

UNITED STATES DISTRICT COURT  
DISTRICT OF MAINE

MAINE PEOPLE’S ALLIANCE and	)	
NATURAL RESOURCES DEFENSE	)	
COUNCIL, INC.,	)	
	)	
Plaintiffs,	)	
	)	
v.	)	1:00-cv-00069-JAW
	)	
HOLTRACHEM MANUFACTURING	)	
COMPANY, LLC, and	)	
MALLINCKRODT INC.,	)	
	)	
Defendants.	)	

**ORDER ON REMEDIATION PLAN**

For the past decade, under the aegis of this Court, a study panel of scientists who specialize in mercury and contaminated ecosystems have researched the mercury contamination in the Penobscot River caused by Mallinckrodt LLC (Mallinckrodt).<sup>1</sup> After the Study Panel presented the Court with Phase II of its report, the Court held a bench trial in June 2014 for nearly a month and heard extensive witness testimony justifying and critiquing the Study Panel’s report. The parties submitted voluminous exhibits, filed post-trial briefs, and orally argued. Having reviewed evidence and evaluated the arguments, the Court orders the appointment of an engineering firm, knowledgeable in mercury cleanup, to be recommended by the parties and selected by the Court to develop cost-effective and effective remedies to clean up the remaining mercury in the Penobscot River. Once

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<sup>1</sup> Mallinckrodt LLC was once known as Mallinckrodt, Inc.

the engineering firm completes its report, the Court will evaluate its contents, allow the parties to object to its recommendations, and resolve any disputes about the proposal and its implementation. The Court orders that Mallinckrodt fund the project to achieve these ends.

## **I. BACKGROUND**

### **A. Factual Background<sup>2</sup>**

From December 9, 1967 through April 30, 1982, Mallinckrodt or one of its affiliates owned and operated a chlor-alkali plant in Orrington, Maine on a 240-acre site. Between 1982 and 1994, the plant was owned and operated by Hanlin Group, Inc. (Hanlin) (d/b/a LCP Chemicals and Plastics, Inc.).<sup>3</sup> Hanlin and its related companies filed a Chapter 11 bankruptcy petition in 1991. HoltraChem Manufacturing Company, LLC (HoltraChem) owned and operated the plant from 1994 until it closed the plant in September 2000.

While Mallinckrodt owned and operated the plant, facility production included the use of mercury—approximately 82 tons of mercury on site at any given time. The plant sent mercury-contaminated brine sludge into its sewer, and then through the facility's outfall directly into the Penobscot River; this occurred every day, repeatedly, from December 9, 1967 through June 1970. Although the plant estimated that 1.5 to 2.5 pounds of mercury were discharged per day through the facility's outfall during this period, this estimate did not include mercury discharged through air emissions

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<sup>2</sup> The recitation of relevant historical facts comes from Judge Carter's 2002 Order. *Me. People's Alliance v. HoltraChem Mfg. Co.*, 211 F. Supp. 2d 237, 241-46 (D. Me. 2002). The facts were "either stipulated by the parties or found by the Court based on the evidence presented at trial." *Id.* at 241.

<sup>3</sup> Hanlin is not a defendant in this action.

or groundwater; in fact, Mallinckrodt admitted more mercury was discharged through air emissions than through the facility outfall. In addition, the state of Maine was unaware that the facility was discharging mercury into the Penobscot River during this period. Although discharges declined between 1970 and 1982, Mallinckrodt continued to discharge mercury through 1982.

In response to a federal suit filed against it by the United States in 1970, Mallinckrodt constructed Hickel's Pond to divert process waste. The pond was located close to the Penobscot River on a downward slope from the plant buildings. The operation manager of the plant indicated in a 1972 letter that the facility took periodic river, fish, and sediment samples and kept the results on file, but to his knowledge in 2002, the facility did not conduct any further sampling.

In 1994, upon buying the plant, HoltraChem assumed (1) Hanlin's obligations under a 1993 consent decree with the Environmental Protection Agency (EPA) that required Hanlin to conduct a site investigation and corrective measures study under the corrective action provisions of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6972(a); and (2) Hanlin's obligations under a 1991 settlement agreement between it and Mallinckrodt regarding expenses for completion of the study. Under the 1993 Consent Decree, a three-phase process was instituted: (1) site investigation, (2) a study of possible corrective measures, and (3) remediation.

## **B. Procedural History; Further Background**

This case has a lengthy procedural history. On April 10, 2000, the Plaintiffs filed suit against HoltraChem and Mallinckrodt, alleging violation of the RCRA, 42

U.S.C. § 6972(a)(1)(B). *Compl.* (ECF No. 1). The Complaint alleged that Mallinckrodt caused an “imminent and substantial endangerment to health and the environment” as a result of discharging mercury into the Penobscot River. *Id.* ¶ 1. Plaintiffs sought injunctive relief, requesting an order “requiring that Mallinckrodt undertake an independent scientific study of mercury contamination in that portion of the Penobscot downriver of the plant and to develop and implement a remediation plan.” *Me. People’s Alliance v. HoltraChem Mfg. Co.*, 211 F. Supp. 2d 237, 241 (D. Me. 2002).

Following a nine-day bench trial that concluded on March 14, 2002, *Tr.* (ECF No. 134), in which the “evidence focused on the status of the Penobscot River south of the plant and the upper Penobscot Bay [a/k/a Penobscot downriver],” *HoltraChem*, 211 F. Supp. 2d at 240-41, Judge Carter found Mallinckrodt liable under the RCRA on July 29, 2002, *id.* at 252 (“[T]he Court concludes that the methylmercury downriver of the plant, resulting, in part, from Mallinckrodt’s actions at the plant site, may present an imminent and substantial endangerment to public health and the environment.”). Mallinckrodt filed a notice of appeal on August 26, 2002. *Def. Mallinckrodt Inc.’s Notice of Appeal* (ECF No. 149). On August 29, 2002, Mallinckrodt filed a motion for stay pending appeal. *Appellant’s Emergency Mot. for Stay Pending Appeal* (ECF No. 151). This Court denied the motion on August 30, 2002, *Endorsement*, and the First Circuit also denied the motion. *Order of Ct.* (ECF No. 153).

**1. Judge Carter’s Implementing Order; The Study Panel and Its Purposes; First Circuit Ruling**

While Mallinckrodt's appeal was pending, Judge Carter ordered Mallinckrodt to fund a two-phase study of mercury in the Penobscot River on November 25, 2003. *Implementing Order for Penobscot River Study Pursuant to Mem. of Decision and Order Dated July 29, 2002* ¶¶ 5-8 (ECF No. 159) (*Implementing Order*).<sup>4</sup> The study was to be executed by a study panel, the purpose of which was to resolve these issues:

- (1) the extent of the existing harm resulting from mercury contamination to the Penobscot River/Bay system south of the Holtrachem plant site at Orrington, Maine ("the site");
- (2) the need for and feasibility of a remediation plan to effectively address the present effects of such existing harm, if any; and
- (3) the elements of and timetable for the execution of the appropriate remediation plan to address the harm existing as a result of mercury contamination.

*Id.* ¶ 1 (emphasis in original). In resolving these three issues, Judge Carter ordered the Study Panel to answer six questions:

- (A) What physical, chemical, and biological processes are presently at work that effect or govern the distribution and fate of mercury and methyl mercury in the sediments and biota of the Penobscot River/Bay system south of the immediate area of the site?
- (B) What is the extent to which any mercury in the Penobscot River/Bay system is being meth[y]lated and bioconcentrated and biomagnified in aquatic organisms and food webs of the Penobscot River/Bay system?
- (C) Is any mercury in the Penobscot River/Bay system having significantly adverse effects on populations of organisms in the lower Penobscot River/Bay system?

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<sup>4</sup> The Court amended this order several times. *Order Amending Implementing Order for Penobscot River Study Pursuant to Mem. of Decision and Order Dated July 29, 2002* (ECF No. 172); *Second Order Amending Implementing Order for Penobscot River Study Pursuant to Mem. of Decision and Order Dated July 29, 2002* (ECF No. 199).

- (D) Is any mercury in the Penobscot River/Bay system posing an unacceptable risk to human health?
- (E) Do the scientific data lead to the conclusion that a mercury remediation program is necessary and feasible to effectively remediate the effects of any such harm caused by mercury contamination in the Penobscot River/Bay system?
- (F) If remediation is deemed necessary and feasible, what are the elements of and schedule required for the execution and completion of such a remediation program, addressing the effects of mercury contamination in the Penobscot River/Bay system, and what additional information is needed in order to design the remediation program?

*Id.* The Court retained jurisdiction of the case. *Id.* ¶ 13.

The purpose of the Phase I Study was to “assess (i) whether mercury within the study site presently poses an unacceptable risk to human health and/or the environment; and (ii) answer the specific questions (A) through (E) . . . .” *Id.* ¶ 5. Following completion of this part of the study, the Court would evaluate the findings and recommendations of the Phase I Study and “determine the purposes and scope of the work to be required by the Phase 2 Study Plan.” *Id.* ¶ 8.

The Court, with input from the parties, appointed a three-member Study Panel, and met with members of the Panel on April 20, 2004. *Order of Notice* (ECF No. 170) (Mar. 17, 2004); *Min. Entry* (ECF No. 173). On July 22, 2005, the Study Panel submitted its proposed Phase I Study Plan to the Court. *Order of Notice Attach. 1 A Study Plan for Evaluation of the Mercury Contamination of the Penobscot River/Estuary, Maine* (ECF No. 259) (*Phase I Study Plan*). On August 10, 2005, after reviewing the parties’ comments and objections, the Court approved the Phase I Study Plan. *Order Approving Study Plan* (ECF No. 266).

On December 22, 2006, the First Circuit affirmed Judge Carter's 2002 order in all respects. *Me. People's Alliance v. Mallinckrodt, Inc.*, 471 F.3d 277 (1st Cir. 2006).

## **2. Phase I Report Findings and Recommendations**

The Study Panel submitted its 117-page report on January 25, 2008. *Penobscot River Mercury Study, Phase I of the Study: 2006-2007* (ECF No. 382) (*Phase I Report*).

The Phase I Report explains that the Study Panel used four criteria

to decide whether the environment and biota of the Penobscot River and estuary have high enough levels of mercury to be of concern to an extent that justifies us proceeding to Phase II of the project and whether the source of that mercury appears to [be from] the HoltraChem plant site.

*Id.* at 5. Based on these criteria, the Phase I Report concluded

there is sufficient weight of scientific evidence to conclude that the Penobscot River and estuary are contaminated with [mercury] to an extent that poses endangerment to some wildlife species and possibly some limited risk for human consumers of fish and shellfish. We further conclude that these data justify our recommendation for the study to proceed to its second phase.

*Id.*

The Plaintiffs "wholeheartedly endorse[d]" the Phase I Report, *Pls.' Comments on Phase I Report* at 1 (ECF No. 387) (Feb. 22, 2008), but Mallinckrodt objected to its recommendations and findings, *Def. Mallinckrodt LLC's Comments on and Objections to Phase 1 Study Report* (ECF No. 388) (Feb. 22, 2008). The Court subsequently approved and adopted the Phase I Report on March 7, 2008, and ordered Phase II to proceed. *Order Approving Phase I Report* (ECF No. 390).

## **3. Phase II and Its Purposes; Case Reassignment; Special Master Appointment; Phase I Update**

In ordering Phase II, the Court explained that

[t]he central issues to be addressed . . . are whether it is necessary and feasible to ameliorate mercury and the methylation of mercury in the Penobscot River now and in the future by means that will exceed the benefits likely to be had by allowing the natural attenuation processes in operation in the River to accomplish over time and, if so, what reasonable human processes will accomplish that end.

*Id.* at 3.

On March 10, 2008, the Study Panel submitted its proposed Phase II Study Plan to the Court. *Phase II Study Plan* (ECF No. 391) (*Phase II Study Plan*). The Court ordered the Study Panel to revise the Phase II Study Plan on April 18, 2008. *Order Requiring Study Panel to Revise Phase II Study Plan* (ECF No. 402). The Study Panel submitted a revised proposed study plan on May 21, 2008. *Revised Phase II Study Plan* (ECF No. 407). On July 2, 2008, after reviewing the parties' comments and objections, the Court approved the Phase II Study Plan. *Order Approving Phase II Study Plan* (ECF No. 413).

On July 14, 2008, the case was reassigned to this Judge. On October 17, 2008, the Court appointed Susan Calkins, a former Justice of the Maine Supreme Judicial Court, as Special Master overseeing the Study Group under Federal Rule of Civil Procedure 53. *Order of Reference* (ECF No. 434).

The Study Panel filed an update to the Phase I Report on July 27, 2009. *Update to the Phase I Report* (ECF No. 480) (*Phase I Update*). The Phase I Update added additional data and analysis to the Phase I Report, and concluded that these data and analyses supported the original conclusions of the Phase I Report. *Id.* at xxiii ("Most of the results presented in this report are confirmatory of those presented in the Phase I report and strengthen the conclusions presented in that report, that

the lower Penobscot River and upper Penobscot estuary are significantly contaminated with [mercury].”).

#### 4. Phase II Report Findings and Recommendations

The Study Panel submitted its Phase II Report on April 19, 2013. *Final Report* (ECF No. 652) (*Phase II Report*). The Phase II Report is over 1,800 pages long and contains twenty-three chapters. *Id.* The Phase II Report concludes that mercury discharged from HoltraChem is present in high concentrations in the upper estuary of the Penobscot River, as well as in the sediments “of the upper and lower Penobscot estuary.” *Id.* Attach. 1 *Executive Summ.*, at ES-6 (*Phase II Summ.*). It also concludes that mercury is being converted by bacteria into methylmercury, an organic form of mercury that enters and persists in the bodies of animals exposed to it. *Id.* Furthermore, it concludes that methylmercury “biomagnifies” in the food chain, meaning it becomes more concentrated as it passes from prey to predator. *Id.* The Phase II Report notes that total mercury levels are declining in some areas, but at the current rate of decline it will take “about 33 years for [mercury] concentrations to be low enough in the main stem of the river to not cause problem levels in biota,” and a longer period of 60 years in Mendall Marsh. *Id.* at ES-6 to ES-7. The Report ascribes this slow rate of decline to “the presence of a large pool of [mercury] contaminated mobile sediments (estimated at 320,000 tonnes) that has been trapped in the upper estuary” through “hydrodynamic processes.” *Id.* at ES-7.

Due to the “continuing risk to biota and human consumers,” the Phase II Report “recommends the establishment of a Remediation Program” that would

“involve[] three types of active remediation procedures.” *Id.* These include some targeted removal of “contaminated mobile sediments” and “replacement with clean sediments,” as well as dispersal of a mercury “binding agent” in Mendall Marsh to lower total mercury concentrations and retard the production of methylmercury. *Id.* The Phase II Report sets targets for total mercury concentrations of 450 ng/g dry weight in the upper estuary and 100 ng/g dry weight in Mendall Marsh. *Id.* It suggests that, if the Court orders its recommended remediation program, and assuming certain “uncertainties for the treatments” are resolved, the recovery time could be reduced to “about 5 years.” *Id.*

Both parties filed objections to the Phase II Report on July 3, 2013. *Pls.’ Challenges to Phase II Report* (ECF No. 663) (*Pls.’ Challenges*); *Mallinckrodt US LLC’s Challenges to Phase II Report* (ECF No. 664) (*Def.’s Challenges*). Plaintiffs argued that the Phase II Report did not go far enough in its recommendations, *Pls.’ Challenges* at 2-5; Mallinckrodt argued that the Report is “riddled with errors and unsupported findings,” *Def.’s Challenges* at 1. The Court dismissed both objections without prejudice on February 28, 2014, preferring to address the challenges in the course of the anticipated bench trial. *Order* (ECF No. 721).

#### **5. Bench Trial: June 3, 2014 to June 27, 2014**

Both parties filed motions to exclude certain proffered testimony in advance of trial on April 4, 2014, ECF Nos. 729-33, but those motions were later withdrawn. *Trial Stipulation Concerning Historical Sources of Mercury to Penobscot River/Estuary* ¶ 3 (ECF No. 774) (June 16, 2014) (Plaintiffs’ withdrawing “as moot

their Motion to Exclude Proposed Testimony on Nonparties' Contribution to the Existing Endangerment" (ECF No. 729)); *Oral Withdrawal* (ECF No. 799) (June 27, 2014) (withdrawing of ECF Nos. 730-33).

The Court held a bench trial between June 3, 2014 and June 27, 2014 to determine the next step in light of the findings and recommendations in the Phase II Report. *Min. Entry* (ECF No. 754); *Min. Entry* (ECF No. 796). The Court summarized the purpose of the trial: "So it seems to me the focus of this hearing is, how bad is the problem? How bad is it likely to be in the future? And what do we do about it?" *1 Tr. of Proceedings* 9:13-15 (ECF No. 755) (June 3, 2014) (*1 Trial Tr.*).

Over the course of trial, the Court heard the testimony of twenty-three witnesses, discussing various issues relating to the Phase II Report. Plaintiffs submitted their post-trial brief on August 28, 2014. *Pls.' Post-Trial Br.* (ECF No. 814) (*Pls.' Br.*). Mallinckrodt submitted its post-trial brief on September 18, 2014. *Mallinckrodt US LLC's Post-Trial Br.* (ECF No. 815) (*Def.'s Br.*). On September 30, 2014, Plaintiffs submitted their post-trial reply brief. *Pls.' Post-Trial Reply Br.* (ECF No. 817) (*Pls.' Reply Br.*).

## II. THE BENCH TRIAL

The testimony heard at trial totals over 3,000 transcript pages (not including relevant testimony taken by deposition and admitted into evidence). Per the Court's request during the last day of trial, the parties submitted an appendix to each of their post-trial briefs, which contains brief summaries of the witnesses' testimonies. *19 Tr. of Proceedings* 3537:25-3538:9, 3541:7-18 (ECF No. 800) (June 27, 2014) (*19 Trial*

*Tr.*); *Pls.’ Br. Attach. 1 Witness Summaries*; *Def.’s Br. Attach. 1 Witness Summaries*.

The Court instructed the parties as to the development of and the purpose of these summaries:

What I’d like each of the parties to do is to -- for each expert, both for the proponent and for the opponent, to prepare a very brief, maybe one paragraph, statement about what it is you think they said and then, second, what is the scientific significance of what they said and then, third, what’s the legal significance in the context of the case. And that will help me understand why it is you -- the proponent who called them and, on the other hand, what it is that the opponent thinks or how it is the opponent thinks I should view the testimony.

*19 Trial Tr. 3537:25-3538:9*. The Court reviewed these summaries as well as the trial testimony.

### **III. POSITIONS OF THE PARTIES**

#### **A. Plaintiffs’ Post-Trial Brief**

Plaintiffs begin by arguing that the trial evidence establishes that “[m]ercury contamination in the Penobscot is severe, posing unacceptable risks to human health and the environment.” *Pls.’ Br.* at 1. Among other examples to support this assertion, Plaintiffs point out that the lobster and crab industries have been affected by the closing of the lower Penobscot by the Department of Marine Resources to protect human health, and that pregnant women and young children have been advised by the Department of Inland Fisheries and Wildlife not to consume duck from Mendall Marsh. *Id.* According to Plaintiffs, “[w]hile portions of the ecosystem are cleansing themselves, the pace is slow. The best estimate, derived from an extensive survey of sediment cores, is that, on average, and in those locations that are recovering,

sediment in the main stem of the river will not reach acceptable levels for three decades.” *Id.* As a result, Plaintiffs seek the following from the Court:

To address this persistent and dangerous contamination, the Court should order the immediate, intensive pursuit of active remedies to accelerate recovery of the ecosystem. All three members of the Court-appointed Study Panel, plus the project leader hired by the panel, recommend that result. Every other witness who testified to that question at trial, except those retained by Mallinckrodt, agreed. Plaintiffs seek an order empanelling an expert group of mercury scientists and engineers to map out, under the Court’s supervision, a feasible suite of remedies, with whatever additional data gathering and pilot testing is necessary to that end. Consistent with the purposes of the Resource Conservation and Recovery Act (RCRA), active remedies will address the continuing human health and environmental dangers the Court-ordered study has uncovered, and will hold Mallinckrodt accountable for having polluted the river in violation of the law.

*Id.* at 2.

#### **1. Mercury Contamination in the Penobscot Estuary**

Plaintiffs assert that “mercury contamination in the Penobscot estuary poses unacceptable risks to human health and the environment.” *Id.* at 7. First, citing an array of trial testimony, Plaintiffs observe that “mercury is a persistent and toxic pollutant,” and among other concerns, “methylmercury harms the central nervous system” of humans. *Id.* at 7-8.

Next, Plaintiffs argue that “mercury concentrations and mercury methylation rates in Penobscot sediments far exceed those in reference areas.” *Id.* at 8. Citing Dr. Gilmour’s testimony, they note that “methylation rates in Mendall Marsh are among the highest ever recorded presenting particular dangers to wildlife who feed there.” *Id.* (citation omitted). In addition, Plaintiffs contend that (1) “sediment mercury concentrations in the Penobscot are many times greater than in relevant

reference areas”; (2) “mercury methylation rates in Mendall Marsh are extraordinarily high” due to both “elevated total mercury levels [and] the rate of methylmercury production”; and (3) “Mallinckrodt’s attempt to minimize the extent of sediment contamination is without basis” (discrediting much of Dr. Connolly’s testimony). *Id.* at 8-13.

Plaintiffs turn to their argument that “mercury in Penobscot species consumed by people poses an unacceptable risk to human health.” *Id.* at 13. Plaintiffs point out that the level of mercury in species such as lobsters, rock crabs, black ducks, and eels exceeds the safety standards established by the state of Maine, as well as the EPA reference dose established by the federal government. *Id.* Citing an array of trial testimony, they assert that state and federal safety standards provide the appropriate measurement of whether these species pose an unacceptable risk to human health. *Id.* at 14-15. For example, Plaintiffs cite Dr. Kopec’s testimony as evidence that “[m]ore than 90 percent of lobsters sampled north of Fort Point, eels below Veazie Dam, and black ducks in Mendall Marsh exceed the state safety limit for mercury.” *Id.* at 15. Similarly, in some testing areas, rock crabs exceeded the state safety standard as well. *Id.* These statistics and others led to the decision by the Department of Marine Resources to close the lobster and crab fishery in the upper Penobscot estuary. *Id.* In addition, citing Dr. Whipple’s testimony, Plaintiffs assert that “mercury contamination appears to be spreading farther south in the estuary, into an important commercial lobster fishery.” *Id.* at 16. Furthermore, according to Plaintiffs, since 2002, “[t]he Study Panel’s sampling . . . reveals more pervasive

contamination, at higher levels than were previously known and in more species than were previously tested.” *Id.* at 18.

In anticipation of some of the criticisms Mallinckrodt will assert regarding the Study Panel’s assessment of human health risk, Plaintiffs first note that the Study Panel did not need to perform a human health risk assessment (unlike the assertion of Dr. Keenan that one was required). *Id.* at 18-19. That is, it was neither Court-ordered nor necessary. *Id.* at 19. Second, they argue that Mallinckrodt’s alternative safety standards “are extreme and unfounded.” *Id.* Addressing the alternative limits presented by Dr. Keenan, Plaintiffs observe that his “values are more than seven times and 22 times higher, respectively, than the state standard.” *Id.* at 19-20. Plaintiffs cite Dr. Whipple’s testimony for the proposition that Dr. Keenan’s standards are “simply wrong” and “nonconservative to the point of approaching silliness.” *Id.* at 20. Third, Plaintiffs urge the Court not to give weight to Dr. Bolger’s testimony, particularly because he “did precious little to support the opinions he expressed,” including his view “that eating high-mercury meals from the Penobscot poses no health risk . . . .” *Id.* at 21-22.

Next, Plaintiffs contend that “mercury contamination poses unacceptable risks to Penobscot wildlife.” *Id.* at 22. Although there are no regulatory standards to assess “mercury toxicity thresholds for wildlife,” Plaintiffs argue that the Study Panel’s comparisons of levels to those found to be toxic in the scientific literature was, in the words of Dr. Wiener and Dr. Driscoll, both “very reasonable” and “common” practice in this type of wide-scale investigation. *Id.* In Plaintiffs’ view, based on Dr. Evers’s

testimony, the Study Panel's findings demonstrate that "mercury concentrations in birds far exceed toxicity thresholds." *Id.* at 23. In fact, according to Plaintiffs, many "birds sampled by the Study Panel exceed the relevant targets, some by an order of magnitude," especially Mendall Marsh songbirds. *Id.* at 24. Citing the testimony of Dr. Evers, Dr. Rudd, Dr. Whipple, Dr. Fisher, Dr. Bodaly, Dr. Kopec, and Dr. Wiener, Plaintiffs assert that they "are unanimous that the evidence of harm to Penobscot birds justifies pursuing active remediation now." *Id.* at 25. Plaintiffs urge the Court not to give weight to Dr. Henry's testimony, who explained at trial the need for field toxicity tests, because, among other reasons, she ultimately changed her mind upon learning that her colleague, Dr. Connolly, stated that a field toxicity test was unnecessary, and because her "insistence on toxicity testing is . . . inconsistent with her client's conduct during the study process." *Id.* at 25-27.

Addressing their view that "mercury concentrations endanger Penobscot fish," Plaintiffs begin by arguing that the thresholds established by the Study Panel—one for predator and one for prey fish—were reasonable, as illustrated by Dr. Wiener's testimony. *Id.* at 28-29. Based on these thresholds, Plaintiffs observe that Penobscot fish exceed them. *Id.* at 29. Once again, Plaintiffs criticize Dr. Keenan's proposed thresholds, which are three to thirteen times higher than the Study Panel's target for predator fish, and thirteen to 100 times higher than the Study Panel's target for prey fish. *Id.* at 30. Primarily, they criticize his targets (1) for lacking scientific soundness; (2) because the studies upon which he relied in deriving his thresholds were much too narrow, and, for the studies upon which he did rely, Dr. Keenan "routinely discarded

low reported values and included high reported values from the same study. He could not articulate any principled basis for doing so”; and (3) because he criticized the prey fish target established by the Study Panel, and to support his critique, he incorrectly compared mercury levels of prey fish to predator fish (i.e., predator fish “accumulate much higher mercury concentrations” than prey fish). *Id.* at 30-31. Finally, Plaintiffs also assert that the “Study Panel’s methodology was scientifically sound,” and while it assumes Mallinckrodt will argue that the Study Panel should have conducted an ecological risk assessment, Plaintiffs observe that such an assessment was never ordered by the Court. *Id.* at 32.

## **2. Mercury Contamination in the Penobscot Estuary and Its Existence Absent Active Remediation**

Turning to active remediation, Plaintiffs argue that “absent active remediation, mercury contamination in the Penobscot estuary will persist for many decades.” *Id.* Although Plaintiffs acknowledge that natural recovery is occurring in some areas, they argue the sediment cores indicate that recovery is occurring too slowly. *Id.* For example, “Dr. Santschi derived average recovery half times of 31 years in the main stem of the Penobscot River, 22 years in Mendall Marsh, 77 years in the Orland River, and 78 years in the lower estuary.” *Id.* at 34. Plaintiffs note, however, that these half times do not represent the timeframes upon which sediments will be fully recovered; for example, Mendall Marsh “will take three or four half times to reach the relevant target, which means a projected recovery time of roughly 66 to 88 years.” *Id.* at 34-35.

Plaintiffs observe that in other locations of the Penobscot System, mercury contamination is not decreasing naturally, rather it is actually increasing. *Id.* at 36. These locations include “the upper Orland River, the mouth of Mendall Marsh, the reach of the Penobscot River just south of Bangor, and—of most concern—the lower estuary.” *Id.* at 37. They also argue that “a large mobile sediment pool and natural sediment trapping facilitate slow redistribution of mercury and delay recovery.” *Id.*

Addressing Dr. Connolly’s projected recovery half times of five to fifteen years, Plaintiffs counter that his predictions are “unsupported by the data and are not credible.” *Id.* at 39. They argue, among other things, that his data is unreliable because he only used “20 of the 58 sediment cores that Dr. Yeager collected,” and of those twenty, he only used seven cores from Mendall Marsh in deriving the fifteen-year recovery half time. *Id.* at 39-40. In addition, Plaintiffs contend that “Dr. Connolly’s reliance on purported biota trends to project a fast recovery is untrustworthy.” *Id.* at 42. Citing the testimony of Dr. Fisher, Dr. Whipple, and Dr. Wiener, this is because, according to Plaintiffs, “the biota sampling record is too short to discern meaningful trends, much less to use such ‘trends’ to predict system recovery.” *Id.* Furthermore, Plaintiffs cite Dr. Rudd’s and Dr. Fisher’s testimonies for the proposition that Dr. Connolly’s methodology is “just wrong” and “nobody does that.” *Id.* at 43.

### **3. The Need for Active Remediation**

Plaintiffs urge the Court to accept the Study Panel’s recommendation and order pursuit of active remediation options, as such an order would be consistent with

“the data collected and analyzed during the nearly nine-year length of the Court-ordered study.” *Id.* at 44-45. Specifically, Plaintiffs argue that the need for active remediation is “urgent” as demonstrated by (1) legacy mercury concentrations found in the mobile sediment pool; (2) elevated levels of mercury and methylmercury found throughout Mendall Marsh; and (3) the state of Maine closing the lobster and crab fishery to protect public health and evidence suggesting that mercury contamination is spreading to the downstream Penobscot Bay lobster fishery. *Id.* at 45.

Assuming the Court were to grant Plaintiffs’ request, they ask that all remedial options be considered (i.e., those mentioned in the Phase II Report and those that were not), and that they be “conducted by unbiased, independent scientists and engineers.” *Id.* at 46. Citing testimony from various experts, Plaintiffs observe that the Study Panel’s remediation proposals are “not definitive” because the Panel lacked “remediation experts,” and thus, a new team must be developed. *Id.* Plaintiffs contend “there are plenty of viable options to evaluate during a targeted remediation phase,” as evidenced by the trial testimony. *Id.* at 47-49 (discussing the various alternatives described by trial witnesses). Furthermore, Plaintiffs argue that “Mallinckrodt did not attempt an open-minded exploration of possible remedies.” *Id.* at 49. In other words, Plaintiffs assert that “Mallinckrodt’s witnesses [(Mr. Glaza and Dr. Connolly)] sought only to poke holes in the Study Panel’s preliminary ideas” rather than address whether a suitable active remedy exists for the Penobscot. *Id.* at 49-50.

Moreover, Plaintiffs argue that the findings and analyses in the Phase II Report offer direction for remedial efforts. Those findings include: (1) reduction in total mercury in sediments should proportionally reduce methylmercury; (2) mercury remains throughout the System due, in part, to the mobile pool (i.e., the mobile pool is slowing down natural recovery); (3) Mendall Marsh requires “special attention”; and (4) “[t]he need to focus remediation on legacy mercury in sediments, not ongoing sources, is a fourth key insight.” *Id.* at 51-57.

#### **4. Active Remediation as an Equitable Remedy**

Finally, Plaintiffs contend that an order of active remediation is an appropriate equitable remedy because “[t]he purpose of RCRA’s imminent and substantial endangerment provision is ‘to eliminate any risks posed by toxic waste.’” *Id.* at 58 (quoting *Mallinckrodt*, 471 F.3d at 287) (citation omitted). According to them, “[t]he First Circuit advises that once an imminent and substantial endangerment has been identified, as is the case here, RCRA places ‘a congressional thumb on the scale in favor of remediation.’” *Id.* at 59 (quoting *Mallinckrodt*, 471 F.3d at 297).

In addition, Plaintiffs argue that they meet the standard four-part test for injunctive relief: (1) they have suffered irreparable injury as demonstrated by the “permanent” harm inflicted on people, biota, and the environment; (2) no adequate remedies at law exist (“Money damages will not restore the river”); (3) the balance of hardships weighs in favor of injunctive relief and *Mallinckrodt* can afford the expense of remediation; and (4) the public interest will benefit from the relief Plaintiffs seek,

as demonstrated, in part, by the trial testimony of community members. *Id.* at 59-65.

### **B. Mallinckrodt's Post-Trial Brief**

Mallinckrodt concedes that the lower Penobscot contains mercury, but counters

that it is less contaminated than the Phase II Report suggests, and much less contaminated than other sediment sites around the country where active remediation has been undertaken. Mercury in the river is not posing an unacceptable risk to human health, nor is it causing significantly adverse effects on populations of organisms.

*Def.'s Br.* at 1. It also argues that the relief sought by Plaintiffs is simply their “hopes that a magic bullet might somehow be discovered . . . . The Court should decline to go down that path.” *Id.* Although Mallinckrodt agrees with Plaintiffs that songbirds may be at risk, it contends that pursuit of active remediation at this current juncture would be “premature” without first conducting further study on “the nature and extent of any harm that may need to be remedied.” *Id.* at 2. It also agrees with Plaintiffs that a “targeted study of the mobile pool and Orland River should be” conducted, but consideration of remedies “such as bank-to-bank dredging, bank-to-bank capping, sediment trenches, or activated carbon” should be ruled out because the evidence established that these potential options “would accomplish little or nothing, would be extremely expensive, and could easily end up doing more harm than good.” *Id.* In summary, Mallinckrodt urges the Court to deny the relief sought by Plaintiffs, and instead order that the remedies noted above should not be

considered at all, and order Mallinckrodt to conduct “targeted further study of the issues that remain to be addressed.” *Id.*

### **1. The State of the Penobscot River**

Addressing its contention that the Penobscot River is less contaminated than the Phase II Report suggests, Mallinckrodt cites Dr. Connolly’s testimony for the proposition that the Study Panel failed to adequately measure mercury concentrations in surface sediments because the figures “were calculated without using carbon-normalized data and were based upon a comparison to pristine water bodies with far less industry and population density than the lower Penobscot.” *Id.* at 3. In other words, Mallinckrodt argues that the Study Panel’s comparison of the Penobscot to other background sites on a dry weight basis was improper because, as explained by Dr. Bodaly and Dr. Connolly, dry weight inflates mercury level calculations. *Id.* at 4.

Regarding its contention that the lower Penobscot is not as contaminated as other sites in the United States that have been subject to active remediation, Mallinckrodt points to several locations identified by Dr. Bridges. *Id.* at 5. It also observes that the target levels established by the Study Panel are much lower than other reference sites. *Id.* at 5-6. Addressing the River’s rate of recovery, Mallinckrodt asserts that the River is “recovering faster than the Study Panel estimates,” as demonstrated by Dr. Connolly and Dr. Santschi’s findings that the half-time recovery is somewhere between fifteen and twenty-two years based on the cores analyzed from Mendall Marsh, which witnesses agreed were the most representative of the System.

*Id.* at 6-8. Mallinckrodt also urges the Court not to give weight to Dr. Driscoll's findings that mercury concentrations in various surface sediments have increased, because they "tell[] little about the system as a whole or particular areas, as mercury calculations in sediment cores are highly variable across the system." *Id.* at 8.

## **2. Risks to Human Health**

Mallinckrodt argues that the mercury levels found in Penobscot biota that are typically consumed by humans "are in the range of values found in widely consumed seafood in the United States." *Id.* at 11-12 (citing the testimony of Dr. Bolger and Dr. Keenan). In addition, Mallinckrodt contends that the "U.S. EPA's reference dose and the Maine Fish Tissue Action Level are conservative screening thresholds, exceedance of which does not prove an unacceptable risk." *Id.* at 12. According to Mallinckrodt, Dr. Bolger's testimony establishes that "[a]n exceedance of the reference dose should not be misunderstood as reflective of any demonstrable human health risk." *Id.* at 12-13. Mallinckrodt also observes that "Plaintiffs offered no evidence that anyone is being exposed to mercury-contaminated Penobscot food items on a daily basis (or any duration)," and criticize Dr. Grandjean for his "single-exposure theory of harm" (which Dr. Whipple criticized as well). *Id.* at 13, 18. Furthermore, Mallinckrodt points out that the state action level for lobsters is exceeded throughout the state of Maine. *Id.* at 14. In other words, "[e]ssentially all rivers and lakes in Maine . . . would require remediation if 0.2 ppm in fish tissue were the standard for making remediation determinations." *Id.* at 15. In sum, Mallinckrodt argues that Plaintiffs have failed "to meet their burden to prove that 'in

actuality, mercury contamination in the lower Penobscot adversely affects . . . human health . . . .” *Id.* (quoting *Mallinckrodt*, 471 F.3d at 282).

Mallinckrodt also contends that “Plaintiffs’ unacceptable-risk-of-harm argument is at odds with the comprehensive analysis of the health effects of mercury in seafood published earlier this year by the FDA.” *Id.* at 16. According to Mallinckrodt, the FDA found that eating seafood containing mercury levels similar to those “found in the Penobscot and even when consumed in quantities far higher than either Dr. Keenan or Dr. Grandjean assume” still has “substantial health benefits.” *Id.* Furthermore, it says that the FDA has already explicitly declared that the theory endorsed by Dr. Grandjean is incorrect. *Id.* at 18-19. Thus, in Mallinckrodt’s view, Plaintiff’s misapply “the reference dose, which is based on chronic, not acute, exposure.” *Id.* at 18.

Unlike Plaintiffs, Mallinckrodt urges the Court to give much weight to Dr. Keenan’s testimony. *Id.* at 19. Based on his analysis, Mallinckrodt argues that “mercury concentrations in Penobscot food items do not pose a substantial human health risk, even if the appropriate yardstick for measuring risk is the reference dose.” *Id.* at 22. In addition, it observes that Dr. Keenan demonstrated the flaws in Dr. Grandjean’s one-meal theory by creating a model showing “that eating two 2 ½ pound lobsters in 48 hours did not cause any meaningful elevation in blood mercury in humans.” *Id.* at 23.

### **3. Adverse Effects on Populations of Organisms**

Except for certain songbirds, Mallinckrodt contends that “[t]he Study Panel’s screening-level ecological risk assessment reveals that neither mammal nor fish populations are at risk of significant adverse effects.” *Id.* at 24. However, citing the testimony of Dr. Rudd, Dr. Whipple, Dr. Fisher, Dr. Sandheinrich, Dr. Bridges, Dr. Henry, and Dr. Connolly, Mallinckrodt claims that site-specific studies and measuring endpoints must be conducted on songbirds before proceeding further. *Id.* In addition, citing Dr. Keenan’s testimony, Mallinckrodt says that this ecological risk assessment should have been a key component of the Study Panel’s work before recommending pursuit of active remediation. *Id.* at 26.

Addressing potential risk to Penobscot fish, Mallinckrodt first urges the Court not to consider the Study Panel’s target for prey fish “because [it] is a novel and untested approach to screening ecological risk at contaminated sites.” *Id.* at 27. As for the screening level of 500 ng/g established by the Study Panel, Mallinckrodt argues that it is “very conservative,” and even when accepted, all fish species but one (eel) fall below that threshold. *Id.* at 28-29. It also contends that even eel are only “7% higher than 500 ng/g,” and thus, there is no risk of significant adverse effects on this set of species either. *Id.* Rather than follow the Study Panel’s threshold level, Mallinckrodt says that Dr. Keenan’s findings that fish health are not at risk are based on “well-accepted statistical ecological risk assessment methodology.” *Id.* at 29.

Discussing the threshold level established by the Study Panel for prey fish in more detail, Mallinckrodt claims that “prey fish do not pose a risk to predator fish health.” *Id.* at 31. In addition, citing Dr. Keenan’s, Dr. Bodaly’s, and Dr. Fisher’s

testimonies, it argues that a screening value for prey fish is unnecessary because there is “actual data on mercury concentrations in predators themselves,” and even if the screening value were considered, it is too low. *Id.* at 32. In other words, “a more direct way of assessing the risk of fish predators is to sample the concentrations of mercury in the predators.” *Id.*

As for fish-eating bird populations, Mallinckrodt cites Dr. Henry’s testimony for the proposition that they are not at risk because they are below the screening value set by the Study Panel. *Id.* at 33. Regarding insect-eating birds, Mallinckrodt concedes that Nelson’s sparrow and the red-winged blackbird in Mendall Marsh are potentially at risk (as established by Dr. Henry), but argues that “the magnitude and extent of risk is unknown and actual harm is unproven.” *Id.* at 34. However, based on Dr. Henry’s findings and testimony, Mallinckrodt says that no other insect-eating birds are potentially at risk and, among other criticisms, says the Study Panel’s reliance on the Jackson et al. paper on Carolina wrens is “not sufficiently strong for use in ecological risk assessment purposes.” *Id.* at 34-35, 36-37 (discussing the flaws of the Jackson et al. paper in more detail).

Even though Mallinckrodt agrees with Plaintiffs that Nelson’s sparrow and the red-winged blackbird are potentially at risk, it argues that “[t]he next step in assessing risk to songbirds is a field study to determine whether there are adverse impacts” to those two species in Mendall Marsh; in particular, Nelson’s sparrow would be selected for further study to discern the adverse impact on that species as well as, in a representative capacity, the impact on the comparable red-winged

blackbird. *Id.* at 38, 41. Mallinckrodt cites Dr. Evers's testimony, in which he explained he had proposed such a study but it was never performed by the Study Panel. *Id.* at 38-39. In Mallinckrodt's view, "[w]ithout a field study of potential adverse effects on songbirds, we are left to rely on screening values derived from the published literature." *Id.* at 40. Mallinckrodt also observes that given the abundance of Nelson's sparrow remaining in Mendall Marsh, such a field study would not likely be difficult to perform, and the results would be applicable to "all comparable birds in that particular area." *Id.* at 40-41.

#### **4. What Controls Recovery in the Penobscot System?**

Mallinckrodt takes the position that "[i]t is currently unclear what mechanisms are responsible for the rate at which the system recovers." *Id.* at 42. It argues that the evidence does not establish that a mobile pool is controlling the rate of recovery, and based on Dr. Geyer's testimony, says that "[o]ne way to get a better understanding of the location and size of the mobile pool would be to take sediment cores during moderate river flow; on the order of three hundred samples would be required." *Id.* at 44.

Addressing the existence of hotspots, Mallinckrodt contends that Dr. Connolly's testimony establishes that none exist. *Id.* at 44-45. Similarly, regarding the existence of erosion, Mallinckrodt again points to Dr. Connolly's testimony for the proposition that erosion is not controlling the rate of recovery either. *Id.* at 45.

#### **5. Remedial Options**

Mallinckrodt observes that the Study Panel did not recommend large-scale dredging or bank-to-bank dredging, and Mallinckrodt's witnesses agreed with this decision. *Id.* at 46. It points to various witness testimony that large-scale dredging can cause resuspension of contaminated sediments, "can disturb buried sediment that is high in mercury," and can be very expensive. *Id.* at 46-47. This is particularly concerning for the Penobscot, says Mallinckrodt, because, as "Dr. Rudd explained[,] . . . much of the contaminated sediment in the Penobscot is buried deeply enough that it is unavailable for cycling and methylation." *Id.* at 47.

Mallinckrodt also observes that large-scale capping was rejected by the Study Panel as a feasible option as well. *Id.* Mallinckrodt cites Dr. Rudd's testimony for the proposition that "capping could actually increase mercury methylation." *Id.* at 48. In addition, it points out that capping could be very expensive, and Mallinckrodt's witnesses agree that large-scale capping is not a "viable remedial option." *Id.*

Addressing remedial options that were recommended by the Study Panel, Mallinckrodt argues that the Study Panel does not know whether any of their recommended potential remedies "would be feasible or effective." *Id.* at 49. In addition, according to Mallinckrodt, "the Study Panel proposes a new research project on the scale of the 2003 Implementing Order that created the Study Panel." *Id.* at 50.

First, regarding the Study Panel's recommendation of sediment traps, Mallinckrodt argues that this option is just as impractical as large-scale dredging, which the Study Panel previously rejected. *Id.* at 51. Citing Mr. Glaza and Dr.

Connolly's testimony, Mallinckrodt says that implementing sediment traps would essentially be a dredging project. *Id.* at 51-52. Second, addressing the Study Panel's recommendation of applying activated carbon to Mendall Marsh, Mallinckrodt cites the testimony of Dr. Vlassopoulos, who "concluded that none [of the amendments] were effective at reducing total mercury or methylmercury two years after they were applied," and Dr. Gilmour did not consider these diminishing effects in her analysis. *Id.* at 54-55.

#### **6. Mallinckrodt's View on Ordering Active Remediation**

Mallinckrodt summarizes Plaintiffs' request for relief as follows: "[W]e don't have experts on this topic with any specific remedial proposal, but maybe some other experts could come up with something." *Id.* at 57. Citing testimony of several witnesses who say that more information is needed before pursuing active remediation, *id.* at 57, it argues that "[d]etermining that active remediation is appropriate based upon this record would be unfounded, and empaneling a team of engineers to design and test potential remedies would be premature," *id.* at 60.

#### **7. The Four-Part Test for Injunctive Relief**

Mallinckrodt contends that the four-part test for injunctive relief has not been met. *Id.* at 62. First, regarding irreparable injury, it says that there is "no unacceptable risk of harm to human health," and while the fishery has been shut down, it is only a "precautionary measure . . . lobsters from the closed area remain safe to eat." *Id.* In addition, Mallinckrodt argues that Plaintiffs have not demonstrated any actual harm to songbirds or fish at this point. *Id.* Second,

Mallinckrodt contends that because Plaintiffs have not demonstrated any actual harm in the Phase II Report, “there is, as the Court has framed the issues, nothing yet to remedy, either at law or at equity.” *Id.* at 63. Third, addressing balance of hardships, Mallinckrodt claims that “Plaintiffs have not come close to proving harm of the type the Court directed the Study Panel to look for.” *Id.* Fourth, regarding the public interest component, Mallinckrodt states:

The anecdotal testimony of Plaintiffs’ lay witnesses, however sincere and well intentioned, establishes only that these four people believe mercury in the Penobscot is causing them harm. The Study Panel was appointed to develop scientific evidence on the effects of mercury in the Penobscot; the public interest lies in basing remedial decisions on what this scientific inquiry has found.

*Id.* at 64.

#### **8. Mallinckrodt’s View on the Next Steps**

Finally, Mallinckrodt urges the Court to deny the relief sought by Plaintiffs as their remedial options “do not stand a realistic chance of reducing mercury concentrations any faster than would happen if natural recovery were permitted to run its course,” nor would the “astronomical price tag” associated with exploring such options be proper. *Id.* at 65-66. Instead, Mallinckrodt asks the Court to

order further study of the extent of the existing harm to Nelson’s sparrows, as a representative of the two populations of biota that may be experiencing significantly adverse effects. The Court should also order further study to quantify the size and location of the mass of the mobile pool through sediment core samples to determine whether the mobile pool is large enough to delay recovery of the system, and if it is, whether a significant mass of the mobile pool resides in a predictable location such that it could be remediated.

*Id.* at 66. In addition, Mallinckrodt asks the Court to order further sampling at the Orland River (as suggested by Dr. Rudd), and more monitoring of recovery in the Penobscot System. *Id.* at 66-67. Furthermore, citing Mr. Glaza and Dr. Connolly's testimony, "Mallinckrodt requests that it be given the opportunity to conduct any further investigation the Court may order as responsible parties are given in the typical case" rather than the appointment of independent experts or panels. *Id.* at 68.

### **C. Plaintiffs' Post-Trial Reply Brief**

In reply, Plaintiffs first counter Mallinckrodt's contention that the Study Panel overstated the amount of contamination in the System by arguing that whether measuring contamination by dry weight or carbon-normalized concentrations, "sediment mercury in the Upper Estuary is severely elevated." *Pls.' Reply Br.* at 1-2. In response to Mallinckrodt's position that the Penobscot is less contaminated than other sites that have received active remediation, Plaintiffs argue that this comparison is beyond the scope of the trial record as there is no evidence permitting such discussion. *Id.* at 2.

Addressing Mallinckrodt's criticism of the Maine action level and EPA reference dose for assessing unacceptable human health risks, Plaintiffs observe that it was because of the state action level that the state of Maine warned pregnant women and young children not to eat duck from Mendall Marsh, and closed lobster and crab fisheries in the lower Penobscot to "protect public health." *Id.* at 3. Plaintiffs urge the Court to reject Dr. Keenan's approach and "decline Mallinckrodt's invitation

to write new state policy for evaluating the health risks of mercury exposure.” *Id.* at 4.

Regarding Mallinckrodt’s position that field toxicity tests must be conducted before pursuing active remediation, Plaintiffs repeat their arguments from their brief, and note that Mallinckrodt previously requested that bird and fish toxicity studies be removed from the Phase I Report, “and did not object to the omission of such studies in the panel’s Phase II plan” until now. *Id.* at 8-9. Citing Dr. Henry’s testimony, Plaintiffs argue that field toxicity studies are not an absolute prerequisite before moving forward with active remediation, and furthermore, citing Dr. Fisher and Dr. Evers’s testimony, contend that the data collected in the Phase II Report is sufficient to order pursuit of active remediation. *Id.* at 9.

Addressing Mallinckrodt’s argument that the entire estuary will recover in fifteen years based on Dr. Connolly’s calculations, Plaintiffs counter that Dr. Santschi previously rejected Mallinckrodt’s present argument that the Mendall Marsh recovery rate applied to the whole Penobscot System. *Id.* at 11. Moreover, Plaintiffs argue that Mallinckrodt has not contradicted Dr. Santschi’s projected half time recovery rates of seventy-seven years in the Orland River and seventy-eight years in the lower estuary, nor addressed evidence demonstrating that some areas of the Penobscot have not recovered at all, and perhaps will get worse and spread to “the center of an important commercial lobster fishery.” *Id.* at 11-12.

Regarding Mallinckrodt’s position that certain remedial alternatives should not be considered at all moving forward, Plaintiffs once again seek the exploration of

all possible options, pointing out that “[e]very member of the panel believes that remediation experts should now evaluate all possible options.” *Id.* at 16-17. Contradicting Mallinckrodt’s argument that Plaintiffs agree that large-scale capping and dredging should not be considered, they cite the testimony of various witnesses who said that these remedial alternatives should not be removed from the list of options. *Id.* at 17.

Finally, addressing Mallinckrodt’s request to control any further investigation or panels moving forward rather than through empanelment of court-appointed experts and consultants, Plaintiffs oppose such a request, arguing “[i]t would be inappropriate for the Court to entrust the substance of further remedy work to a party that has fought for more than 40 years to avoid any remedy at all.” *Id.* at 18.

#### **IV. DISCUSSION**

##### **A. Legal Standards**

On July 29, 2002, Judge Carter issued an order that found Mallinckrodt had violated the Resource Conservation and Recovery Act (RCRA), specifically 42 U.S.C. § 6972(a)(1)(B), by discharging mercury into the Penobscot River. *HoltraChem*, 211 F. Supp. 2d at 255. On December 22, 2006, the First Circuit affirmed Judge Carter’s liability finding. *Mallinckrodt*, 471 F.3d at 298. In its affirmance, the First Circuit emphasized that “after a finding of liability” under the RCRA, the district court possesses a broad range of “equitable discretion” in crafting an appropriate remedy and that the specific nature of that remedy “is largely in the informed discretion of the trial court.” *Id.* at 297, 298.

As the nature of the remedy is injunctive, the First Circuit described the “familiar four-part framework for injunctive relief” as “a suitable guide”. *Id.* at 296. Those four factors are: (1) that the injunction-seeker has suffered an irreparable injury; (2) that the remedies available at law, such as monetary damages, are inadequate to compensate for that injury; (3) that, considering the balance of hardships between the parties, a remedy in equity is warranted, and (4) that the public interest would not be disserved by an injunction. *Id.* (quoting *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391 (2006)).

With this said, the First Circuit emphasized that an injunction under the RCRA is not a “garden-variety injunction.” *Id.* at 297. It is true that the First Circuit cautioned that “this is not to say that the costs associated with injunctive relief are immaterial,” and charged the trial court with striking a balance “between the public interest and private needs.” *Id.* at 298 (quoting *Hecht Co. v. Bowles*, 321 U.S. 321, 329 (1944)). Nevertheless, quoting *United States v. Price*, 688 F.2d 204, 211 (3d Cir. 1982), the First Circuit observed that “Congress sought to invoke the broad and flexible equity powers of the federal courts in instances where hazardous wastes threaten[] human health.” *Mallinckrodt*, 471 F.3d at 297. Indeed, the First Circuit stated that it perceived “a congressional thumb on the scale in favor of remediation.” *Id.*

## **B. Commendations**

Before undertaking its analysis, the Court acknowledges that its task, though still onerous, has been immeasurably eased by the constructive efforts of a number of people.

**1. Judge Gene Carter**

Foremost is Judge Gene Carter. Judge Carter presided over this case with characteristic energy and distinction from April 10, 2000 until July 14, 2008 when he retired as a United States District Judge for this District. Judge Carter made the liability determination that the First Circuit upheld. *HoltraChem*, 211 F. Supp. 2d at 255; *Mallinckrodt*, 471 F.3d at 298. But for present purposes, this Court is profoundly grateful to Judge Carter for his visionary decision to appoint a Study Panel, consisting of world-class experts, to study the Penobscot River and to make recommendations to the Court. The genesis of the Study Panel is found in Judge Carter's July 29, 2002 Order. *HoltraChem*, 211 F. Supp. 2d at 256 (“The Court **ORDERS** the parties to confer and make genuine, good-faith efforts to agree on a specific plan for an independent study”). Then on November 23, 2003, Judge Carter issued an implementing order, which—subject to Court approval—allowed each party to select one expert and for those experts to select a neutral chair and a consultant to study the Penobscot River and to answer crucial questions. *Implementing Order* at 3-4.

Critically, Judge Carter provided that the Study Panel was to be “independent.” *Id.* at 1. During the nearly month-long evidentiary hearing on the pending motion, this Court had time to contemplate the wisdom of Judge Carter's

Study Panel order. The Study Panel became the benchmark for discussion, yet it allowed both the Plaintiffs and Mallinckrodt to present their own experts if they disagreed with the Study Panel. Absent the Study Panel, the Court would likely have faced dueling, non-neutral experts, hired by the parties, whose scientific opinions may have been difficult to separate from advocacy. Given the rarefied scientific nature of the evidence, the Court's job in distinguishing fact from argument from competing experts would have been arduous at best. Instead, the work of the Study Panel narrowed the range of esoteric scientific issues before the Court and hastened the Court's comprehension.

## **2. The Study Panel and the Experts**

According to the Study Panel Report, between 1967 and the early 1970s, the HoltraChem chlor-alkali plant in Orrington discharged between six and twelve tons of mercury into the Penobscot River. *Phase II Summ.* at ES-6. Over forty years after the last significant discharge, the story of the mercury discharge and its impact on the Penobscot River, its wildlife, and the people of this region has not yet been fully written. It was, however, science that underpinned the existence and operation of the chlor-alkali plant and that resulted in the discharge of such enormous volumes of mercury. As such, the plant is a cautionary tale about the potential for damage to the environment that science can sometimes—intentionally or not—wrought.

There was, however, another, more edifying side to science on display in the Court's courtroom. The members of the Study Panel and the parties' expert witnesses represent cause for optimism. To a person, these highly intelligent, well-educated

and accomplished scientists were impressive, and they give the Court hope that science will be able to undo the harm that science caused.

### **3. The Lawyers**

Finally, the Court commends the lawyers, both for the Plaintiffs and for Mallinckrodt. This is nothing new. *Mallinckrodt*, 471 F.3d at 298 (describing “an impressive array of arguments, skillfully presented by extraordinarily able counsel”). The lawyers in this case have greatly assisted the Court by their thorough understanding of the complicated science, their elimination of unnecessary disputes, and their artful oral and written advocacy.

#### **C. The Dispute**

As advocates, lawyers argue. Upon analysis, however, the areas of true disagreement are relatively narrow. In their post-trial memorandum, the Plaintiffs request an Order:

- (1) affirming the Study Panel’s findings that (a) the Penobscot estuary is heavily contaminated with mercury, and (b) absent active remediation, it will remain contaminated for too long a time, on the order of decades;
- (2) accepting the Study Panel’s recommendation to pursue active remedies to accelerate recovery of the ecosystem;
- (3) adopting the Study Panel’s biota thresholds as remediation targets to eliminate unacceptable risks to human health and wildlife;
- (4) directing the creation of a panel of independent engineers and mercury scientists to design and propose to the Court a suite of active remedies to

achieve those targets as quickly as possible, along with a long-term monitoring program to chart progress toward specific remediation goals; and

- (5) retaining Court oversight—perhaps through a Special Master—to maintain control of the process.

*Pls.’ Br.* at 65.

In its post-trial memorandum, Mallinckrodt summarized its position and proposed that the Court should issue an Order:

- (1) requiring an additional study to determine whether there is any harm to the population of Nelson’s sparrows and, if so, to what extent;
- (2) requiring an additional study of the mobile pool to quantify the size of the mobile pool and to determine its location;
- (3) requiring additional sediment samples in the Orland River (in conjunction with sediment samples to quantify the size of the mobile pool); and
- (4) requiring ongoing Penobscot River system recovery monitoring.

*Def.’s Br.* at 66-67. Mallinckrodt urged the Court not to allow the continued exploration of the Study Panel’s “unworkable remedial ideas” and also argued that the Court should disband the Study Panel and instead should require Mallinckrodt to lead the remedial effort. *Id.* at 67-68.

Underlying the parties’ positions is an acknowledgement that mercury contamination continues to be a significant problem in the Penobscot estuary. Thus, the Plaintiffs and Mallinckrodt agree that some continued study and some

exploration of the engineering alternatives to a clean-up are necessary. They disagree on the scope of continued work and who should do it.

**D. Applying the Standards for Further Injunctive Relief**

**1. Irreparable Harm**

In his seminal Order of July 29, 2002 concluding that Mallinckrodt had violated the RCRA, Judge Carter found that the levels of mercury contamination in the Penobscot River estuary “may present an immediate and substantial endangerment to public health and the environment,” *HoltraChem*, 211 F. Supp. 2d at 251, and on December 22, 2006, the First Circuit affirmed Judge Carter’s finding, *Mallinckrodt*, 471 F.3d at 296. In his testimony, Dr. Whipple of the Study Panel summarized the Panel’s main conclusion:

I think our principal finding is that left to itself, which I think we all wish we could have recommended, the system simply is too contaminated and will be too slow to recover and that we need to consider active remediation measures as a result.

*3 Tr. of Proceedings* 475:12-16 (ECF No. 759) (June 5, 2014) (*Dr. Whipple*) (*Whipple*).

Based on the extensive testimony of the experts, the Court finds that the mercury contamination of the Penobscot River estuary caused by Mallinckrodt continues to “present an immediate and substantial endangerment to health and to the environment.” 42 U.S.C. § 6972(a)(1)(B). This is a significant finding and the Court will explain it.

**a. Mercury**

The Court begins with mercury. Mercury is a naturally-occurring chemical element with the symbol Hg and an atomic number 80. Mercury is probably the most

toxic element on the periodic table. *4 Tr. of Proceedings* 684:23-24 (ECF No. 761) (June 6, 2014) (*Dr. Fisher*) (*Fisher*). Mercury has no known useful function in the human body. *5 Tr. of Proceedings* 799:2-4 (ECF No. 763) (June 9, 2014) (*Dr. Grandjean*) (*Grandjean*).

In general, there are two types of mercury: inorganic and organic. Inorganic mercury is a form of mercury with no carbon atoms attached to it, the type of mercury in older-style thermometers. *1 Tr. of Proceedings* 30:22-31:2 (ECF No. 755) (June 3, 2014) (*Dr. Rudd*) (*Rudd*). The type of organic mercury that most concerns the scientists is methylmercury, which has a carbon atom and two or three hydrogen atoms attached to it. *Id.* 31:8-13. There is a process by which inorganic mercury becomes organic or methylmercury called methylation. *Id.* 32:10-24. Once released into the environment, inorganic mercury is ingested by bacteria and through their biochemical activity, a methyl group is attached. *Id.* As a result, what was inorganic mercury is released into the environment as methylmercury. *Id.* 31:8-13.

Methylmercury is in orders of magnitude more toxic than inorganic mercury. *Id.* 31:14-17. Scientists have recognized that there is a significant human health risk with methylmercury. The impact is most acute in the fetuses of exposed pregnant women. Children born to women who had high mercury levels during pregnancy tend to experience a neurological developmental lag when compared with children born to women without elevated levels. Once the mercury-exposed child reaches school age, they have been documented to have slower motor speed, a poor concentration span, delays in language acquisition, and impaired cognitive function.

There is, therefore, an enhanced risk of mercury exposure for women of child-bearing age. If these women become pregnant, the mercury in the mother's blood reaches the fetus through the umbilical cord, penetrates the placenta, and circulates within the fetus, including the fetal brain. Mercury concentrations in umbilical cord blood are forty to fifty times higher than mercury concentrations in the mother's blood. Furthermore, the fetus is unable to excrete mercury from his or her brain. *HoltraChem*, 211 F. Supp. 2d at 245. In the toxicology world, methylmercury is known to cause developmental neurotoxicity, that is, adverse effects on brain development. *Grandjean* 799:12-14; *HoltraChem*, 211 F. Supp. 2d at 245 (“Methylmercury is classified as a developmental neurotoxicant, which causes harm to the human central nervous system and is ‘extremely toxic to the developing brain.’”).

Methylmercury exposure is exacerbated by four phenomena: bioaccumulation, biomagnification, mobility, and non-degradability. Bioaccumulation means that if a species injects another species with mercury, the predator assimilates the mercury into its body and the mercury becomes attached to its tissues. *Rudd* 32:2-9. Biomagnification refers to the principle that as mercury travels up the food chain, the higher up the food chain, the more concentrated the levels of methylmercury. *Id.* 31:14-32-4. Thus, predator concentrations are many orders higher than concentrations at the bacterial levels. *Id.* 31:23-32:1. Furthermore, although over time some mercury and methylmercury becomes buried in sediment, it remains possible for mercury in either form to become mobile with the stirring of the water

currents, become deposited, and then to become re-suspended with further agitation. *Id.* 142:3-14. Finally, unlike many other elements, methylmercury does not break down over time. *Fisher* 692:19-20 (“[Mercury] doesn’t break down the way an organic compound breaks down.”).

The most common source for methylmercury exposure to humans comes from eating fish and shellfish. *HoltraChem*, 211 F. Supp. 2d 245. When a person eats fish or shellfish, which have a high methylmercury concentration level, the mercury is nearly completely absorbed through the digestive process. *Grandjean* 794:19-25. The mercury is taken up into blood, circulated throughout the body, including penetrating the brain, and only a small amount is excreted. *Id.* Once ingested, methylmercury stays in the body for several months. *Id.* 795:13-19. In a month and a half or forty-five days, humans lose about fifty percent of mercury levels that existed directly after ingestion. *Id.*

#### **b. Maine, EPA, and Study Panel Standards**

In its report, the Study Panel recommended a target “for total Hg concentrations in certain key aquatic and marsh species and for surface sediments in the upper estuary and Mendall Marsh (450 ng/g dry wt. and 100 ng/g dry wt. respectively).” *Phase II Summ.* at ES-7. These targets compare to the state of Maine standard of 0.2 parts per million, or 200 nanograms per gram for recreationally-caught fish as the concentration below which there should be a negligible risk of toxicity at a consumption rate of one meal a week. *Whipple* 482:25-483:7. The Environmental Protection Agency established a guidance level of 300 nanograms per

gram, slightly higher than the Maine standard. *Id.* 483:14-18. Dr. Whipple explained that the difference between the EPA guidance level and the Maine standard is based on fish consumption; people along the coast tending to eat more fish than the national average. *Id.* 485:5-13; *see Phase II Report Attach. 38 Chapter 2*, at 2-5 (*Phase II, Chapter 2*).

**c. The Penobscot River**

The Penobscot River is a river system entirely within the state of Maine consisting of four branches: the East Branch, the West Branch, the Mattawamkeag River, and the Piscataquis River.<sup>5</sup> Including the branches, the Penobscot flows 264 miles from its sources to Penobscot Bay, and after uniting above Bangor, the Penobscot flows southerly toward the ocean. It is the second largest river in New England, draining an area of 22,300 km and is the largest estuary in New England with a surface area of about 90 km.

From north to south, the landmarks for purposes of this case include what used to be the Veazie Dam just north of Bangor; the former HoltraChem plant on the east bank of the River in Orrington just south of Bangor; Mendall Marsh on the west bank in Frankfort just north of Bucksport; Verona Island just south of Bucksport; and Fort Point, where the River meets Penobscot Bay. Verona Island, over six square miles in area, is a bulwark in the River that divides the Penobscot. The main channel of the River continues south to the Bay, and a second arm called the Eastern Channel tracks

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<sup>5</sup> This description of the Penobscot River is an extrapolation from the maps that the parties admitted into evidence. *See Pls.' Ex. 59*.

easterly and then southeasterly, where it meets the Orland River and proceeds southerly to the Bay.

**d. A Mobile Pool of Sediment**

One of the puzzles about the mercury contamination of the Penobscot River has been why the River has not entirely flushed the mercury into the ocean. After all, it has been over forty years since HoltraChem's last significant mercury discharge into the Penobscot, and the Penobscot River is a highly dynamic and powerful river system. *Rudd* 141:8-18 (“[I]ntuitively, one would think in a system like this that these particles would just get washed out to sea.”).

Dr. Wayne R. “Rocky” Geyer presented a convincing explanation for the comparatively slow recovery of the Penobscot River estuary. *6 Tr. of Proceedings* 1143:16-1163:25 (ECF No. 765) (June 10, 2014); *7 Tr. of Proceedings* 1169:11-1272:4 (ECF 767) (June 11, 2014) (*Dr. Geyer*) (*Geyer*). The Court finds Dr. Geyer’s testimony persuasive and adopts his expert opinions. Dr. Geyer is an expert in the circulation and sediment transport processes in estuaries and the coastal ocean. *Geyer* 1144:7-12. He holds a Ph.D. in physical oceanography and works at the Woods Hole Oceanographic Institution. *Id.* 1146:11-15; 1143:18-21.

Once mercury is released into a river, it hitches a ride on minute pieces of sediment as it travels downstream. *Id.* 1149:3-14 (“[T]he mercury is mostly bound to the sediment, so that the -- the transport of mercury is mostly associated with the transport of the sediment.”). Some of the sediment is deposited on the river bed and over time is layered over with ensuing generations of less toxic sediment. Dr. Geyer

focused on what happens to the sediment as it nears Penobscot Bay, and it turns out the sediment is subject to tidal forces and a salt barrier that affects the movement of sediment into the Bay.

In his investigation of the Penobscot River estuary, Dr. Geyer made a number of significant findings. First, he found that there was a comparatively modest amount of sediment coming over what was the Veazie dam north and upriver from the HoltraChem plant site in Orrington. *Id.* 1150:6-10. This point is important because it tends to minimize the impact of potential upriver sources of the mercury found below the HoltraChem site.

Next, Dr. Geyer described what he called a “very effective trap” where the River meets the Bay. *Id.* 1151:4-10. He explained that scientists have known that often when a river meets a bay, a phenomenon called estuarine turbidity maximum takes place, essentially muddying the water with suspended sediment. *Id.* 1150:17-1151:3. Thus, the water at that point tends to be muddier and more turbulent than source waters or bay waters. Dr. Geyer discovered that very little sediment escapes from the River into the Bay. *Id.* 1151:4-10.

Dr. Geyer described two important factors that help explain why so little sediment escapes. First, the sediment meets what he described as the “salt front,” a type of barrier. *Id.* 1144:18-25, 1152:8-17. As the mercury-laden sediment in fresh water meets the salt of the ocean coming from the Bay, the salt front reduces turbidity in the upper water column, and this phenomenon tends to trap the sediment and accumulate it on the bottom.

A second influence is the tide. Penobscot Bay is tidal and the River itself continues to be tidal until at least Bangor. Also, unlike some rivers, the channel for the Penobscot is fairly constricted, thereby increasing the tidal energy. *Id.* 1150:11-16. Near the mouth of the River, powerful tidal currents meet the energy of the downstream currents of the River and the two currents influence the sediment, picking up the deposited sediment and moving it north or south in the direction of the prevailing force. *Id.* The result is what Dr. Geyer termed a “mobile pool” in which the sediments are continually deposited, picked up, suspended, and redeposited in a cycle. *Id.* 1152:1-1153:17.

A final factor is seasonal variation of the trapping of sediment due to changes in river flow. *Id.* 1153:2-14. Like most rivers in the northern part of the northern hemisphere, the Penobscot flows strongest in the spring from snow runoff and eases as the year goes on. This cycle results in what Dr. Geyer described as a seasonal variation of frontal trapping: the location of the front heads north on the River during low discharge periods and south during high discharge conditions. *Id.* 1156:23-1157:3 (“[S]ediment . . . contaminated with mercury is subject to this seasonal remobilization, migration, and -- and blending . . . over the distance of the excursion of the mobile pool.”).

Dr. Geyer’s discovery of the mobile pool around the throat and mouth of the Penobscot River explains why the Penobscot has not experienced the type of recovery from the HoltraChem mercury that a layman might expect given the passage of volumes of water over decades of time.

**e. Mendall Marsh**

During the hearing in June 2014, the parties spent untold hours discussing Mendall Marsh. Mendall Marsh is located in the towns of Frankfort and Prospect on the west bank of the Penobscot River. The state of Maine designated Mendall Marsh as a wildlife management area. Like many combination salt-fresh water marshes, Mendall Marsh serves as a nursery for fish and wildlife: a place where some bird species, such as the Nelson's sparrow, reproduce before fanning out to other habitats, and a place where other bird species congregate before heading south.

Mendall Marsh has some unique characteristics. Although the Penobscot River flows generally southward toward Penobscot Bay, Mendall Marsh is fed in part by a stream and small river that flows from south to north into the River. Thus, although a point of land blunts the Marsh from the direct current of the River, the Penobscot still delivers its waters, including mercury-infused sediment, into the Marsh. Because the Marsh is shaped somewhat like a stopped funnel pointed toward the flow of the Penobscot, once the mercury enters the Marsh, it has nowhere to go and tends to stay there. At the same time, Mendall Marsh is tidal and subject to the seasonal variation of the mobile pool that Dr. Geyer described. Moreover, Dr. Geyer testified that the area around Mendall Marsh is subject to significant sediment trapping. This means that Mendall Marsh experiences the same mobile pool sediment cycling that Dr. Geyer described.

As a consequence of these phenomena, Mendall Marsh is a highly efficient factory for methylmercury production. *6 Tr. of Proceedings* 998:4-5 (ECF No. 765)

(June 10, 2014) (*Dr. Bodaly*) (*Bodaly*) (“[A]reas like Mendall Marsh are very efficient at methylating mercury.”). Dr. Cynthia Gilmour, a biogeochemist with the Smithsonian Institution with a subspecialty in the cycling of mercury in the environment, testified:

[O]ur big-picture conclusions were that the tidal marshes in the river were particularly important sites of methylation. Methylation rates were particularly high there. Another important conclusion was that methylation rates in the tidal marshes in the Penobscot were exceptional. Um, having studied dozens and dozens of ecosystems, ah, the amount of methylmercury production in Mendall Marsh is among the highest or perhaps the highest I’ve ever seen and among and perhaps the highest of what’s out there in the published literature. So exceptional methylmercury production was, for a scientist, the most interesting aspect of the study.

*9 Tr. of Proceedings* 1563:22-1564:7 (ECF No. 772) (June 13, 2014) (*Dr. Gilmour*) (*Gilmour*). Dr. Gilmour’s view about Mendall Marsh methylation production is shared by other scientists both for the Plaintiffs and for Mallinckrodt. *See 8 Tr. of Proceedings* 1456:12-14 (ECF No. 770) (June 12, 2014) (*Dr. Wiener*) (*Wiener*) (“[T]he methylmercury concentrations, as reflected on this axis, are exceptionally high when we look at data from many different systems that have been intensively studied”); *17 Tr. of Proceedings* 2973:7-20 (ECF No. 792) (June 25, 2014) (*Dr. Vlassopoulos*) (*Vlassopoulos*) (“[I]n Mendall Marsh . . . when we look at, on average, the inorganic mercury concentrations in pore water are approximately equal to methylmercury concentrations in pore water. So if you think about that as a -- from a chemical engineering point of view, of -- of a chemical reactor or bioreactor, that’s running at a hundred-percent efficiency. . . . [A] perfectly efficient methylmercury-producing system within these sediments.”).

Although the parties engaged in vigorous argument about the significance of the methylation rate in Mendall Marsh and its broader impact, Mallinckrodt has conceded that “two species of migratory songbirds in Mendall Marsh (Nelson’s sparrow and red-winged blackbird) are at potential risk.” *Def.’s Br.* at 34. Indeed, Mallinckrodt admitted that “[a]dverse reproductive effects on these two species cannot be ruled out based on the screening level ecological risk assessment performed so far.” *Id.*

Mallinckrodt criticized the state of Maine safety thresholds through the testimony of Dr. Russell Edward Keenan and Dr. Betsy Henry. Dr. Keenan is an expert in human health and ecological risk assessment. *14 Tr. of Proceedings* 2445:1-12 (ECF No. 786) (June 20, 2014) (*Dr. Keenan*) (*Keenan*). One of his areas of expertise is exposure assessment. *Id.* 2445:25-246:6. Dr. Keenan expressed the view that the safety threshold for lobster, for example, should be 510 nanograms per gram, which he opined left “a large margin of safety.” *Id.* 2487:4-17.

Dr. Henry is an expert in mercury transport fate and bioaccumulation applied to mercury-contaminated site assessment and remediation. *16 Tr. of Proceedings* 2737:11-14 (ECF No. 790) (June 24, 2014) (*Dr. Henry*) (*Henry*). She testified that using the Study Group’s figures (about the same as hers), the Nelson’s sparrow and the red-winged blackbird have mean mercury concentrations of 4.98 and 4.07 parts per million, respectively, in their blood. *Id.* 2767:21-2768:12. The Study Panel used 1.2 ug/g for mercury in the blood of insectivorous birds. *Phase II, Chapter 2* at 2-6.<sup>6</sup>

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<sup>6</sup> The scientists used three main mercury measurements: ppm, ug/g, and ng/g. Ppm stands for parts per million; ug/g is shorthand for microgram per gram and expresses parts per million; and ng/g

However, Dr. Henry used a threshold screening range for harm between 3.0-4.0 ug/g for marsh birds. *Henry* 2770:11-22, 2774:8-13, 2776:21-2777:2.

Using this threshold, she screened out some species (Virginia rail, swamp sparrow, and song sparrow), but she conceded that both the Nelson's sparrow and the red-winged blackbird in Mendall Marsh exceeded her more relaxed threshold. *Id.* 2775:15-2776:5. Despite this conclusion, Dr. Henry was reluctant to state that there is a significant population-level risk to Nelson's sparrow and the red-winged blackbird, *id.* 2776:17-20, and suggested instead that a field study of the Nelson's sparrow in particular be conducted to "understand whether or not there actually is an impact to reproduction for the Nelson's sparrow in the marsh, and if there is, the magnitude of that," *id.* 2795:25-2796:5.

The Plaintiffs strongly disagree with Dr. Henry's decision to use 3.0-4.0 ug/g as the threshold standard. They point out that the state of Maine action level is 2.0 ug/g (0.2 ppm or 200 ng/g) and the EPA reference dose for a safe intake level is expressed in terms of a mercury ingestion rate of 0.0001 milligrams of mercury per kilogram of body weight per day. *Pls.' Br.* at 14, 19; *Phase II, Chapter 2* at 2-5. Although the EPA has set 0.3 ppm (3.0 ug/g or 300 ng/g) as the threshold, the EPA has encouraged states to set their own levels and Maine adopted the lower threshold because people in Maine tend to eat more fish and shellfish than the national average. *Pls.' Br.* at 19-20; *Phase II, Chapter 2* at 2-5.

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is the symbol for nanogram per gram or parts per billion: for example, 0.2 ppm equals 2.0 ug/g or 200 ng/g.

The experts' differing viewpoints as to the appropriate standards by which to measure remediation are irreducibly complex. The Study Panel Report itself devoted a full chapter consisting of 123 pages to its discussion of the appropriate remediation targets. *Phase II, Chapter 2* at 1-123. At this point, it is not necessary to wade into this earnest and highly-technical debate among eminent scientists concerning the appropriate standards by which success in cleansing the River must be measured. The short answer is that the debate will remain theoretical until the engineers have opined on feasibility and cost and have expressed expert opinions about the likely effectiveness of the remedy. For example, if the lower limits are readily and inexpensively attainable, the Court suspects that Mallinckrodt and its experts would have no objection to attaining them. However, if the lower limits are simply unattainable or attainable only with extraordinary expenditure and considerable delay, the Court suspects the Plaintiffs will be satisfied with a more cost-effective and efficient, but imperfect, remedy. Nevertheless, to the extent the parties require a general benchmark, the Court adopts the state of Maine standard of 200 nanograms per gram, not the more relaxed benchmark Mallinckrodt's experts proposed.

**f. The Maine Department of Inland Fisheries and Wildlife and Mendall Marsh Black Duck**

Robert Duchesne, a birding guide and outdoors enthusiast, testified about the impact contamination in Mendall Marsh had on his birding business. *10 Tr. of Proceedings* 1658:3-1679:21 (ECF No. 775) (June 16, 2014) (*Robert Duchesne*). Mr. Duchesne stated that he had brought birding groups to Mendall Marsh specifically to see the Nelson's sparrow, which is not common elsewhere. *Id.* 1662:1-11. However,

he stopped bringing groups to Mendall Marsh two years ago, after he came upon a poster warning against eating waterfowl. *Id.* 1664:18-1665:8. As a consequence, Mr. Duchesne has been unable to anchor his birding business near Bangor, where his costs would be lower, and instead has had to provide more expensive, logistical tours to Baxter State Park and other areas. *Id.* 1665:15-1666:13, 1671:6-11. Mr. Duchesne also stated that the mercury contamination has “sullied a portion of the river” where the state of Maine has been trying to build “nature-based tourism”. *Id.* 1671:11-18.

**g. The Maine DMR and the Closure of the Verona Island Area to Lobster and Crab Fishing**

Much of the Study Panel’s attention was directed to Mendall Marsh. However, there is a separate area of concern: Verona Island south to Fort Point. This is the area of the Penobscot River just before it opens up into Penobscot Bay. *Pls.’ Ex.* 85, *Map of Lobster Closure Area; Grandjean* 807:7-17. Upon receipt of the Study Panel report, the Maine Department of Marine Resources (MDMR) reviewed the data concerning mercury levels in that area and stated that “[r]ecent data provided to the Department indicates that lobsters in this area may have mercury levels above the Maine CDC active level and would warrant a consumption advisory for the most sensitive populations.” *Pls.’ Ex.* 83, *Notice of Rule-Making Adoption* at 1. On February 22, 2014, the MDMR issued a Notice of Agency Rule-Making Adoption, adopting an “emergency closure to the taking of lobster and crab in this area.” *Id.* The MDMR explained that the “emergency rulemaking is necessary to protect the public health.” *Id.*, *Basis Statement* at 1.

On May 14, 2014, the MDMR proposed making the emergency closure permanent “in order to protect the public health due to the risk of mercury contamination in lobsters and crabs found in the mouth of the Penobscot River above a line starting at the most northwestern point of Wilson Point (near the end of Wilson Point Road) in the Town of Castine continuing in a northwesterly direction to the Fort Point Lighthouse on Cape Jellison in the Town of Stockton Springs.” *Pls.’ Ex. 84, Notice of Agency Rule-Making Adoption* at 1. As justification, the MDMR expressly referred to the Study Panel’s report:

[T]he Department recently received additional data which were collected as a result of court-ordered study stemming from a federal lawsuit (*Maine People’s Alliance and the Natural Resources Defense Council v. Mallinckrodt, Inc.*). The Department requested analysis of the data by the State Toxicologist and Department of Environmental Protection staff. Based on this analysis, [M]DMR determined that a consumption advisory would be warranted for lobster taken from the designated area. Because this is a very discrete area and in order to be health protective, [M]DMR . . . instead took immediate action to close the area as a precautionary measure. [M]DMR anticipates that the closure will be in place a minimum of two years while the State continues to collect more information from the area to inform future management and public health actions.

*Id.* The MDMR extended the closure to crabs as well as lobsters because “there is adequate reason to be concerned that crabs could have similar contamination levels to lobster in the closure area.” *Pls.’ Ex 84, Basis Statement* at 1.

During the hearing, the Plaintiffs presented the testimony of Kenneth Wyman, Jr., a commercial fisherman from Stockton Springs. *11 Tr. Proceeding* 1830:2-1847:20 (ECF No. 778) (June 17, 2014) (*Kenneth Wyman*). For the past twenty-five years, Mr. Wyman fished for lobsters and crabs in the upper Penobscot Bay including

the area the MDMR closed in 2014. *Id.* 1830:19-21, 1832:10-14. In addition, from 1992 or 1993 to 2011, Mr. Wyman ran a business called Wyman Seafood in Stockton Springs, where he sold crabmeat, lobster meat, scallops, clams, and shrimp to the general public. *Id.* 1837:4-14. Mr. Wyman estimated that he had “tens of thousands” of customers over this eighteen to nineteen year period. *Id.* 1838:10-13. Mr. Wyman also used his lobster and crab catch to feed his family and occasionally his friends. *Id.* 1837:25-1838:9. Specifically, he fed lobsters and crabs to his daughter-in-law when she was pregnant and to young children in his family. *Id.* 1838:14-1839:4. When Mr. Wyman learned of the MDMR closure, he was “sickened to the core” by the thought that he had sold contaminated lobsters and crabs to the general public and had fed that same contaminated shellfish to his own family and friends. *Id.* 1841:2-17.

#### **h. Irreparable Injury: Conclusion**

The Court concludes that the Plaintiffs have demonstrated that the Penobscot River estuary continues to suffer irreparable injury from ongoing mercury contamination caused by Mallinckrodt. This finding merely updates and reiterates Judge Carter’s 2002 finding of “imminent and substantial endangerment to public health and the environment,” *HoltraChem*, 211 F. Supp. 2d at 251, which the First Circuit affirmed, *Mallinckrodt*, 471 F.3d at 287. Unfortunately, despite the passage of thirteen years since Judge Carter’s order, the Penobscot River estuary remains unacceptably contaminated with mercury. Specifically, the Court finds that the level

of mercury in Mendall Marsh, in the Orland River, and being recirculated by the mobile pool constitutes irreparable harm to the Penobscot River estuary.

Although the parties fenced over the exact degree of harm from the current level of mercury contamination throughout the estuary, the Court views the MDMR closure from lobstering and crabbing of a large area at the mouth of Penobscot Bay as a game-changer. The closure, which the Court accepts as directly related to the level of mercury in the Penobscot estuary, is by its terms either “permanent or at least of long duration, *i.e.*, irreparable.” *Amoco Prod. Co. v. Vill. of Gambell*, 480 U.S. 531, 545 (1987); *Sánchez v. Esso Standard Oil Co.*, 572 F.3d 1, 21 (1st Cir. 2009). Moreover, in acknowledging that at least Mendall Marsh, the mobile pool, and the Orland River area all require further study to evaluate the ongoing impact of mercury, Mallinckrodt has answered its own argument. Now, over four decades after the last significant deposit of mercury into the Penobscot River, there would be no need for further intensive study if the nature of the damage, at least in the context of this case, were not irreparable.

## **2. Adequate Remedies at Law**

Turning to the second criterion for the issuance of an injunction, the Court also finds that there are no adequate remedies at law. In *Amoco*, the Supreme Court wrote:

Environmental injury, by its nature, can seldom be adequately remedied by money damages and is often permanent or at least of long duration, *i.e.*, irreparable. If such injury is sufficiently likely, therefore, the balance of harms will usually favor the issuance of an injunction to protect the environment.

*Amoco*, 480 U.S. at 545. An award of money damages, even if it could be reasonably calculated, would not undo the elevated methylation levels in the Nelson's sparrow, the Orland River lobster, or the recycling sediment in the mobile pool. Nor is this a situation where the failure to order a remedy now could result in harm that itself could be remediated. *But cf. Northwest Bypass Grp. v. United States Army Corps. of Eng'rs*, 470 F. Supp. 2d 30, 64 (D.N.H. 2007) (finding no irreparable harm in environmental case where plaintiffs alleged a procedural violation of National Environmental Policy Act). The Court concludes that there is no adequate remedy at law.

### **3. The Balance of Hardships**

The Court also concludes that the third factor, the balance of hardships, strongly favors the Plaintiffs at this stage. When the impact of ongoing mercury pollution in the Penobscot River estuary is weighed against the financial impact on Mallinckrodt of the obligation to fund a study analyzing the remedy, the Court strikes the balance in favor of the River. In making this determination, the Court emphasizes that the next stage will focus on possible remedies; it remains to be seen what those remedies may be and whether they will meet the same tests for injunctive relief.

### **4. The Public Interest**

The public has an obvious and compelling interest in reducing mercury contamination in the Penobscot River.

### **5. Conclusion**

Having determined that the Plaintiffs have demonstrated their entitlement to injunctive relief, the Court turns to the next question: the form of relief to be mandated.

### **E. The Remedy**

The Court concludes that a Phase III engineering study is essential in order to understand the range, practicality, and cost of potential solutions.

#### **1. Engineers**

Although the Study Panel scientists have educated notions about solutions, feasibility is a matter for engineers who unite the theoretical with the practical. The appointment of an engineering firm is essential to the task. The Court considered appointing a panel of engineers using the current Study Panel model. However, upon discussion with counsel and upon further reflection, the Court has concluded that the appointment of a single engineering firm would be preferable. One advantage of a Study Panel for Phase II was that the Panel could call in experts in specific areas as necessary. By contrast, an engineering firm should have the in-house capacity to make many of the remedial recommendations. At this stage, to appoint a panel of engineers would be less efficient and would likely delay recommendations and implementation. Moreover, when the Court discussed the engineering options at the close of the June 17, 2015 oral argument, the parties convinced the Court that it would be more efficient and preferable to select one engineering firm, rather than a panel of engineers.

#### **2. Mallinckrodt as Leader**

Mallinckrodt argued that the Court should allow it to assume a leadership role in any further studies or remediation, contending that it “can move quickly and efficiently perform the necessary work, avoiding excessive administrative costs, delay, and quality problems.” *Def.’s Br.* at 68. The Court disagrees.

The problem is public trust. To entrust the cleanup to the polluter would be viewed as naive. However sensible such a solution might be for more localized sites, Mallinckrodt released tons of mercury into a great, vital public resource that stretches from Orrington to Penobscot Bay. Accordingly, Mallinckrodt cannot reasonably expect that the public will simply take Mallinckrodt at its word.

Nor would the Court expect the vigorous and knowledgeable advocates representing the Plaintiffs to accept without close scrutiny whatever Mallinckrodt proposed. In the context of this litigation, if Mallinckrodt took the lead, the Court envisions greater contention, not less. In the Court’s view, Mallinckrodt is better off allowing engineers whose loyalty runs to the Court make remedial suggestions and contesting those recommendations, if necessary, rather than to proposing solutions and inviting inevitable criticism. Of course, as with this phase, if Mallinckrodt or the Plaintiffs disagree with the engineering recommendations, they will have the right to challenge their proposals and make counter-proposals.

### **3. The Range of Potential Remedies**

Mallinckrodt argues that the Court should discard some areas of investigation as fruitless. For example, Mallinckrodt urges the Court to declare that bank-to-bank

dredging and bank-to-bank capping must not be investigated. The Plaintiffs urge the Court not to restrict the engineers from proposing any particular solution.

The Court agrees with the Plaintiffs. The testimony from the scientists during the June 2014 hearing strongly suggests that for some alternatives, such as bank-to-bank dredging, the clean-up may be worse than the condition itself. However, the Court will not artificially constrain the engineers from considering all possible alternatives.

#### **4. Engineering Considerations**

In evaluating the recommendations of the engineering firm, the Court will consider at least the following factors: (1) whether the proposed solution has been successfully attempted previously or is innovative; (2) the likely cost of the solutions; (3) the length of time to complete the recommendations; (4) the likely effectiveness of the solution; and (5) any potential environmental harm that may be caused by the proposed solution.

#### **5. A Special Master**

During Phase II, the Court appointed former Maine Supreme Judicial Court Justice Susan Calkins to oversee the process, address day-to-day issues, and make recommendations to the Court about any unresolved disputes. Justice Calkins handled this task in exemplary fashion, and the Special Master procedure worked well, relieving the Court of the burden of ongoing administration, yet preserving the parties' right to judicial review. The Court will use the Special Master procedure for this next stage.

## **6. The Current Study Panel**

The Court views the current Study Panel as a potential resource for the engineers. The Study Panel is composed of eminent scientists who have first-hand, detailed knowledge of the Penobscot River and its mercury contamination and whose loyalty ran to the Court. The engineers may wish to consult with the members of the Study Panel to clarify aspects of the Phase II Study. The engineers may also find it appropriate to request the Study Panel to perform specified research to inform the engineers' task of remedying the mercury contamination. For example, the engineers may require further study in a particular area of the River in order to make their final recommendations. Although the Court points out that the Study Panel may be a valuable resource for the engineers, the Court is not mandating its use. Furthermore, any further study requiring the expenditure of funds will be subject to judicial oversight.

## **7. Joint Proposed Order**

At the close of the June 17, 2015 oral argument, the Court asked the parties to anticipate that the Court would order an engineering study and to propose, if possible, a joint order to that effect. On June 26, 2015, the parties filed a proposed Order. Upon issuance of this Order, the Court will schedule a telephone conference of counsel to discuss the proposed Order in light of the passage of time.

## **V. CONCLUSION**

The Court concludes that the Plaintiffs have sustained their burden to justify a continuing injunction, one that mandates further study of the mercury

contamination of the Penobscot River caused by Mallinckrodt. More specifically, the Plaintiffs have demonstrated it is essential for an engineering firm to investigate the current status of mercury contamination in the Penobscot River and to propose potential solutions to mitigate the current harm to the people, biota, and environment of the Penobscot River estuary.

SO ORDERED.

/s/ John A. Woodcock, Jr.  
JOHN A. WOODCOCK, JR.  
UNITED STATES DISTRICT JUDGE

Dated this 2nd day of September, 2015