Document 2 Attachment A

SELLING OUR HEALTH DOWN THE RIVER:

Why EPA Needs to Finalize the Strongest Rule to Stop Water Pollution from Power Plants.

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EXECUTIVE SUMMARY

Fossil-fuel burning power plants discharge at least 5.5 billion pounds of pollution into rivers, streams, lakes and bays each year. Coal-burning plants in particular discharge some of the most dangerous heavy metals on earth, including arsenic, cadmium, chromium, lead, mercury and selenium.

Power plant wastewater has contributed to over 23,000 miles of contaminated rivers, fish too polluted to eat in 185 bodies of water, and the degradation of 399 water bodies that are used as public drinking water sources.

In September 2015, the U.S. Environmental Protection Agency (EPA) will issue new regulations to reduce toxic pollutants in power plant wastewater, which will produce enormous benefits to human health and the environment. This report discusses the health benefits the new rules could achieve by eliminating toxic power plant water pollution and examines EPA's estimate of the monetary value of these benefits. The report finds:

1. **EPA's water toxics rule will reduce risks of cancer and neurological damage, especially to the developing brains and nervous systems of children.**
   - Power plants discharge tens of thousands of pounds of cancer-causing pollutants into waterways each year, including arsenic, which is known to cause cancers of the lung, kidney, bladder, skin and other organs, and hexavalent chromium, which can cause stomach cancer. These carcinogens contaminate water used for fishing and swimming, and enter drinking water supplies.

- Power plants discharge dangerous neurotoxins including lead and mercury. Lead can reduce IQ, affect mental development, and cause hyperactivity and behavioral and attention deficits. Mercury is capable of causing profound and permanent developmental and neurological delays to babies exposed in utero. The most common pathway of exposure is the mother's consumption of mercury-contaminated fish.

2. **EPA underestimated the monetary value of the rule's positive benefits by a large margin.**

EPA estimated the monetary value of three specific human health benefits anticipated from the proposed rule. It calculated those benefits would be worth—if the rule were implemented in its stronger forms—between $14 and $20 million per year. However, EPA's estimate disregards multiple other benefits to human health that would result from the rule, such as those associated with reducing:

- risks likely to persist in drinking water, even after treatment, both near power plants and further downstream;
- the greater-than-recognized cancer risk from arsenic exposure through drinking water and fish consumption, due to EPA's reliance on an outdated assessment of arsenic's cancer potency;
- the full range of possible harm from downstream consumption of contaminated fish, including the effects of exposure to lead after age seven and to mercury after birth, other neurological impacts besides loss of IQ, and risks from other neurotoxins discharged by power plants; and
- the full, cumulative health and environmental impacts suffered by communities adjacent to and downstream of the plants.

EPA's estimate also leaves out the many benefits to human and ecological health that cannot readily be monetized.

3. **A full accounting of the human health benefits unambiguously justifies a stringent rule.**

- A comprehensive valuation of the human health benefits of the proposed rule would be far greater than the $14 to $20 million per year estimated by EPA. Taking into account the value of the many benefits not quantified by EPA, a strong final rule would create hundreds of millions of dollars in additional benefits every year.
- Human health will benefit. Water will be safer to drink, fish will be safer to eat, fewer people will develop cancer, fewer children will experience neurological damage, and the toxic burden on vulnerable communities, including communities of color and low-income communities, will be reduced.
- The rule will contribute immense, if un-monetized, additional benefits in the form of clean and healthy watersheds.
- These benefits will be achieved only if EPA finalizes the rule in a robust form that requires the elimination of nearly all toxic discharges from coal-fired power plants.

1. INTRODUCTION

It is widely known that burning fossil fuels to produce electricity pollutes the air with deadly toxic substances. What is less known is that the same power plants that so severely pollute the air also discharge more toxic pollution into rivers, streams, lakes and bays than the other top nine polluting industries combined.[1] Each day, across the United States, power plants dump millions of gallons of wastewater loaded with toxic pollutants like arsenic, boron, cadmium, chromium, lead, mercury and selenium into surface waters. This polluted wastewater is discharged from surface impoundments (ponds) where many plants store toxic coal ash and smokestack scrubber sludge.

In September 2015, the U.S. Environmental Protection Agency (EPA) will finally issue new regulations to reduce toxic pollutants in the wastewater from steam electric power plants. EPA and state regulatory officials have long known about the risks posed by these discharges, and the new regulations will impose long-overdue limits on the discharge of toxic metals and other pollutants. In doing so, these rules will produce an enormous benefit to human health and the environment. Not only will a strong rule bring an end to the daily discharge of these pollutants into our waterways, it will also significantly reduce the risk of catastrophic releases from coal ash impoundments and the ongoing pollution of groundwater from these unlined impoundments.

This report discusses the human health benefits of the proposed rule, then looks at EPA's estimate of the monetary value of these benefits. We conclude that EPA underestimated the value of the rule by a large margin. A full accounting of the human health benefits would unambiguously justify a stringent rule.

2. BACKGROUND

EPA estimates that steam electric power plants discharge at least 5.5 billion pounds of pollution into our nation's waterways every year. Most of that pollution comes from coal combustion wastes and scrubber sludge, which contain a toxic soup of pollutants than can be harmful to humans or aquatic life, even in very small doses.[2] According to EPA, power plant wastewater has contributed to over 23,000 miles of contaminated rivers, fish too polluted to eat in 185 bodies of water, and the degradation of 399 water bodies that are used as public drinking water sources.

Despite the magnitude of this pollution problem, the existing effluent guidelines and standards, which have not been updated since 1982, do not include discharge limits for power plants for a long list of pollutants toxic to humans and aquatic life. EPA finally proposed new wastewater standards in April 2013, but its proposal contains multiple options that vary greatly in the amount of water pollution they would reduce. The two strongest options — options 4 and 5 — would eliminate the majority of toxic discharges using technologies that are available and

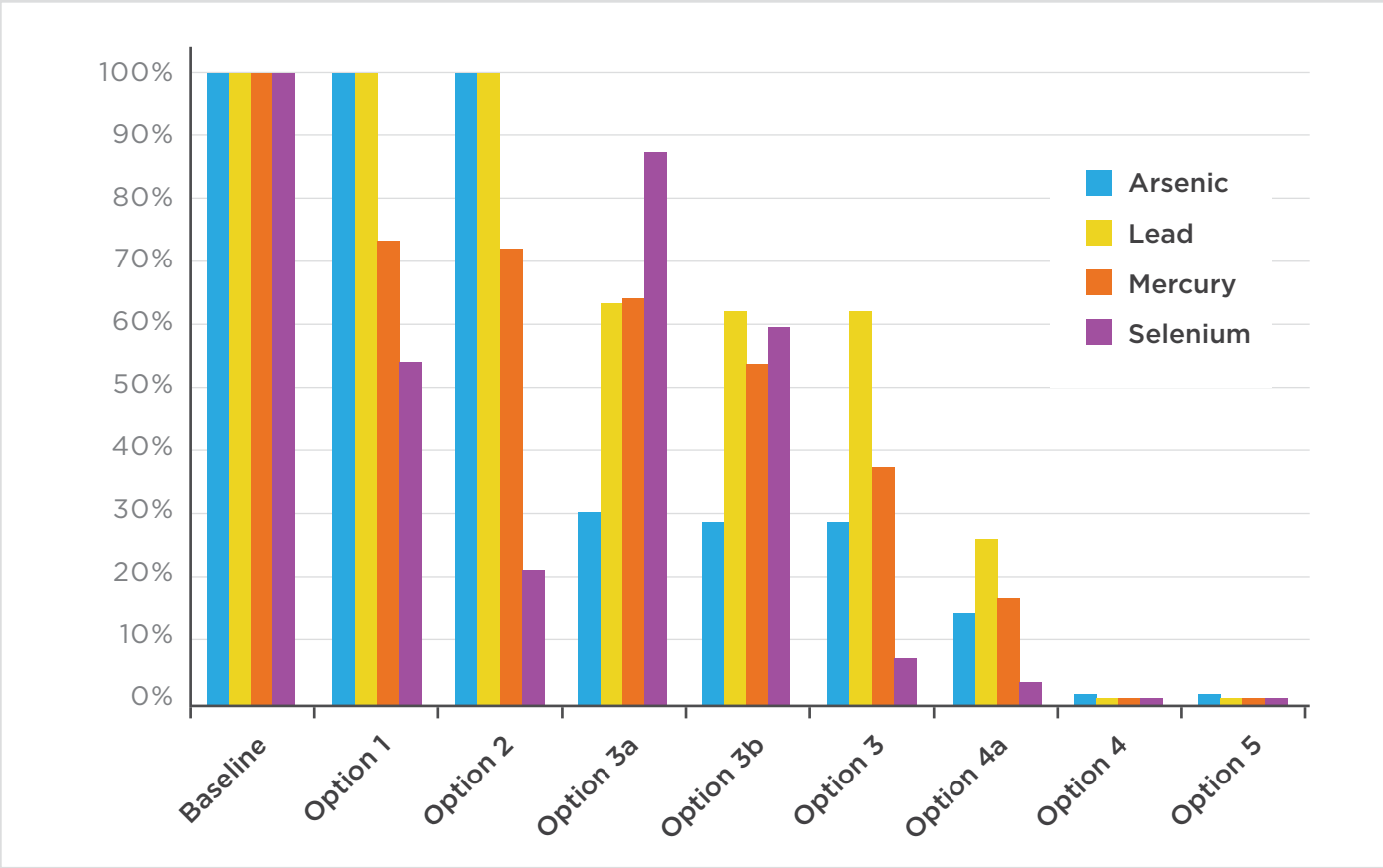

FIGURE 1: POWER PLANT WASTEWATER LOADINGS OF SELECTED POLLUTANTS BEFORE THE RULE (BASELINE) AND AFTER IMPLEMENTATION OF EACH PROPOSED OPTION.

affordable, costing less than 1 percent of the average power plant's revenue.[3] Despite the effectiveness of the stronger options, EPA's proposed rule does not designate them as "preferred options." The options that EPA did put forward as "preferred" would do little to curb this dangerous pollution (see Figure 1). These weaker options were inserted by the White House Office of Management and Budget (OMB) during an inter-agency review process. OMB's interference overruled EPA's technical judgment and shifted the proposal away from the stringent controls necessary to eliminate billions of pounds of pollution, despite the fact that these pollutants can be controlled with technology that is available and affordable to the power plant industry.[4]

By eliminating or significantly reducing toxic discharges from power plants, a strong final rule would create hundreds of millions of dollars in benefits every year in the form of improved health and recreational opportunities for all Americans. In addition, it would contribute immense benefits in the form of clean and healthy watersheds. This report will focus on the human health benefits that could be achieved by eliminating toxic power plant pollution from water sources used for fishing or drinking.

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3. HEALTH RISKS FROM POWER PLANT WASTEWATER ARE WIDESPREAD AND SUBSTANTIAL

3.1 A NATIONWIDE PROBLEM

Power plant wastewater pollution creates a twofold risk: contaminated water becomes unsafe to drink, and fish in the water become unsafe to eat. Since two-thirds of the nation's public water supply comes from surface water,[5] it is important to note that 37 percent of power plants are located within five miles of a drinking water intake.[6] When EPA modeled the instream concentrations of pollutants near power plants, it estimated that discharges from power plants would, without any other sources of pollution, contaminate 20 percent of the bodies of water receiving these discharges to a level formally considered unsafe to drink. In technical terms, the streams would contain dangerous substances at levels exceeding Maximum Contaminant Levels (MCLs, see sidebar, opposite), the standards that EPA sets for public drinking water supplies.[7] In reality, many of these receiving streams are already unsafe: EPA estimates that 25 percent of receiving streams are contaminated with dangerous concentrations of the same pollutants found in power plant wastewater, making the water unsafe for drinking, recreation, and wildlife.[8] In other words, these power plants are causing further injury to already damaged and vulnerable water resources. And that is only the waterbodies right next to power plants; looking downstream, EPA estimates that power plants cause nearly 1,000 river miles to exceed drinking water standards (MCLs).[9]

Contamination of drinking water is not the only health threat caused by power plant wastewater. Some of the pollutants in power plant wastewater, such as mercury, bioaccumulate: They are absorbed by wildlife from worms and snails to fish, becoming more concentrated as they move up the food chain, increasing the risk to people who eat contaminated fish.[10] EPA estimates that power plants alone cause almost half of receiving streams to exceed criteria for water that

MAXIMUM CONTAMINANT LEVELS AND HUMAN HEALTH

As mandated under the Safe Drinking Water Act, EPA sets limits for contaminants that are known to be present in drinking water. These limits, called Maximum Contaminant Levels (MCLs), are legally enforceable standards that apply to public water systems. However, they do not always limit dangerous contaminants to levels that protect health.

EPA decides which contaminants to regulate by considering, among other things, the potential health effects of a contaminant and how often that contaminant occurs in public water supplies. Once EPA decides to regulate a contaminant, it sets a Maximum Contaminant Level Goal—the maximum level of that contaminant that should be allowed in drinking water. The goal is set at a level "at which no known or anticipated adverse effect on the health of persons would occur."[72] The goal for most carcinogens, including arsenic, is zero, because there is no known exposure level that would not increase cancer risk.

Once the MCL Goal is set, EPA establishes the MCL itself as close to the goal as feasible, taking into account the cost of treatment. The MCL for arsenic, for example, is 10 micrograms per liter of water, because EPA concluded that the costs of a stricter MCL would not justify the benefits.[73] Since the MCL for arsenic is much higher than the MCL goal, the MCL is set at a level that is, by definition, unsafe.

For many contaminants, there is no MCL at all. For some of those, EPA has set Secondary MCLs, designed to prevent aesthetic effects like staining or odor. But secondary MCLs are not health-based, and they are not enforceable. Other contaminants that are known to present risks to human health, like boron, are not regulated at all.

is used for fishing as well as drinking.[11] The reality is that many receiving streams are already unsafe—38 percent of these streams are under fish consumption advisories for pollutants found in power plant wastewater.[12] Again, this is only for waterbodies right next to power plants. The scale of the fish contamination problem downstream from power plants is enormous — EPA estimates that over 22,000 river miles are unsafe for subsistence fishing due to power plant wastewater pollution alone.[13]

3.2 POWER PLANT WASTEWATER IS AN ENVIRONMENTAL JUSTICE ISSUE

The water pollution caused by coal plants does not affect everyone equally. In its proposal, EPA failed to fully evaluate the health and environmental harms suffered by communities closest to the source of pollution.[14] In a separate rulemaking, EPA found that the percentage of people of color living immediately downstream of coal ash impoundments is disproportionately high relative to the general population. EPA also found that, among residents immediately downstream of coal ash impoundments, the percentage of the population below the Federal Poverty Level is nearly twice as high compared with the general population.[15]

Families in many communities of color, including African-Americans and Native peoples, rely on fishing to supply basic nutritional needs.[16] Fishing can provide an inexpensive and healthful food source, but when fish are contaminated, reliance on fishing for food poses increased health risks. Subsistence fishing communities are therefore far more vulnerable to water pollution and contaminated fish than the general population. Furthermore, because coal plants are often located in areas where communities are impacted by other industrial pollution sources, the potential for cancer, lung disease and neurological harm is raised as a result of cumulative chemical exposure. Compounding this risk is that fact that communities of color and low-income communities frequently have limited access to health care, allowing adverse impacts to go unaddressed.

So what are the health risks to which so many Americans are exposed? There are several, but the leading risks are cancer and neurological damage.

3.3 INCREASED CANCER RISK

Power plants discharge tens of thousands of pounds of cancer-causing pollutants into waterways each year. One of these is arsenic, known to cause cancers of the lung, kidney, bladder, skin and other organs.[17] Recent evidence suggests that arsenic is more dangerous than previously thought: EPA is in the process of revising its cancer potency estimate, which will reflect that arsenic is 17 times more carcinogenic than indicated by previous estimates.[18] Power plants discharge nearly 80,000 pounds of arsenic each year.[19] A strong rule would eliminate 98 percent of this pollution.[20]

Hexavalent chromium is another potent carcinogen in power plant wastewater. Studies in humans show that hexavalent chromium in drinking water can cause stomach cancer, and this is consistent with evidence of digestive system cancers in animal studies.[21] EPA recently proposed a designation of “likely to be carcinogenic

to humans" for oral exposure,[22] and the California EPA stated that hexavalent chromium "is carcinogenic by the oral route of exposure."[23] Power plants discharge nearly 12,000 pounds of hexavalent chromium each year.[24] A strong rule would eliminate 97-99 percent of this pollution.[25]

Lead and mercury, which are assessed for their neurological risks in EPA's rulemaking, may also cause cancer. Lead is currently categorized by EPA as a "probable" carcinogen, and methyl mercury is categorized as a "possible human carcinogen," both based on animal studies and evidence of damage to genetic material, a first step in cancer formation.[26] Power plants discharge over 67,000 pounds of lead and mercury each year.[27]

Finally, bromide, while not toxic itself, is of increasing concern because chemical reactions can occur during the drinking water treatment process to form carcinogenic disinfection byproducts including bromate, trihalomethanes, and haloacetic acids. Human exposure to these byproducts is associated with bladder cancer.[28] While EPA has established safe drinking water standards for a few of these disinfection byproducts, which public water treatment utilities are responsible for meeting, hundreds more remain unregulated. Furthermore, EPA has also acknowledged that drinking water utilities do not always effectively remove bromide and are having an increasingly difficult time meeting the MCLs for its byproducts.[29]

Concentrations of brominated disinfection byproducts in drinking water systems are on the rise, and some of these increases have been linked to upstream discharges of bromide-laden sludge from air pollution control devices that use flue gas desulfurization (FGD) technology.[30] As scrubbers remove air pollutants from the smokestacks of coal- and oil-burning power plants, these toxic substances are often transferred into holding ponds and then into waterways. Thus, as more power plants install air pollution control scrubbers to comply with new Clean Air Act regulations, we can expect to see an increase in bromide discharges from these plants. Absent a zero discharge requirement for scrubber sludge (which EPA's proposed Option 5 would require), the costs of controlling additional brominated disinfection byproducts will continue to be borne by public water systems and those of us who drink the water they provide.

3.4 INCREASED NEUROLOGICAL RISK

Many of the pollutants in power plant wastewater can damage the nervous system, particularly the developing nervous systems of children. Lead has long been known to cause neurological problems, and in children, as noted in EPA's proposed rule, lead can cause "hyperactivity, behavioral and attention difficulties, delayed mental development, and motor and perceptual skill deficits."[31] As described below, EPA estimated the monetary value of reducing lead pollution in terms of one of its more obvious impacts — reduced IQ.[32]

Mercury is another well-known neurotoxin, dangerous in very small doses, and children can experience "profound and permanent

developmental and neurological delays as a result of exposure in utero."[33] Mercury, like a number of the pollutants in power plant wastewater, bioaccumulates, meaning it builds up in animal tissue. As larger animals eat smaller ones, their bodies store this toxic substance, resulting in greater concentrations that work their way up the food chain. This bioaccumulation results in a significant risk to people who eat contaminated fish. Most at risk are the unborn, who absorb mercury from their mothers' bodies while in utero. It has been estimated that every year 300,000 to 600,000 infants are born at risk for brain development defects because of their mothers' elevated blood mercury levels.[35] Exposure at those levels is associated with significant, permanent and irreversible loss of IQ. EPA modeled human exposure to mercury through contaminated fish and estimated that 65% of the bodies of water that receive discharges from power plants are associated with unsafe methyl mercury ingestion (greater than EPA reference dose).[36]

Manganese is another known neurotoxin found in power plant wastewater.[37] There is growing concern in the scientific community over the effects of manganese, specifically in drinking water.[38] The effects of manganese exposure, even at levels that are commonly found in North American groundwater supplies, include reduced IQ and impaired memory and attention.[39] As with many neurotoxins, children are more sensitive than adults.[40] Power plants dump over 14 million pounds of manganese into U.S. waterways each year.[41] A strong rule would eliminate 97-99% of this pollution.[42]

Arsenic, in addition to causing cancer, is a neurotoxin.[43] As with manganese, there is growing concern over the risks associated with levels commonly found in drinking water. One recent study in Maine, for example, found significant reductions in IQ and other endpoints in children exposed to 5-10 micrograms of arsenic per liter, a level that is below the current drinking water standard for arsenic.[44]

Finally, power plants discharge nearly two million pounds of aluminum each year,[45] and EPA has stated that "[o]ne of the greatest health concerns regarding aluminum is its neurological effects."[46] As with many neurotoxins, the developing fetus and infants are especially vulnerable.[47]

3.5 OTHER SERIOUS HEALTH RISKS

The pollutants listed above, and other toxic pollutants in power plant discharges, present a wide range of health risks beyond cancer and neurotoxicity. For example, arsenic, boron, lead, and thallium are all associated with reproductive and developmental risks.[48] Cadmium can cause kidney, liver and lung damage.[49] Hexavalent chromium can harm the liver and blood.[50] Adults exposed to lead have an increased risk of many health effects including hypertension, heart attacks, strokes, and anemia.[51] Furthermore, little is known about the health effects of concurrent exposure to multiple toxic substances, which may intensify known effects or may give rise to interactions and synergies that create new adverse health effects.

4. HOW MUCH ARE THE HUMAN HEALTH BENEFITS OF THE RULE WORTH, ACCORDING TO EPA?

EPA estimated the monetary value of the human health benefits of the proposed rule in its Benefit-Cost Analysis. The size of the benefit is strongly influenced by the choice of "discount rate," which is a way of adjusting estimates of benefits and costs that will occur in the future to approximate their present value. EPA presents estimates for both 3% and 7% discount rates.[52] For purposes of this discussion, we will assume a 3% discount rate.

For human health effects associated with surface water quality improvements, EPA monetized three benefits:

- The rule will reduce the number of cancer cases caused by the consumption of arsenic-contaminated fish near power plants.[53] EPA estimates that the monetary benefits of reduced cancer under a strong rule, meaning Option 4 or 5, would be between $150,000 and $160,000 per year.[54]
- The rule will prevent IQ losses associated with the consumption of lead-contaminated fish near power plants by children younger than seven, and will also reduce the need for compensatory education of affected children.[55] EPA places the value of these benefits, again calculated under a strong rule, at between $5.62 and $8.01 million per year.[56]
- The rule will prevent IQ losses in children whose mothers ate mercury-contaminated fish from waters near power plants during pregnancy.[57] EPA places the value of this benefit, if a strong rule were in place, at between $8.42 and $12.06 million per year.[58]

Taken together, EPA estimates that the human health benefits of a strong rule—Option 4 or 5—are worth between $14 and $20 million per year.[59]

5. EPA DRAMATICALLY UNDERESTIMATED THE HUMAN HEALTH IMPACT OF THE WATER TOXICS RULE

The benefits that EPA monetized were just the tip of the iceberg. EPA's analysis did not account for the risks associated with contaminated drinking water near power plants, or the risks associated with downstream consumption of contaminated fish or drinking water. In regard to fish consumption, the analysis only looked at two of many health risks, and underestimated even the two that it did analyze. The analysis of the cancer risks associated with contaminated fish only looked at one carcinogen, arsenic, and for arsenic EPA used an outdated cancer potency estimate. EPA's analysis of the neurological effects of contaminated fish only looked at two neurotoxins and failed to account for exposure after age seven (for lead) or after birth (for mercury). Even the value of reduced neurological damage in young children exposed to lead and mercury was underestimated, as EPA admits (see below). For all of these reasons, the true public health benefit of the rule is likely to be many times greater than the value reflected in EPA's Benefit-Cost Analysis.

5.1 DRINKING WATER RISKS

Although EPA found substantial cancer and neurological risks associated with fish consumption, it ignored all of the risks associated with drinking water, stating that "public drinking water supplies are already treated for pollutants that pose human health risks."[60] However, many health risks are likely to persist, even after treatment, for the following reasons:

- First, although drinking water utilities are required to ensure that water meets Maximum Contaminant Levels (MCLs) for many individual pollutants, they do not always accomplish this goal. The most recent data from EPA show that in 2011, there were over 8,000 MCL violations, exposing nearly 15 million people to higher than authorized levels of toxic substances.[61] Lower levels of pollutants in drinking water sources would decrease the number of MCL violations.
- Second, MCLs are not always set at levels that eliminate unacceptable risks (see sidebar — Maximum Contaminant Levels and human health). The MCL for arsenic, for example, is calculated not just on the basis of human health protection, but also to reflect the cost of treatment.[62] As discussed below, exposure to arsenic at the MCL is not safe or acceptable, and even treated drinking water can carry a substantial cancer risk. Therefore, reducing the amount of arsenic in the source water would provide significant additional health benefits.
- Third, EPA has not set MCLs for many of the most health-threatening pollutants in power plant discharges. For example, drinking water utilities are not required to remove manganese, which as discussed above can cause damage to the developing nervous system, and which power plants discharge at a rate of over 14 million pounds each year.[63]

- Finally, MCLs do not account for the combined risk of multiple pollutants that share a common mechanism of toxicity, affect the same body organ or system, or result in the same health endpoint. As discussed above, power plants discharge several cancer-causing pollutants and several neurotoxins, yet cumulative effects are not considered.

Taking the above points into account, it is clear that drinking water contaminated by power plants, even after treatment, is likely to increase the risk of cancer due to the presence of arsenic, hexavalent chromium, brominated disinfection byproducts, and other carcinogens. It is also likely to increase the risk of neurological problems due the presence of lead, mercury, arsenic, manganese, and aluminum.

5.2 RISKS TO PEOPLE LIVING DOWNSTREAM

EPA's Benefit-Cost Analysis monetized the benefits of the rule for surface water bodies that power plants discharge into directly.[64] However, much of the pollution travels downstream and into other water bodies where it continues to present a health risk. In order to get a sense of how significant these downstream risks might be, EPA performed another modeling exercise looking at the same endpoints (cancer and neurological risk from arsenic-, lead-, and mercury-contaminated fish) in downstream waterways. Figure 2, right, shows the benefits that EPA did, and did not, choose to monetize in the final Benefit-Cost Analysis. The analysis of downstream health effects suggests that the monetized human health benefits of a strong rule (Option 4 or Option 5) would be 16 to 17 times greater if downstream exposures were counted. Specifically, a strong rule, assuming a 3% discount rate, would create substantial human health benefits thanks to the reduced exposure to arsenic, mercury and lead in fish. EPA calculates the value of those health benefits as being worth between $230 and $330 million per year.[65]

5.3 CANCER RISK FROM ARSENIC

The cancer risk from arsenic alone is much higher than EPA assumes. According to EPA's proposed revision to the cancer assessment for arsenic, the best available science supports a cancer potency estimate for oral exposure of 25.7 cases per mg/kg-d, roughly 17 times higher than the potency estimate of 1.5 cases per mg/kg-d used in EPA analyses.[66] This affects both drinking water risks and fish consumption risks.

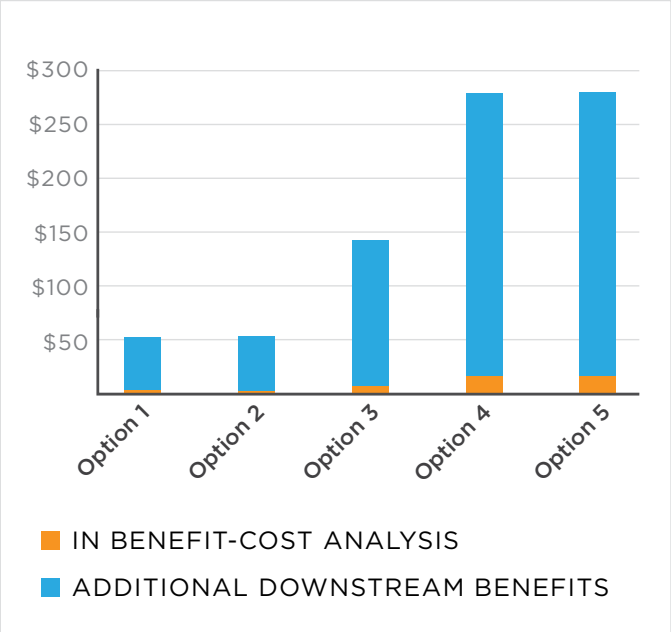

FIGURE 2: ANNUAL VALUE OF THE HUMAN HEALTH BENEFIT ASSUMED IN EPA BENEFIT-COST ANALYSIS (DARK BARS), AND ADDITIONAL BENEFITS THAT EPA CALCULATED BUT OMITTED FROM THE BENEFIT-COST ANALYSIS (LIGHT BARS).

Exposure to arsenic in drinking water at the MCL of 0.01 mg/L, using the proposed arsenic potency factor and standard assumptions about body weight (70 kg) and drinking water intake (2 L/d), is associated with a cancer risk of 73 in 10,000. This is well above the range of cancer risks that EPA considers acceptable in drinking water (1 in 1,000,000 to 1 in 10,000).[67] A minimally "acceptable" arsenic exposure concentration — one that would present a risk of 1 in 10,000 — would be less than 0.001 mg/L. It is clear that surface water contaminated by power plants discharges, even if treated, can present a substantial cancer risk. A strong rule would reduce arsenic discharges by 98%;[68] the corresponding public health benefit would be enormous.

EPA also underestimated the benefit of eliminating cancers caused by eating arsenic-contaminated fish. Using the proposed cancer potency estimate, the number of avoided cancers would be 17 times higher, and the monetary value would be $2.6–$2.7 million per year (assuming a strong rule and a 3% discount rate).

5.4 NEUROTOXICITY

Although EPA's Benefit-Cost Analysis does address a component of the neurological risks associated with contaminated fish, it underestimates the total risk in several ways. First, it only looks at two neurotoxins (lead and mercury), when there are several more in power plant wastewater. Second, it fails to account for exposure to lead after age seven or exposure to mercury after birth, despite the fact that these exposures are also known to present neurological risks at all life stages – adult exposure to lead, for example, can affect both the central and peripheral nervous systems.[69] Finally, as EPA admits, "there are deficits in cognitive abilities that are not reflected in IQ scores, including acquisition and retention of information presented verbally and many motor skills."[70]

5.5 PITFALLS OF BENEFIT-COST ANALYSIS

Benefit-cost analysis is fraught with difficulties, both moral — how much is a human life worth? — and mathematical. One of its biggest drawbacks is that many benefits to human health (and ecological health) cannot be readily monetized. By failing to monetize known benefits, an analysis implicitly assumes that they do not exist. To its credit, EPA did acknowledge that it was underestimating the human health benefits of the rule, at least for the fish consumption pathway:

> [T]he available research does not always allow complete economic evaluation, even for quantifiable health effects. For example, EPA's analysis of health benefits omits the following health effects: morbidity preceding cancer mortality from exposure to arsenic; neonatal mortality from exposure to lead; effects to adults from exposure to lead (including increased incidence of hypertension, heart attack, strokes, and premature mortality, nervous system disorders, anemia and blood disorders, and other effects); effects to adults from exposure to mercury, including vision defects, hand-eye coordination, hearing loss, tremors, cerebellar changes,

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and others; and non-cancer effects from exposure to other steam electric pollutants. Therefore, the total monetized human health benefits included in this analysis represent only a subset of the potential human health benefits that would result from the proposed ELGs.[71]

The Benefit-Cost Analysis does in fact assume a value for all of these benefits — zero dollars. This is plainly inaccurate, and highlights the limited value of the Benefit-Cost Analysis as a basis for assessment. Instead, EPA should account for the all of the benefits that can be monetized, and more prominently acknowledge the limitations of its benefits estimate.

6. CONCLUSION

While a comprehensive valuation of the benefits of EPA's proposed effluent limitation guidelines is not available, it is clear that reducing the amount of arsenic, mercury and other pollutants in our nation's waters will be a tremendous boon to public health at minimal cost to the power plant industry. Water will be safer to drink, fish will be safer to eat, fewer people will develop cancer, fewer children will experience neurological damage, and many other adverse health effects will be avoided. Of course, the monetary value of improved public health tells only a small part of the story. The more salient value of protecting health, and ultimately its true significance, is to be found in the lives that will be shielded from unnecessary disease and premature death, allowed to enjoy a full lifespan, a higher quality of life and development to their full potential.

ENDNOTES

1. U.S. EPA, Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category; Proposed Rule, 78 Fed. Reg. 34432, 34435 (June 7, 2013) (hereinafter "Proposed Rule"); U.S. EPA, Environmental Assessment for the Proposed Effluent Limitation Guidelines for the Steam Electric Power Generating Point Source Category 3-13 (April 2013), Docket No. EPA-HQ-OW-2009-0819-2260 (hereinafter "Environmental Assessment").
2. Although the steam electric power industry includes nuclear plants and plants powered by fossil fuels other than coal, the rule focuses on coal combustion wastewater based on EPA's assessment that the majority of toxic pollutants discharged by the industry come from coal plants. Proposed Rule at 34439.
3. Proposed Rule at 34494.
4. See Environmental Integrity Project et al., Closing the Floodgates: How the Coal Industry is Poisoning Our Water and How We Can Stop It (July 2013), *http://environmentalintegrity.org/news_reports/documents/2013_07_23_ClosingTheFloodgates-Final.pd.*
5. U.S. Geological Survey, Public-supply water use, *https://water.usgs.gov/edu/wups.html*.
6. Environmental Assessment at 3-33.
7. Id. at 5-9.
8. Id. at 3-27.
9. Id. at 6-46.
10. Id. at 3-25.
11. Id. at 5-9.
12. Id. at 3-27.
13. Id. at 6-46.
14. 80 Fed. Reg. at 21,467.
15. Id.
16. National Environmental Justice Advisory Council, Fish Consumption and Environmental Justice (Nov. 2002).
17. U.S. EPA (1998), Integrated Risk Information System, Inorganic Arsenic, available at *http://www.epa.gov/iris/subst/0278.ht.*
18. U.S. EPA, Benefit and Cost Analysis for the Proposed Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point source Category, 3-6 (April 2013) (hereinafter "Benefit-Cost Analysis"); see also U.S. EPA (2010), Draft Toxicological Review of Inorganic Arsenic in Support of Summary Information on the Integrated Risk Information System (IRIS) (increasing the cancer potency estimate from 1.5 cases per mg/kg-d to 25.7 cases per mg/kg-d). Although EPA identified separate potency estimates for women (25.7 cases per mg/kg-d) and men (16.9 cases per mg/kg-d), it stated that the potency estimate for women should be used as the point of departure for the derivation of health criteria.
19. Environmental Assessment at 3-13.
20. Id. at 6-9.
21. U.S. EPA (2010), Draft Toxicological Review of Hexavalent Chromium in Support of Summary Information on the Integrated Risk Information System (IRIS), page 199.
22. Id.
23. California EPA (2011), Public Health Goal for Hexavalent Chromium (Cr VI) in Drinking Water, page 1.
24. Environmental Assessment at 3-13.
25. Id. at 9-9.
26. U.S. EPA (1995), Integrated Risk Information System, Methyl Mercury, available at *http://www.epa.gov/iris/subst/0073.htm*; U.S. EPA (1993), Integrated Risk Information System, Lead and Compounds, available at *http://www.epa.gov/iris/subst/0277.htm*
27. Environmental Assessment at 3-13.
28. Proposed Rule at 34505.
29. Benefit-Cost Analysis at 2-9.
30. McTigue et al. (2014), Occurrence and consequences of increased bromide in drinking water sources, Journal American Water Works Association 106 (11): E492-E508, available at: *http://www.awwa.org/publications/journal-awwa/abstract/articleid/47434302.aspx*
31. Proposed Rule at 34511.
32. Id.
33. Id.
34. Environmental Assessment at 3-25.
35. Trasande, Landrigan, and Schechter (2005). Public health and economic consequences of methylmercury toxicity to the developing brain. Environ. Health Perspect. 113:590-596.
36. Environmental Assessment at 5-16
37. See, e.g., ATSDR (2012), Toxicological Profile for Manganese; Grandjean and Landrigan (2014), Neurobehavioural Effects of Developmental Toxicity, Lancet Neurol 13:330-338.

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40. ATSDR (2012), Toxicological Profile for Manganese.

41. Environmental Assessment, 3-13

42. Id. at 5-9.

43. ATSDR (2007), Toxicological Profile for Arsenic; Grandjean and Landrigan (2014), Neurobehavioural Effects of Developmental Toxicity, Lancet Neurol 13:330-338.

44. Wasserman et al. (2014), A Cross-Sectional Study of Well Water Arsenic and Child IQ in Maine Schoolchildren, Environ Health 13:23-32.

45. Environmental Assessment at 3-13.

46. U.S. EPA (2006), Provisional Peer-Reviewed Toxicity Values for Aluminum, page 6.

47. Id. at 28.

48. Environmental Assessment at 3-4 to 3-10; U.S. EPA (1993), Integrated Risk Information System, Lead and Compounds, available at *http://www.epa.gov/iris/subst/0277.htm.*

49. Environmental Assessment at 3-4 to 3-10

50. California EPA (2011), Public Health Goal for Hexavalent Chromium (Cr VI) in Drinking Water, pg. 1.

51. Benefit-Cost Analysis at 2-4.

52. Id. at 1-2.

53. Id. at 2-3.

54. Id. at 3-6.

55. Id. at 2-3.

56. Id. at 3-10 to 3-11.

57. Id. at 2-3.

58. Id. at 3-10 to 3-11.

59. Proposed Rule at 34512.

60. Benefit-Cost Analysis at 2-4.

61. U.S. EPA (2013), Fiscal Year 2011 Drinking Water and Ground Water Statistics (EPA-816-R-13-003).

62. U.S. EPA (2001), National Primary Drinking Water Regulations – Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring, 66 Fed. Reg. 6976.

63. Power plants discharge more boron than they do any other metal. Risk Assessment at 3-13.

64. Benefit-Cost Analysis at 3-17.

65. Id. at C-1 to C-3.

66. Id. at 3-6; see also U.S. EPA (2010), Draft Toxicological Review of Inorganic Arsenic in Support of Summary Information on the Integrated Risk Information System (IRIS).

67. See, e.g., U.S. EPA (1990), National Oil and Hazardous Substances Pollution Contingency Plan, 55 FR 8666, 8616 ("EPA's risk range of 10-4 to 10-6 represents EPA's opinion on what are generally acceptable levels.").

68. Environmental Assessment at 6-9.

69. ATSDR (2007), Toxicological Profile for Lead, pages 101-109.

70. Benefit-Cost Analysis at 3-18.

71. Id. at 2-4 (internal citations omitted).

72. EPA, Regulating Public Water Systems and Contaminants Under the Safe Drinking Water Act, *http://water.epa.gov/lawsregs/rulesregs/regulatingcontaminants/basicinformation.cfm#Do%20regulatory%20determinations%20impose%20any%20requirements%20on%20public%20water%20systems*

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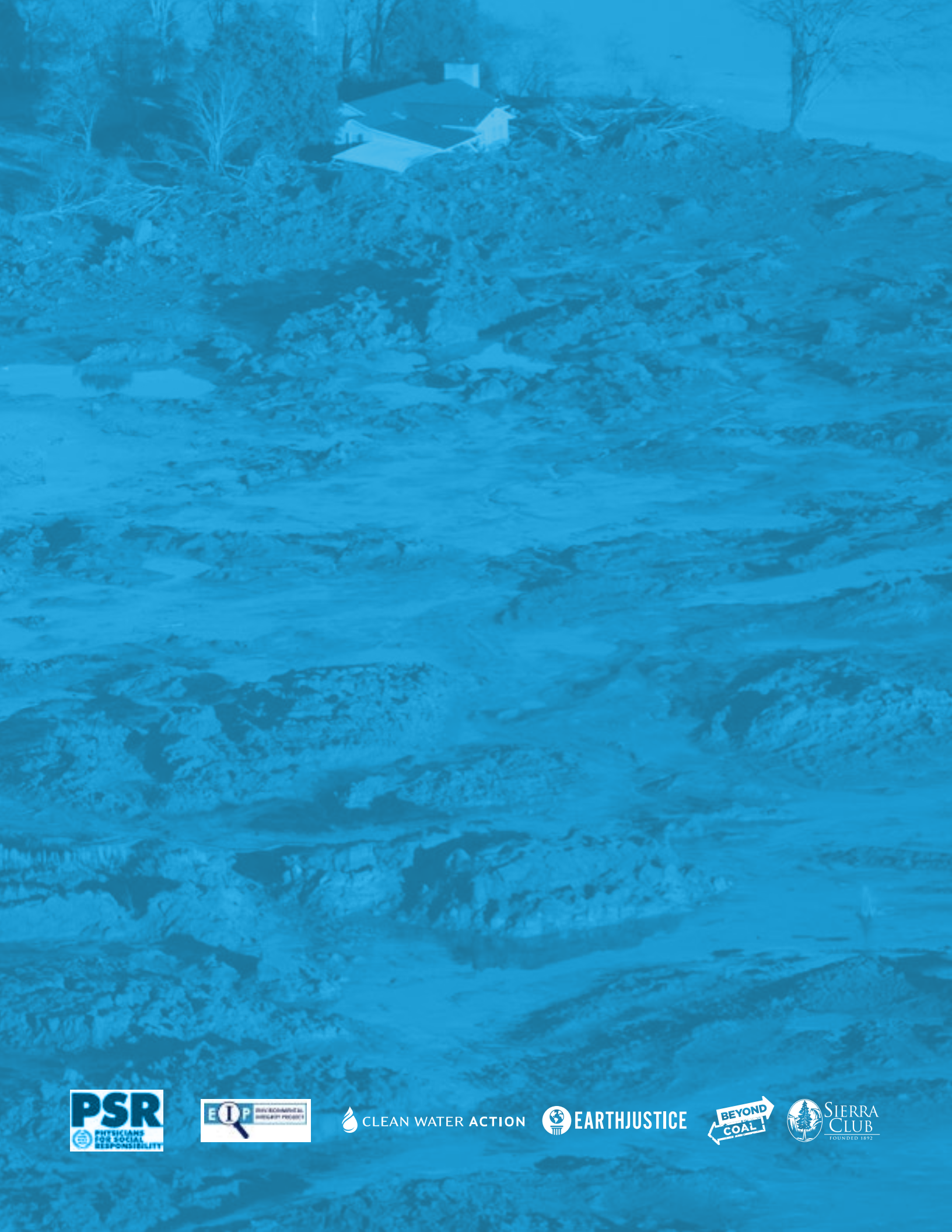

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