 5). The Aroclor analysis for these same three sites and specimens, both for the fillets and whole fish (n=6 samples), showed 100% Aroclor 1260. This homolog profile suggesting Aroclor 1260 was similar to the profile seen in most fish species in the Yadkin River Reservoirs in North Carolina (Mort 2017) but different from the Aroclor analysis processed from the Great Pee Dee River in South Carolina, Lake Hartwell in South Carolina, and Langley Pond in South Carolina, all of which were reported as predominantly Aroclor 1254 (Figure 5).

YADKIN/PEE DEE WATERSHED

Figures 6 through 8 show the pattern of PCB contamination in largemouth bass and catfish fillets from the Yadkin/Pee Dee River Basin in North Carolina and South Carolina. PCBs are relatively low (<0.05 ppm) in fish from a series of reservoirs on the Yadkin River and the Great Pee Dee River in North Carolina near the state line. In the Great Pee Dee River in South Carolina the levels are substantially higher, with mean PCB levels in largemouth bass fillets at 0.26 ppm at station PD-012. There was a decreasing trend from this site moving downriver. Levels were above 0.05 ppm at PD-337 (n=5 samples), which was 74 km downriver of PD-012, but were low or below detection limits beginning at PD-622 (n=5 samples), which is 98 km downriver of PD-012. The ANOVA analysis indicated group differences in PCBs of largemouth bass in the Great Pee Dee River Basin ($F=4.7$, $p<0.01$). In general, this was driven by the high levels of PCBs in the Great Pee Dee River in South Carolina. The Tukey-Kramer Test indicated that reservoirs in North Carolina were not statistically different from each other ($p>0.05$), with the exception of Falls Reservoir, where significantly different levels were reported from the Great Pee Dee River in South Carolina.

Patterns were similar for catfish fillets as for largemouth bass in the Great Pee Dee Basin (Figure 8). However, PCBs for catfish were sufficiently elevated in some of the Yadkin Reservoirs in North Carolina to the point where the NCDHHS (2021) issued restrictive consumption advice for catfish. Group differences were significant (ANOVA $F=6.3$, $p<0.001$) and appeared to be driven by the high values in the Great Pee Dee River in South Carolina (Figure 8). However, means were not significantly different for Badin Lake and the Great Pee Dee River in South Carolina (Tukey-Kramer $q=2.7$, $p=0.33$).

Most PCBs from fish collected from stations on the upper Pee Dee River in South Carolina were reported as Aroclor 1254 (92%) (Figure 5). This was comparable to Langley Pond (97%). PCBs from fish in Lake Hartwell were also reported as mostly Aroclor 1254 (67%), but 29% were also reported as Aroclor 1260. This contrasts with the Catawba River Basin, where 95% of Aroclors were reported as 1260. However, the homolog profile for sites on the Yadkin Reservoirs in North Carolina was like those on the Catawba and suggests Aroclor 1260 as the dominant mixture in fish tissue from most locations. Mort (2017) reported similar results and provided a comprehensive evaluation of the homolog and congener patterns in the tissue of fish from these Yadkin reservoirs.

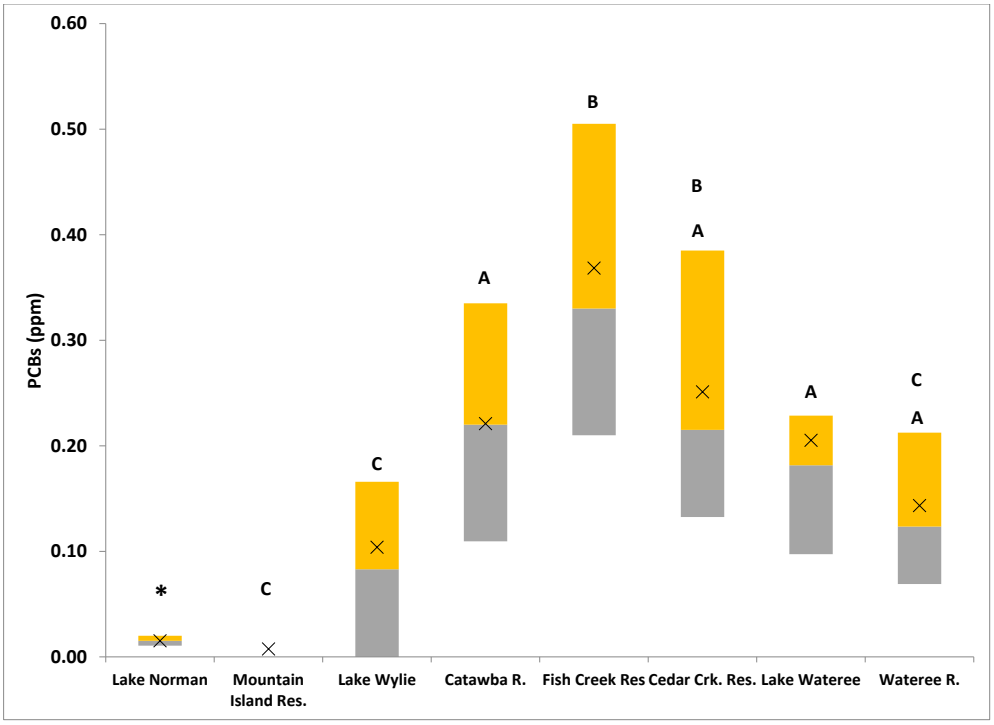


Figure 3. Box plot of PCBs in largemouth bass from water bodies in the Catawba River Watershed showing quartile 1 (bottom of grey columns), median (top of grey columns, bottom of yellow columns), quartile 3 (top of yellow columns), and mean (X). Group means were significantly different (Kruskal-Wallis Test $H=42.7$, $p < 0.001$). Groups with different letters were significantly different from each other ($p < 0.05$), while groups with the same letter were not significantly different (Dunn's post hoc test). *Not included in model due to low sample size.

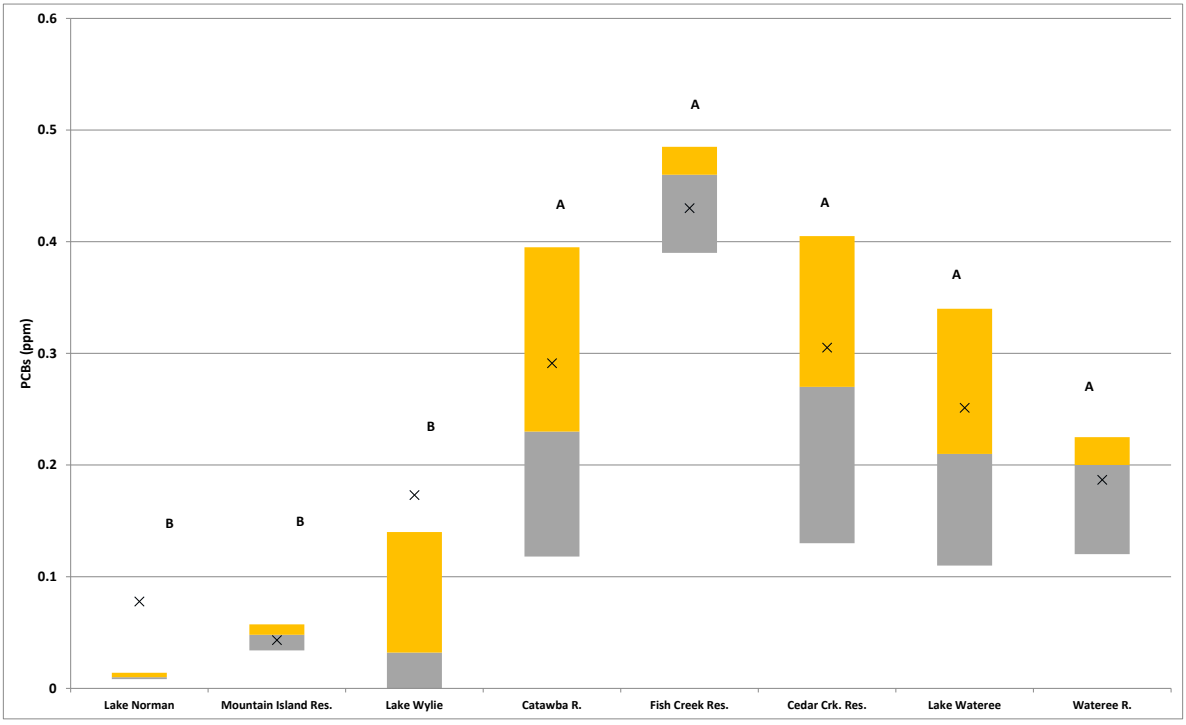


Figure 4. Box plot of PCBs in catfish (blue catfish and channel catfish combined) from water bodies in the Catawba River Watershed showing quartile 1 (bottom of grey columns), median (top of grey columns, bottom of yellow columns), quartile 3 (top of yellow columns), and mean (X). Group means were significantly different (Kruskal-Wallis Test $H=30$, $p < 0.001$). Groups with different letters were significantly different from each other ($p < 0.05$), while groups with the same letter were not significantly different (Dunn's post hoc test).

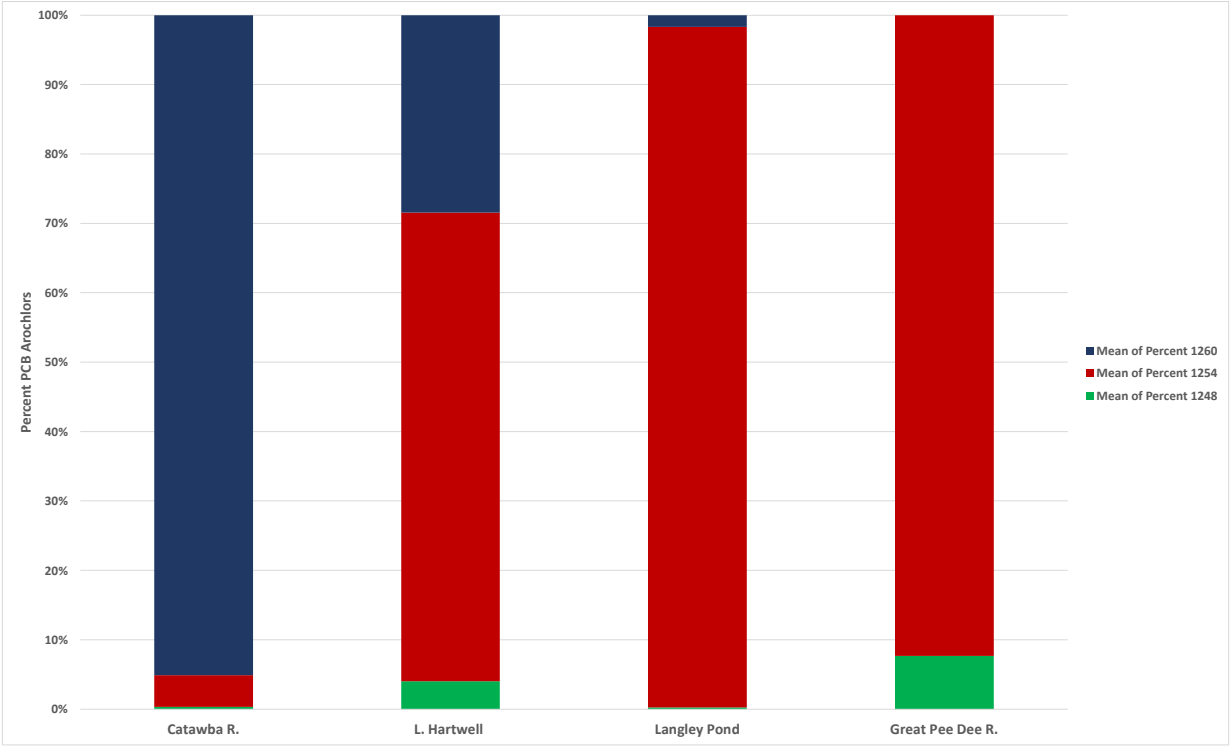


Figure 5. Percent Aroclors in largemouth bass from the Catawba River Basin, the Great Pee Dee River, Lake Hartwell, and Langley Pond in South Carolina.

DISCUSSION

THE USE OF OIL FOR MOSQUITO CONTROL—A BRIEF HISTORY

In the late nineteenth century, a campaign was initiated by the US military and public health officials to stop the spread of malaria, which included an aggressive effort to reduce the population of Anopheles mosquitoes (Ross 1900). In the first half of the twentieth century, tremendous volumes of waste oils were applied directly to US waterways, particularly on large reservoirs in the southeast, in an attempt to kill the larvae of the Anopheles mosquito (Carter 1913). While Dichlorodiphenyltrichloroethane (DDT), Paris Green, and other pesticides were applied to row crops in and around homes, great quantities were also applied directly to the water's surface, usually after being mixed with oils of various grades (Johnson 1922).

While malaria in the early part of the twentieth century had been on the decline in the US, there was great concern in the southeast about the many large reservoirs that were being built (Le Prince 1927). The still waters along the shores and in coves provided an ideal habitat for *Anopheles* mosquito larvae. Henry Carter, Senior Surgeon of the US Public Health Service, recognized early in the twentieth century the potential impact on public health of the many hydropower plants that were being planned and provided strong words of warning (Carter 1914). In addition to the concerns of public health officials, there were fiscal considerations, as lawsuits were common during this era (Kay 1915; Clark 1931). Williams (1958) reported that in the early twentieth century, "power companies were multiplying impoundments, malaria became epidemic around the new ponds, and resulting lawsuits threatened some companies with bankruptcy." Malaria was thus a major consideration in planning the construction of hydroelectric plants through the first half of the twentieth century and appears to have consumed much consideration and expense pre- and post-construction (Williams 1958). Duke Energy (2013) reported that their mosquito control program began in 1923 and was the "oldest continuous environmental program of any utility in the US, and one of the first in North America." Their program continued for 93 years before being terminated in 2016.

EVIDENCE OF TRANSFORMER OIL USED FOR MOSQUITO CONTROL IN THE CAROLINAS

It is not surprising that in May 1970 the participants at a workshop on mosquito control in North Carolina were well represented not only by public health officials and academia but also by utilities, the Tennessee Valley Authority (TVA), and the US Army Corps of Engineers. The proceedings were published in August 1970, which included the questions and answers for the speakers (Howells 1970). To the question of what chemicals hydroelectric plants use for mosquito

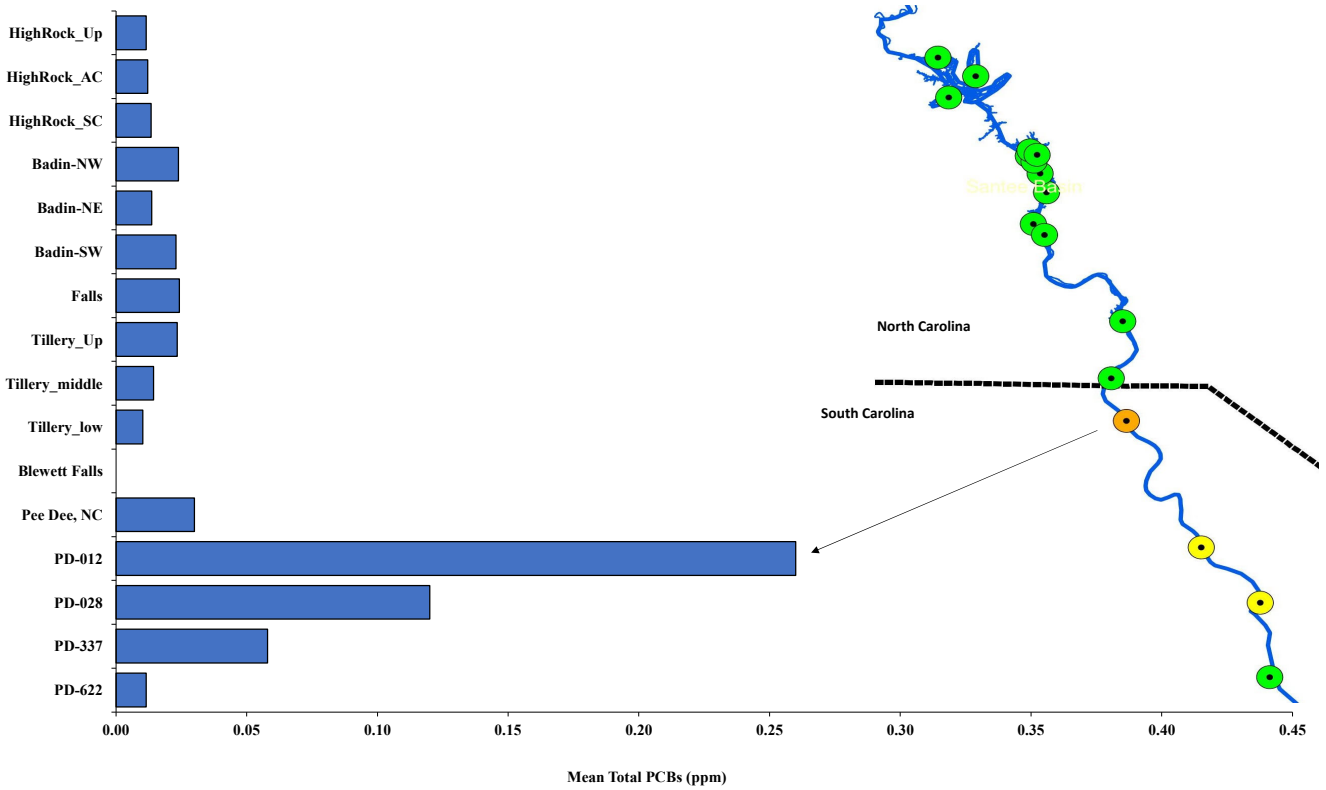


Figure 6. Mean total PCBs (ppm wet weight) in largemouth bass fillets from the Great Pee Dee River Basin. Mean total PCBs for green points <0.05 ppm, yellow points 0.05–0.19 ppm, and orange points 0.20–0.99 ppm.

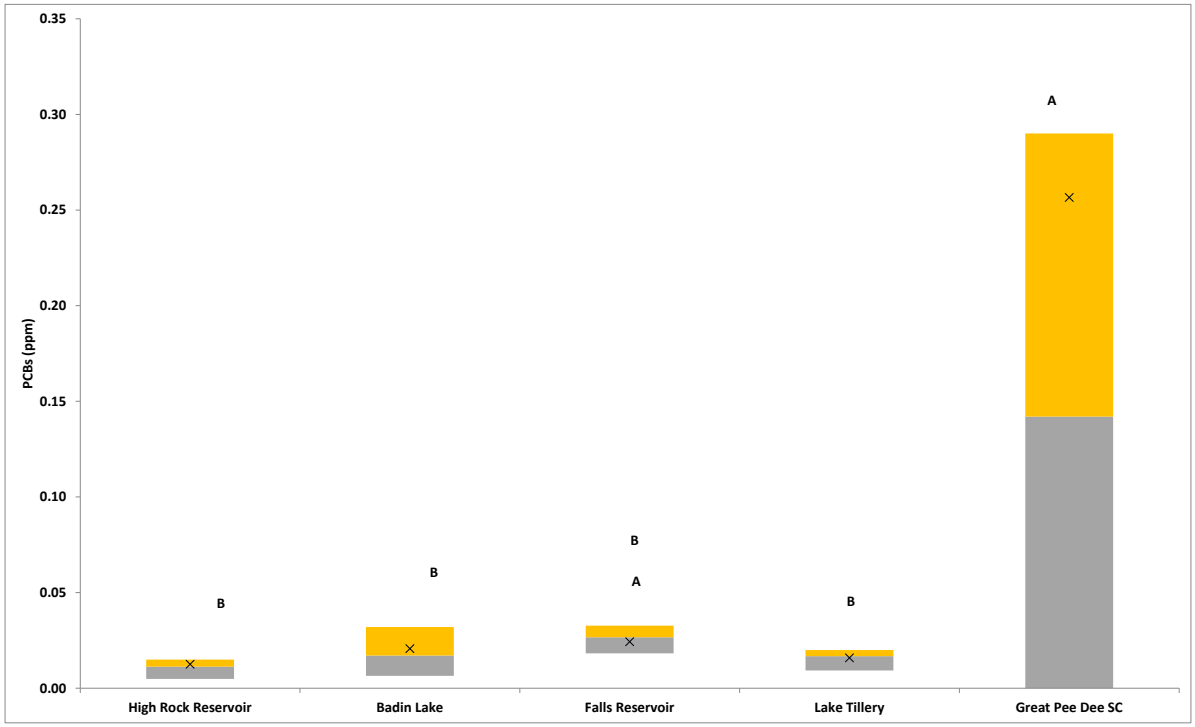


Figure 7. Box plot of PCBs in largemouth bass from waterbodies in the Great Pee Dee River Watershed showing quartile 1 (bottom of grey columns), median (top of grey columns, bottom of yellow columns), quartile 3 (top of yellow columns), and mean (X). Group means were significantly different (ANOVA $F=4.7$, $p < 0.01$). Groups with different letters were significantly different from each other ($p < 0.05$), while groups with the same letter were not significantly different (Tukey-Kramer post hoc test).

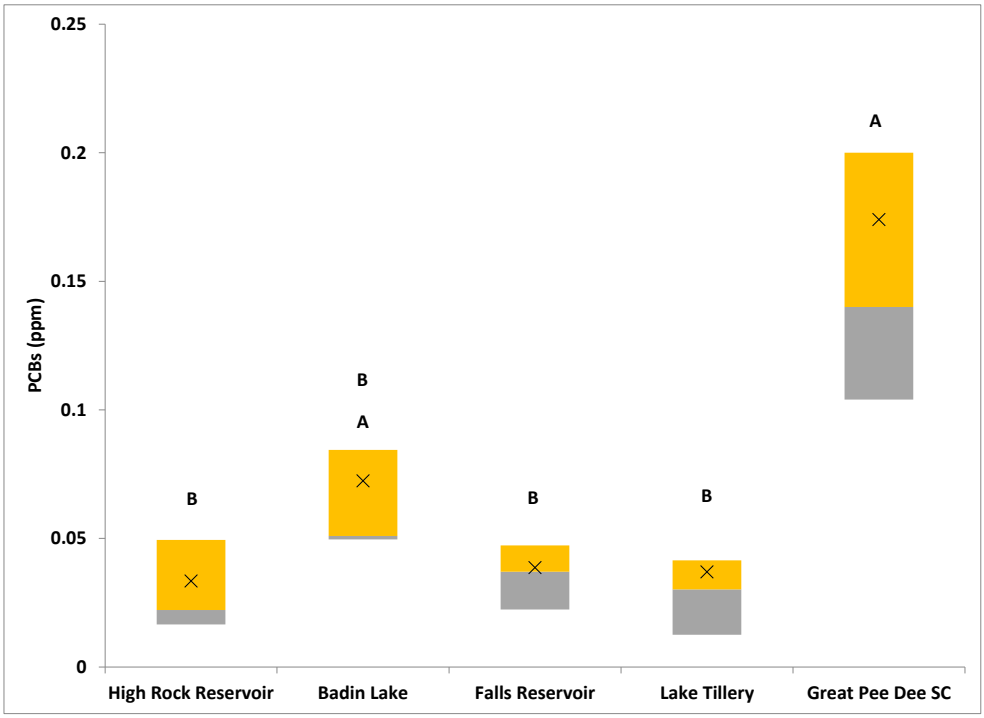


Figure 8. Box plot of PCBs in catfish (blue catfish and channel catfish combined) from water bodies in the Great Pee Dee River Watershed showing quartile 1 (bottom of grey columns), median (top of grey columns, bottom of yellow columns), quartile 3 (top of yellow columns), and mean (X). Group means were significantly different (ANOVA $F=6.3$, $p < 0.001$). Groups with different letters were significantly different from each other ($p < 0.05$), while groups with the same letter were not significantly different (Tukey-Kramer post hoc test).

control, Ashton (1970), with the North Carolina State Board of Health, indicated that a mixture of No. 2 fuel oil and used transformer oil was used by two electric companies. The oil was applied at the rate of 10 to 15 gallons per acre. Swearingen (1970), of Duke Power, reported that they used transformer oil and No. 2 diesel fuel in their mosquito control program. It was estimated that 2,500 miles of shoreline were being treated in North Carolina and South Carolina beginning in April and ending in October, with treatments occurring every 8 days. These are the reservoirs in the Catawba Basin shown in Figures 1 through 4. Harris (1970), with Carolina Power and Light (now Duke Energy) and superintendent of the Blewett Tillery Hydroelectric Project (see Figures 6 through 8) on the Pee Dee/Yadkin River, stated that when transformer oil was available it was used instead of motor oil because it was free. It was suggested that transformer oil had been used for many years, and it was preferred over motor oil because it left a better sheen on the water's surface, which helped the boat operators see where they had sprayed. Motor oil was reported at 20% by volume with the application rate of 150 gallons per day.

The spatial patterns of PCBs in fish shown in Figures 1 through 8 suggest that the past use of transformer oil on these reservoirs contributed, in part, to contemporary contamination. In general, PCBs are absent throughout most of the study area, including large reservoirs operated by other utilities in South Carolina. Where PCBs are present (Lake Hartwell, Langely Pond, and Great Pee Dee River in SC), there is a known point source. The fact that the PCBs found in fish from the Catawba River and Yadkin River reservoirs are Aroclor 1260 (Figure 5; Mort 2017) while those from other sites are mostly Aroclor 1254 further points to these compounds coming from a similar industrial source.

Taken together, these findings strongly suggest that the widespread contamination of PCBs within the Catawba River reservoirs (Figures 2 through 4) and the reservoirs on the Yadkin/Pee Dee (Figures 6 through 8) was caused, at least in part, by the direct application of used transformer oils as part of mosquito control efforts by the reservoir operators. We suggest that the culture of mosquito control and malarial eradication that coevolved with the creation of hydroelectric plants in the early part of the twentieth century likely made the use of waste oil from transformers likely, if not inevitable, at some locations in the Carolinas.

OTHER POTENTIAL SOURCES

Burlington Fibers Plant on Great Pee Dee River, South Carolina

In the fall of 2015, the SCDHEC discovered large quantities of PCBs in soil and sediment around a former Burlington Industrial Fibers plant in Cheraw, South Carolina (SCDHEC 2016). Further investigations found PCBs in the drainage that empties into the Great Pee Dee River near Cheraw, South Carolina (Figure 6). The US EPA, in cooperation with the SCDHEC, soon initiated an intensive investigation of the extent of the contamination. Remediation has occurred and is ongoing, with the site being listed on the National Priorities List (US EPA Superfund) in 2018 (US EPA 2021). The levels and extent of the PCBs in fish tissue of the Great Pee Dee River strongly points to this site as the source of contamination. The predominant Aroclor in the tissue of all fish species in the Great Pee Dee River in South Carolina was Aroclor 1254, but Aroclor 1248 was also present (Figure 5). This pattern was similar to Langley Pond, where the textile industry was also the suspected source. Aroclor 1248 and 1254 were also the primary mixture found in soil samples throughout the area of the former Burlington Fibers plant (SCDHEC 2016). The highest levels of PCBs in fish from the Great Pee Dee River were found at station PD-012, which is immediately downstream from the drainage of the former plant (Figure 6). The decreasing pattern of fish PCBs seen in the Great Pee Dee River moving downriver strongly points to this plant being the source of contamination. This is similar to patterns of PCB in fish from other waterways, with the highest concentrations being near the origin of contamination (e.g., Lake Hartwell in South Carolina; see Gaymon 1992a). The levels of PCBs were much lower in fishes upriver in the Great Pee Dee River in North Carolina, the Yadkin River, and the constructed reservoirs in North Carolina. The homolog pattern from largemouth bass from this basin in North Carolina resembled Aroclor 1260, which was similar to that of the Catawba River fishes (Figure 5). Similar findings were provided in the comprehensive evaluation of fish from the Yadkin Reservoirs conducted by Mort (2017), who showed that the patterns of individual congeners and homologs suggested Aroclor 1260 for most species of fish. It is unlikely that the oiling conducted by the utilities' mosquito control program in the Yadkin reservoirs or the contamination of Badin Lake sediments by the Alcoa plant (see below) contributed to the PCBs present in fish tissue of the Great Pee Dee River in South Carolina.

Alcoa Plant on Badin Lake, North Carolina

The Alcoa plant on Badin Lake also has been shown to have released PCBs into this reservoir and was implicated in the contamination of the fish there (NCDHHS 2012). Remediation, to include capping of lake sediment near the Alcoa plant, was initiated in 2012 as authorized through the North Carolina's Inactive sites and Hazardous Substance Response Act (NCDEQ 2012). However, High Rock Reservoir, where PCBs in fish have also been found, is upriver from Badin Lake (Figure 1 and Figures 6 through 8), and many of the other Yadkin reservoirs, where PCBS have been found in fish, appeared in the early literature related to malaria eradication and have been managed for mosquitoes for decades (Carter 1915; Gage 1925; Clark 1931). Further, there is strong evidence, including that reported here for the Burlington site, that where point source contamination exists, fish tissue PCBs are highest near the source and progressively lower further from the point of highest contamination (Gaymon 1992a). However, in the three Badin Lake sampling sites, no obvious trends were seen in largemouth bass PCB levels (Figure 6), with the two distant sites having similar levels of PCBs in fish as the site close to the Alcoa plant. The NCDHHS concluded that it was not feasible to link PCBs in fish and people who ate fish from Badin Lake to the Alcoa plant, for reasons that were enumerated by NCDHHS (2012). We support this view and suggest that application of transformer oils for mosquito control may have contributed to the contamination seen in Badin Lake.

Past Industrial Pollution

The discovery of large quantities of PCBs at the former Burlington Fibers site on the Great Pee Dee River in 2015 serves as a reminder that past industrial releases may remain undiscovered. A large portion of the city of Charlotte is in the Catawba River drainage, with much of the urban land area draining into the Catawba River through Sugar Creek (Figure 1). Data from the 1970s (Aldridge 1978) to date shows that levels of PCBs in fish tissue are consistently higher in fish below the confluence of Sugar Creek and the Catawba River in South Carolina (Catawba River, Fishing Creek Reservoir, Cedar Creek Reservoir, Lake Wateree, and Wateree River) than above in North Carolina (Lake Wylie, Mountain Island Reservoir, and Lake Norman) (Figures 1 through 4). The detection of PCBs in fish tissue of the Catawba River proper near the Catawba Indian Nation (US EPA 2016), where mosquito oiling likely did not occur, further points to additional sources (Figure 1). However, most of these reservoirs on the Catawba River were completed before 1930 while Lake Norman is a relatively newer reservoir (formed in1963) (Table 1). There would thus be a shorter history of mosquito control on Lake Norman than on other Catawba Reservoirs, which could explain the relatively lower levels of PCBs in that reservoir. However, this does not explain the relatively lower levels in Mountain Island Reservoir (constructed in 1924), suggesting that other sources of PCBs may have contributed to the relatively higher levels of contamination in the downriver reservoirs of South Carolina.

Regardless of potential other sources, the widespread contamination in the reservoirs managed by Duke Power

and Carolina Power and Light (both now Duke Energy), and Alcoa Corporation (now Cube Energy, LLC), along with the acknowledged use of transformer oil in the operations mosquito control programs, strongly suggests that some of the contamination is from the direct application for mosquito control.

CONCLUSION

The global ramifications of these findings are numerous. It is unknown whether PCB waste oils were used by other mosquito control programs. The only documentation we found was from the proceedings of the Mosquito Control Workshop in North Carolina (Howells 1970). However, even here this could have escaped scrutiny if the post-presentation questions and answers had not been captured in the proceedings. Outside of this workshop and the published proceedings, it is also unclear how widely the idea of using spent transformer oils for mosquito control was shared with other regional operators. While the Tennessee Valley Authority (TVA) used oiling on their many reservoirs, water elevation management became an increasingly more important part of its mosquito control program than oiling (Gartrell and Ludvick 1954; Breeland et al. 1961).

In reservoirs where PCBs have been detected, but an obvious source has not been identified, a reevaluation of data and literature would seem appropriate. Many of these hydroelectric projects occur in the southeastern US, but oiling has been a staple for mosquito control throughout the world, even in regions where malaria does not exist. Early research found that PCBs were toxic to the larvae of Anopheles mosquitos (Deonier et al. 1947), but it appears that the primary application was to extend the effective life of other pesticides such as Lindane (Duda 1957). A prerequisite to suppose an association of contemporary PCB contamination with legacy mosquito control would require the same components that were seen in our study, such as a mature and well-funded mosquito control programs, presence of PCBs in the fish of the treated reservoirs but absent in others, and a ready supply of PCB oils that were expendable, likely in combination with other waste oils.

We believe consideration should also be given to remote locations where PCBs have been discovered. There is a large body of literature on this topic, with much of it focused on atmospheric transport and deposition of PCBs traveling great distances from their original source (Bright et al. 1995). For example, some of these projects have occurred in the artic, with PCBs being discovered far from any known source and in remote areas in this region (Freidman and Selin 2016). Mosquito control in the artic and subartic, as elsewhere, is well documented in the historic literature, with the same means and methods employed for eradication (Twinn 1950). For example, using aircraft, 2,777 gallons of a diesel oil mixed with Dichlorodiphenyltrichloroethane DDT was used to cover 3,500 acres of test plots near Churchill, Manitoba, Canada, in 1947 (Goldsmith et al. 1949). In a thorough review on control of biting flies in Northern Canada, Twinn (1950) reported on experimental control measures being carried out at Fort St. John and Fort Nelson, British Columbia; Watson Lake and Whitehorse, Yukon Territory; Goose Bay, Labrador; Rockcliff, Ontario; and Churchill, Manitoba. As was common during this period, DDT mixed with oil sprayed from aircraft was the primary form of treatment in these experiments, with up to 43 square miles being treated in some studies. The mixtures of these treatments were well documented by Twinn (1950) and appeared to consist solely of fuel oil, kerosene, and methylated naphthalenes as emulsifiers for DDT. However, Nordin et al. (1993) suggested that some petroleum oils in the Yukon Territories could have been contaminated with PCBs and that these could have been used in the region's mosquito control programs. It is unclear if PCB oils, when available, were used intentionally in subartic mosquito control programs, but our findings suggest that this should be considered in future investigations.

ACKNOWLEDGMENTS

Two anonymous reviewers and the journal editor provided important and valuable suggestions to improve this manuscript, for which we are very grateful. Thanks also to Dan Liebert, US Department of Agriculture, who provided valuable suggestions to early drafts of this paper. Last, we are grateful to the many dedicated public servants who have been involved in the various aspects of fish tissue advisory programs in the states of South Carolina, North Carolina, and Georgia in partnership with the US EPA.

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