BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
WATER QUALITY STANDARDS AND	)	
EFFLUENT LIMITATIONS FOR THE	)	R08-9
CHICAGO AREA WATERWAY SYSTEM	)	(Rulemaking-Water)
AND THE LOWER DES PLAINES RIVER:	)	
Adm. Code Parts 301, 302, 303 and 304	)	(Subdocket C)

NOTICE OF FILING

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Please take notice that on October 8, 2010, we filed electronically with the Office of the Clerk of the Illinois Pollution Control Board the attached Pre-Filed Testimony of Robin L. Garibay, REM and accompanying Attachments, which is served upon you.

CITGO PETROLEUM CORPORATION, and
PDV MIDWEST, LLC, Petitioners

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PRE-FILED TESTIMONY OF ROBIN L. GARIBAY, REM

INTRODUCTION

My name is Robin L. Garibay, REM, and I am a principal of ENVIRON International Corporation and the Manager for the Wastewater Management services of the Integrated Industrial Wastewater Management Practice Area. I have over 20 years of experience in wastewater management, including participation in the development of federal and state water quality standards, NPDES permitting and establishment of water quality-based effluent limits based on water quality criteria.

I am a Registered Environmental Manager (REM) with a B.S. in biochemistry from Rice University and graduate work in biochemistry at Texas A&M University. Prior to joining The ADVENT Group, Inc. (now ENVIRON) in 1987, I worked for the State of Kansas Board of Agriculture Laboratories focusing on pesticide characterization in products, residues, and groundwater. Since joining ADVENT, I worked on characterization studies of effluents and receiving waters in support of NPDES permitting including wasteload allocation and TMDL studies. In addition, I have assisted in determining the applicability of designated uses in support of proposed revisions to water quality standards or in support of a variance from water quality standards. My work has been on behalf of both municipal and industrial clients.

I personally have worked on behalf of numerous industrial and municipal clients in the State of Illinois on the development of elements of the Illinois water quality standards program and on NPDES permitting issues. I have participated in the Illinois rulemaking process on adopting the federal Great Lakes Water Quality Agreement ("GLI") into the Illinois Water Quality Standards, revision to the antidegradation standard and implementation procedures, and revisions to the sulfate and TDS water quality standards.

In preparing this testimony, I worked closely with Dr Jeff Fisher from the Environ office for the Pacific Northwest. I sought out Dr Fisher because of his experience in invasive species controls specific to the Great Lakes. Our resumes are included in Attachment 1.

ENVIRON's testimony, on behalf of the Citgo Lemont Refinery, will focus on the highest quality of aquatic life use in the Chicago Sanitary and Ship Canal (Ship Canal), which is achievable taking into account the Use Attainability Analysis (UAA) factors established by U.S.EPA. The intent of this testimony is to combine documented facts with recent information on the appropriate use for the Lower Reach of the Ship Canal; I am not going to comprehensively review the materials submitted over the past 3 years in with respect to the proposed upgrade of the Lower Reach of the Ship Canal aquatic designated use from the current Indigenous Aquatic Life to Aquatic Life Use B. As this rulemaking has progressed, the Lemont Refinery has recommended that the Lower Reach of the Ship Canal be recognized for its uniqueness in capabilities to support aquatic life which are not captured in the proposed Aquatic Life Use B. Recently, it has become evident to the Lemont Refinery the importance of not upgrading the designated aquatic life use to Aquatic Life Use B. In our view, effective water quality management strongly indicates that this upgrade recommendation should not be followed by the Board.

The Ship Canal is unique in regards to recreational and aquatic life support uses as demonstrated by the results of the IEPA 2007 Use Attainability Analysis (UAA), which resulted in the proposed designation for non-recreation use and Aquatic Life Use B. However, when considering the UAA Factors for Water Quality standards, with respect to Human-Caused Conditions, Hydrologic Modifications, and Physical Conditions, we believe that the Lower Reach of the Ship Canal cannot support the upgrade to an aquatic designated Use B. In this testimony we will address the UAA factors as they relate to appropriate aquatic use designation for the Lower Reach. We will review three of the factors that EPA has recognized justify a state choosing not to "upgrade" the uses; while IEPA also found that these three factors were applicable, they seem to have ignored those findings in their approach to upgrading the water quality standards, particularly for the Lower Reach of the Ship Canal. Indeed, more recent information provides even greater reason why one of the factors, UAA Factor 3, due to the need to protect Lake Michigan against invasive species, is even more significant than when this proceeding began.

In this testimony, I will first review Factors 4 and 5, and then turn to Factor 3, and the additional reasons why this Factor is particularly applicable for the Lower Reach of the Ship Canal.

UAA FACTOR 4 – HYDROLOGIC MODIFICATION AND UAA FACTOR 5 – PHYSICAL CONDITION

The assessment and data in evaluating the role of hydrologic modifications and physical conditions in determining the appropriate aquatic use of the Ship Canal (also referred to as CSSC) are intertwined due to the design and operations of the Ship Canal and as such the discussion is in support of both factors.

The Lower Reach of the Ship Canal is defined as starting "at the confluence with Calumet-Channel and ends at the confluence with Des Plaines River near the EJ&E railroad crossing". It includes monitoring data from sites described as:

- 16th St at Lockport or Lockport or AWQM 92
- Romeoville Rd or Romeoville (electric barriers are located just upstream of Romeoville Rd bridge)
- Stephen St or AWQM 48

This Lower Reach of the Ship Canal reach does not include data from monitoring sites described as "Damen Ave", "Cicero Ave", "Harlem Ave", "Route 83", "Bedford Park", or "Willow Springs" which fall into the upper reach of the Ship Canal.

Habitat and biological data from the Lower Reach have been summarized in documents originally filed by IEPA to support this rulemaking specifically IEPA "Statement of Reasons" and its references to Attachment B (CDM, Chicago Area Waterways Use Attainability Analysis, August 2007) and Attachment R (CABB, Rankin, "Analysis of Physical Habitat Quality and Limitations to Waterways in the Chicago Area). In addition, the recently submitted document, as PC#284, "Chicago Area Waterway System Habitat Evaluation and Improvement Study: Habitat Evaluation Report", MWRDGC and LimnoTech, January 2010, provides further information in support of my testimony.

There is consistency in the characterization of the Lower Reach amongst the researchers with the 2010 report incorporating recent results of recent surveys. Highlights include:

- Habitat for supporting aquatic life is poor to very poor
- Richness and abundance of aquatic species is poor to very poor

Attributes referenced by the researchers as contributing to the poor to very poor scores include:

- Canal depth and shape (square or rectangular cross-section) to accommodate navigation and flood control (i.e., deep draft steep vertical-wall)
- No sinuosity (the Ship Canal is a navigation canal)
- Absence of riffle-run, pool-glide characteristics (the Ship Canal is a navigation canal)
- Rapid changes in flow velocity and water level (4 to 6 feet in a 24-hr to 48-hr period) to accommodate flood control, including stormwater run-off, and maintain navigation
- Little or no fixed aquatic or overhanging riparian vegetation or other refugia for aquatic life
- Poor substrate material and silty substrates
- Presence of suspended sediments from navigation and flood control resuspension, stormwater runoff, and treated effluents.

Data in support of these attributes have been presented in 2007 and 2010 reports with the habitat and biological assessments summarized for the Lower Reach of the CSSC. The available information from these reports includes:

2007 Qualitative Habitat Evaluation Index (QHEI) Scores are:

- 37 (Stephen St)
- 27 (Romeoville)
- 40.5 (Lockport)

As referenced in 2007 report, QHEI scores less than 30 are indicative of very poor ability to support aquatic life and scores between 30 and 45 are indicated of a poor ability to support aquatic life.

2010 Report of Primary QHEI Habitat Attributes[1] applicable to the Ship Canal:

- Off-channel Refuge: 4 (score), applicable to entire reach of Ship Canal (maximum score for CAWS is 8, and a higher score represents better habitat)

- Vertical Wall Banks: 35.5 miles is vertically walled with 78% of the walled banks due to construction of Ship Canal through limestone bedrock. The Ship Canal has a high percentage of vertical walls in the CAWS. Such extensive armoring removes natural interactions that would otherwise occur with an intact riparian zone greatly reducing the quality of aquatic habitat to support life history functions of fish and invertebrates

[1] Primary habitat attributes for the CAWS as related to correlation with fish richness and/or abundance and may have some potential for improvement in the CAWS.

- Riprap-armored Banks: 3.3 miles, which is relatively few miles as compared to other CAWS

- Macrophyte Cover:
  - 0% (Stephen St)
  - < 2% (Lockport)

  The range for other CAWS is 0% to 13% submerged aquatic macrophyte cover; higher percentage coverage, the more supportive of aquatic life.

- Overhanging Vegetation:
  - ~2% (Stephen St)
  - ~3% (Lockport)

  The range of other CAWS is 0% to ~34% overhanging riparian vegetation, higher percentage overhanging vegetation, the more supportive of aquatic life.

- Bank Pocket Areas (score) with a maximum for CAWS of 20.
  - ~20 (Stephen St)
  - ~6 (Lockport)

  A higher score would be more supportive of aquatic life.

Biological assessment summaries were based on data generated between 1993 to 2002 for the 2007 report and 2001 to 2008 for the 2010 report.

- 2007 fish Index of Biological Integrity (IBI) = 17 (Lockport)

  IEPA considers IBI scores of greater than 41 to be indicative of a fully supported fish community and scores of less than 20 to be very poor.

- 2007 Macroinvertebrate Biotic Index (MBI)
  - 10 (Lockport)

  IEPA considers MBI scores of less than 5.9 to be indicative of a fully supported macroinvertebrate community and values greater than 8.9 to be poor.

- 2010 Fish Richness = 2 to 9 species or taxa (Lockport) with more than 80% to all of the species classified as tolerant (to pollution) species. For example, gizzard shad, carp, and certain sunfishes, with their presence being noted to being consistent with only mobile species suited to the habitat conditions.

- 2010 Fish Abundance = 22 to 179 individuals, which is consistent with the presence of mobile species

In addition to habitat and biological assessments, the researchers have also evaluated and summarized sediment quality and water quality data for the Ship Canal. Sediment quality for the Ship Canal exceeds published sediment threshold effect concentrations for 7 metals and 2 organic chemical families. Water quality, when compared to the upgraded water quality criteria for Illinois general aquatic use, is not been consistently attained for 10 constituents including DO, temperature and ammonia. Citgo has presented (March 25, 2009) and will be presenting additional TDS and chloride water quality data specific to the Lower Reach of the Ship Canal as compared to the potential water quality criteria to protect upgraded aquatic life use. However, the predominant factor impacting aquatic life and the ability of the lower reach of the Ship Canal in supporting aquatic life are related to the physical habitat characteristics inherent to the Canal. These physical habitat conditions will not change regardless and cannot be significantly improved regardless of proposed water quality criteria changes associated with the proposed upgrade to Aquatic Life Use B designation.

The habitat characteristics which result in poor to very poor attributes to support aquatic life are directly related to the main objectives of this manmade canal: to support commercial navigation and convey waters away from Lake Michigan. The waters conveyed away from Lake Michigan include stormwater from point sources and non-point sources, treated effluent, and non-contact cooling water. In operating the Ship Canal, there is mandatory management of the water level in the canal for navigation and flood control. The combination of operations and physical construction constrains shoreline habitat, causes drying and wetting of the limited shoreline habitat, encourages sediment scouring and resuspension, and does not allow for submerged or overhanging vegetation to be in-place. As noted in the Statement of Reason, these conditions are

"irreversible", the design and operations of the lower reach of Canal are such that a biological condition that meets the Clean Water Act aquatic life goal are not maintainable.

The aquatic life in the lower reach of Ship Canal has been classified according to established species richness and abundance estimations relevant to the ecoregion as 'poor' to 'very poor', with low species richness. The fish species have been identified as mobile species that are predominately pollutant tolerant, with the habitat predominantly unsupportive of their early life stages. The macroinvertebrates are dominated by pollutant tolerant worms.

The design and operation of the Lower Reach of the Ship Canal and the impact on habitat features certainly impact the aquatic life uses as noted by monitoring data and the recent statistical analysis relating fish data to habitat data submitted by the District. Based on the proposed definition of Aquatic Life Use B and the criteria to support that designation, IEPA seems to have incorrectly interrupted their own evaluation of Factors 4 and 5 to support an upgraded use for the Lower Reach of the Ship Canal. We do not agree. In our understanding, since IEPA found that the EPA goals for optimal uses of the waters could not be obtained, and particularly since they were the result of irreversible conditions for more than one factor, the focus should have been on what water quality standards were needed to support those uses that were, in fact, occurring.

As the design and operation of the Lower Reach of the Ship Canal are irreversible, the evaluation of the UAA Factor 4 - of hydrologic modification, including dams, - and Factor 5 - of physical conditions, including flow, depth, pools and riffles - would lead to a determination that an expectation of attainment of aquatic life use higher than the current use is extremely unlikely.

Moreover, based on the District's recently submitted "Habitat Improvement Report", and disregarding economic feasibility, the technically feasible options for improving habitat for the Ship Canal would not significantly impact the Ship Canal fisheries quality. We would assert that for the Lower Reach of the Ship Canal, habitat improvements identified in this report may not be technical feasible. Based on our evaluation of the Factors 4 and 5 the appropriate expectation of designated use for the Lower Reach of the Ship Canal is as it is currently designated for the support of indigenous aquatic life.

UAA FACTOR 3 – HUMAN-CAUSED CONDITIONS

Many of the human-caused conditions that do not support an upgrade to the aquatic life use designation and cannot be remedied have been identified in the evaluation of UAA Factors 4 and 5. These are directly related to the use of the Ship Canal for navigation, flood control, and conveyance of water away from Lake Michigan. Our evaluation of human-caused conditions preventing an upgrade of aquatic life use designation shows that, if those measures were "remedied", that such would cause more environmental damage to correct. And this is particularly true with respect to the operation of the Lower Reach of the Ship Canal for invasive species control. As noted in the 2007 Statement of Reason, the operation of the Aquatic Invasive Species Dispersal Barrier, involves applying an electrical charge directly to the water at rate intended to prevent any fish from passing alive (pg 50, IEPA Statement of Reason). Since the 2007 Statement of Reason, the operations of the Lower Reach of the Ship Canal for invasive species control has escalated to include the operation of two barriers, not just one, and the repeated use of piscicides to further control fish encroachment and allow more frequent maintenance of the electric barriers. We believe that these operations, combined with managing water quality at current conditions, are an important, and currently overlooked, designated use of the Lower Reach of the Ship Canal. In addition, we believe that inattention to this use or

unintended consequences from upgrading the aquatic use could reduce the effectiveness of invasive species control to prevent detrimental impacts to Lake Michigan. It would not be wise to discontinue these activities - or "use" of the Lower Ship Canal - in the foreseeable future.

Human-Caused Condition: Invasive Species Prevention and Control

The Great Lakes Basin, the largest freshwater watershed in the world, also supports the most taxonomically invaded temperate freshwater ecosystem in the world (Mills et al. 1993). Previous invasions of alewife (Miller 1957), sea lamprey (Lawrie 1970) and more recent introductions of zebra mussels (Griffiths et al. 1991) and Eurasian ruffe (Pratt et al. 1992) represent but a fraction of the non-native biomass that have invaded this system, with significant ecological and economic impacts. These introductions, and their recognized consequences, have been a major driver for federal, state and transboundary actions that have been implemented to prevent future invasions of non-native species into the Great Lakes and to address the ecological and economic impacts of those that have already become established. To this end, the Great Lakes Fisheries Commission receives approximately $12 million annually from both the U.S. Department of State (State) and Canada for many years address invasive species issues affecting the Basin.

Strategies selected to prevent invasions of non-native species into the Great Lakes, such as Asian carp, include the electric barrier and the piscicide rotenone. An electric barrier at Romeoville, IL became operational in 2002 and provided an electrical field within the Ship Canal, through which fish will not pass. Additional electric barriers within the CAWS have since been installed to specifically prevent migration of to and from Lake Michigan of invasive species and allow for continuous deterrence within the CAWS during periods of maintenance. Directed funding through the State Department, through the US Army Corps of Engineers and through other state

funding supports the construction and maintenance of the second electrical barrier in the Lower Reach of the Ship Canal. The main objective of the funding of this barrier is preventing the potential spread of Asian carp into the Great Lakes system. The implementation of these strategic measures is in keeping with the broad recognition of the harm invasive species cause and is causing to the Great Lakes Basin, and is wholly consistent with the provisions of the National Invasive Species Management Plan, as mandated by Executive Order 13112. That Executive Order expressly directs federal efforts to prevent, control and minimize invasive species and their impacts (NISC 2008).

Recognition of the ecological and economic harm created by Asian carp established in the Mississippi and Illinois drainages highlights the need to assert maximum efforts to prevent the spread of the Asian carp into the Great Lakes, and thorough risk assessments have detailed the potential consequences of their introduction into the Great Lakes *(see:* http://www.fws.gov/contaminants/OtherDocuments/ ACBSRAFinalReport2005.pdf). Transboundary cooperation with Canada over this issue has heretofore been successful at minimizing the potential for spread, with recognition that invasive species can be interpreted as 'biological pollutants' under the Boundary Waters Treaty between the U.S. and Canada.

It is important that the State of Illinois and other agencies continue to support prevention of invasive species from migrating into Lake Michigan via the Ship Canal. Factors specific to the control of Asian carp in the Ship Canal include the following summary of recommendations and excerpts from the American Fisheries Society and the Asian Carp Regional Coordinating Committee (see: http://www.asiancarp.org):

- The installation of the electronic barrier in the CSSC demonstrates an understanding "that the artificial connection—known as the Chicago Waterway System—connects the Great

Lakes to the Illinois River, which connects to the Mississippi River. This waterway system provides the pathway for Asian carp to enter the Great Lakes".

- Asian carp consume plankton—algae and other microscopic organisms—stripping the food web of the key source of food for other small and big fish. Asian carp can grow to large sizes and a carp is capable of eating 5 to 20% of its body weight each day. Asian carp often compete directly with native fish. Their diet overlaps with native fishes in the Mississippi and Illinois Rivers.
- Between 1991 and 2000, as scientists watched the Asian carp spread in the Mississippi and Illinois Rivers, Asian carp abundances surged exponentially (Chick and Pegg 2001). Between 1994 and 1997, for instance, commercial catch of bighead carp in the Mississippi River increased from 5.5 tons to 55 tons (Chick and Pegg 2001). The commercial value of Asian carp is quite low and much less valuable than the native fish they replaced.

Not only are Asian carp consuming the aquatic resources in the Illinois River system, they would appear to pose a threat to the Great Lakes, according to the Coordinating Committee. The Committee notes:

- The presence of Asian carp in the Great Lakes could cause declines in abundances of native fish species. Asian carp will compete with native fish for food—native fish like ciscos, bloaters, and yellow perch, which in turn, are fed upon by predator species including lake trout and walleye (Hansen 2010). Under the conditions found in some areas of the Great Lakes (such as water temperature and food abundance), Asian carp could outnumber all other native species, as is happening in parts of Illinois, Mississippi, and Missouri Rivers.
- The Great Lakes may offer the carp an abundant and varied food supply in portions of the Lakes. Bighead carp would consume zooplankton in the Great Lakes and silver carp would prey heavily on phytoplankton. This feeding could place the carp in direct competition with young and mature native species (Hansen 2010). More troubling is that Asian carp appear to be highly opportunistic when it comes to feeding. For instance, bighead carp diet in the Mississippi River is more varied than in their native range, showing the carp take advantage of the food that is present. By feeding on plankton, the Asian carp feed on the "low end" of the food web, and few people doubt that the carp would have significant negative impacts on the food web (Hansen 2010; Lodge 2010).
- Risk assessments carried out by officials from the U.S. Department of Interior (Kolar et al. 2005) and the Department of Fisheries and Oceans Canada (Mandrak and Cudmore 2004), indicate that the carp could tolerate the Great Lakes basin's climate, as the basin is well within the fishes' native climate range. Mean annual air temperatures range between -2°C and 22°C for bighead carp and -6°C and 24°C for silver carp, a temperature span that would support Asian carp populations in much of the United States and Canada, including the Great Lakes.
- The Great Lakes may also offer the Asian carp suitable spawning habitat. The risk assessments show that the Asian carp require 30-60 miles of unimpeded rivers to spawn (Kolar et al. 2005; Mandrak and Cudmore 2004). The carp also thrive in areas with

vegetated shorelines; areas that provide habitat for feeding. The Great Lakes basin contains numerous streams with suitable spawning habitat and large areas of vegetated shorelines, particularly large bays, wide river mouths, connecting channels (e.g., the Saint Marys River), wetlands, and lentic areas (areas of still waters). Ample habitat for spawning and feeding exists in all five of the Great Lakes, including Lake Superior.

Moreover, the Committee notes that ecologically there are several facets of Asian carp that confound typical control strategies including (see http://www.asiancarp.org/faq.asp):

- There are few North American fishes large enough to eat an adult Asian carp. White pelicans and eagles, however, have been seen feeding on juvenile or smaller adult Asian carps. Largemouth bass have often been observed feeding on small juvenile Asian carps, and many other native predators probably also feed on them before they grow too large. Asian carps produce many offspring which grow quickly and if conditions are good, they rapidly become too large to be eaten by North American predators.
- If Asian carp do get into the Great Lakes, there is also a potential that they adapt to the local food system and availability, shorter rivers for spawning, and other detrimental behavior as yet unforeseen.
- The CSSC is a manmade waterway that provides a direct connection between the Mississippi River system and Lake Michigan. Measures are being taken to prevent Asian carp from passing through the system.
- Other points of possible entry to the CSSC which are above the electric barrier are the low lying areas of land positioned between the Des Plaines River, and the Illinois and Michigan (I&M) Canal. During heavy rainfall events, these areas are prone to flooding. A significant rain could flood the banks, joining the Des Plaines with the CSSC or the I&M Canal with the CSSC, and allowing these fish to bypass the barrier and advance toward Lake Michigan. Construction of interim measures to address potential bypass of the barriers via the Des Plaines River and I&M Canal have recently been completed. The U.S. Army Corps of Engineers and others are continuing to investigate potential solutions to all bypass issues.
- Rotenone, a piscicide, is being used in some circumstances in the Chicago Area Waterway System as a tool for Rapid Response against Asian carp. The use of rotenone provides the highest level of certainty that Asian carp will not advance past the electric barrier while it is shut down temporarily for routine maintenance. Traditional fishing gear may not work. Silver carp are very good at avoiding nets and the extensive navigational traffic in the canal makes using nets for bighead carp ineffective. Nets would not remove all the fish and may miss the juveniles, which are of particular concern. The International Joint Commission funded an Asian carp sensitivity project at the U.S. Geological Survey Laboratory in Columbia, Missouri. Researchers determined that Asian carp are more sensitive to rotenone than to other piscicide chemicals that were tested.
- The electrical barrier is currently the best tool to stop large-scale movement of Asian carp from the Illinois River into the Great Lakes via the Chicago Sanitary and Ship Canal and tests conducted to date indicate the barriers are effective at deterring Asian carp. Without the electrical barrier system in place, Asian carp and other fish would have an unimpeded

> pathway from the Mississippi basin to the Great Lakes and vice versa. Though the barriers are very efficient, they are not immune to failures or disruptions in their electric fields. Some scientists and managers, therefore, believe that the electrical barrier is part, but not all, of the solution to keeping Asian carp out of the Great Lakes and other species from transferring into either basin.

The installation in 2002 (and later expansion) of the invasive species dispersal barrier in the Lower Reach of the Ship Canal to prevent passage of Asian carp and other similar invasive species to Lake Michigan and the Great Lakes system reflects of the recognition of US-Canada Boundary Waters Treaty implications and the state mandate and regional interest to protect Lake Michigan and the Great Lakes designated use and resources. The deterrent of Asian carp to Lake Michigan in the Lower Reach of the Ship Canal is an existing use, whether or not it is recognized in the water quality standards. While the installation and presence of the electrical fish barrier has been recognized as a mechanism that cannot support a recreational use within the lower reach of the Ship Canal (as shown by a inclusion of "non-recreational waters" in proposed Section 302.402 and CSSC identified in Section 303.227), the prevention of invasion of invasive species has not been similarly recognized.

It is the recommendation of Environ that the Board should recognize the design and operation of invasive species controls as:

1. A mechanism that prevents support for an upgraded designated aquatic life use,
2. A recognized designated use for the Lower Reach of the Ship Canal, specifically through operation of electrical barriers to deter migration of Asian carp to the Great Lakes, and use of piscicides to allow maintenance of the barriers, and
3. Discontinued use of electrical barriers and piscicides would cause more systemwide environmental damage than leaving them in-place.

In our evaluation of the human-caused conditions (use of electric barrier and piscicides) preventing an upgrade of aquatic life use designation, it is easy to establish that if these

conditions were "remedied"[2](i.e., the fish barrier were removed and no use were made of piscicides to prevent the spread of invasive species), there would be significant damage not only to aquatic life is in the Lower Reach of the Ship Canal, but also to Lake Michigan due to the introduction of Asian carp. However, another remedy - to allow an upgrade to aquatic life use designation from current designation to Aquatic Life Use B - would result in improvements of habitat and water quality conditions that are also related to human-caused conditions. Remedies to improve human-caused conditions (i.e. the introduction of Asian carp into the Mississippi and Illinois River Systems and the consequential efforts to stop their migration to Lake Michigan) would cause more environmental damage to correct as those remedies relate to the intended operation of the Lower Reach of the Ship Canal for invasive species control.

Efforts in support of preventing Asian Carp and other invasive fish species from entering the Great Lakes system include strategies that prevent or minimize conditions that would attract or be favorable to the target species. Available habitat and food resources are two key factors that often allow invasive species to become established. The actions that prevent or minimize available habitat and food resources to the Asian carp within the Lower Reach will support the use of invasive species control and prevention of their migration upstream. The biological habitat of the Lower Reach is poor and considered irreversible because of navigation use and flood control severely limit habitat improvement options. Within sections of the Lower Reach where habitat improvement can take place, the anticipated effects are considered negligible with respect to benefits to the fishery based on the 2010 report by the District.

Conversely, improvements in the aquatic habitat are self-defeating due to Asian carp. They are primarily water column feeders where algae, zooplankton typically occur, and where migrating

[2] As used in this testimony, remedy is as discussed in support of 40 CFR 131.10(g)(3)

or re-suspended benthic macroinvertebrates or micro-crustaceans may occur. One of the threats to the Great Lakes is the potential for Asian carp to displace existing species by crowding and outcompeting them for planktonic food resources to a level that may be detrimental to the entire food web. Actions that prevent or minimize available food resources of the Asian Carp within the Lower Reach would support the use of invasive species control. Such actions could include habitat instream and shoreline habitat improvement. Since the implementation of the habitat improvement options in the Lower Reach was judged to have negligible benefit to the resident fishery, it is suggested that no habitat improvement options be implemented that would increase the reproduction or presence of algae and macroinvertebrates from existing conditions.

Similarly, water quality standards that may be more protective of aquatic life may benefit the plankton species and enhance the food resource and act as an attractant for Asian carp. Additional Asian carp in the Lower Reach would likely be detrimental to the resident fish populations, and is counter to the goal of invasive species control. One example is the proposed change in copper criteria from 1.0 mg/L (support of Indigenous Species stream classification) to a value of 0.36 mg/L (acute) and 0.022 mg/L (chronic) in support of Aquatic Life Use B waters (calculated using an average hardness value of 260 mg/L for Lower Reach). For derivation of the Illinois copper criteria, the four organisms most sensitive to toxic effects are all invertebrates and include the cladocerans *Ceriodaphnia reticulata* (first), followed by *Daphnia pulicaria*, *D. pulex*, and *D. magna* as a group; the amphipod *Gammarus pseudolimnaeus*; and then the bryozoans (*Plumatella emarginata* and *Lophopodella cartera*). All of these organisms are potential plankton and select food resource for Asian carp that currently may or may not exist in the Lower Reach. Copper is just one example where the current water quality criteria change under the proposed upgrade to Aquatic Life Use B, and the basis for the lowering of criteria is

driven by protecting planktonic species. Changing water quality so that the water conditions could accommodate a more productive plankton community could create a more abundant food source available to Asian carp, hence the Lower Reach of the Ship Canal water quality could be an attractant to an invasive and nuisance species. The point here is not to ignore protection and support of aquatic life in the Lower Reach, but to minimize conditions that would attract the Asian carp; minimize conditions that would benefit growth and reproduction of Asian carp; and maximize conditions that enhance the effectiveness of the invasive species barrier strategies.

ENVIRON recommends that control measures for the prevention of the passing of invasive species or control of invasive species migration should be recognized as a designated use for the Lower Reach of the Ship Canal. This designated use should be recognized in the Illinois regulations for water quality standards. In a systemwide approach to the Great Lakes, this designated use in the CAWS is in full support of the intent of the Clean Water Act goals.

SUMMARY

ENVIRON strongly recommends that the IEPA and IPCB re-evaluate the UAA factors specific to the Lower Reach of the Ship Canal utilizing data and information that has evolved since 2007. ENVIRON, in evaluating the data and information available in support of UAA Factor 5, Physical Conditions, Factor 4, Hydrologic Modification, and Factor 3, Human-caused Conditions, finds that the design and operation of the Lower Reach of the Ship Canal for navigation, flood control, conveyance of waters away from Lake Michigan, and invasive species control impact the aquatic life use attainable for the Lower Reach of the Ship Canal. In addition, the aquatic life limitations created by the design and operation of the Lower Reach of the Ship Canal are irreversible, Therefore, "remedies" are limited and would not result in aquatic life conditions to support an upgraded designated use. Moreover, a potential remedy of improving

water quality could contribute to systemwide detrimental aquatic impacts by creating conditions counter to mandatory invasive species control. ENVIRON, on behalf of Citgo Lemont Refinery, recommends that the current designated aquatic life use is appropriate for the Lower Reach and that upgrading the designated use to the proposed Aquatic Life Use B is not warranted or supported.

Thank you, this concludes my pre-filed testimony.

Robin L. Garibay, October 8, 2010

REFERENCES (IN ADDITION TO DOCUMENTS ALREADY IN THE DOCKET)

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CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 8th day of October, 2010, I have served electronically the attached Pre-Filed Testimony of Robin L. Garibay, accompanying Attachments, and Notice of Filing upon the following person:

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ATTACHMENT 1

Jeffrey P. Fisher, PhD

EDUCATION

1996	Postdoctoral Research Associate, University of Connecticut, Department of Natural Resources Management and Engineering
1995	PhD Ecotoxicology, Department of Avian & Aquatic Animal Medicine, Cornell University
1990	MSc, Aquatic Pathobiology, Inst. of Aquaculture, Stirling University, Scotland
1985	BS, Fisheries Biology/Aquatic Ecology, University of Washington

REGISTRATIONS & CERTIFICATIONS

Certified Erosion Control Lead, Washington State Department of Ecology, 2007

Certified Fisheries Professional, American Fisheries Professional, 2000

Certified Washington DNR Fish Habitat, Riparian and Water Quality Analyst, 1997

PADI Scuba, Open Water, Medic, Night and Rescue Certifications, 1983

EXPERIENCE

Dr. Jeffrey Fisher is a Principal at ENVIRON Corporation. He is a fisheries biologist and ecotoxicologist with 22 years of experience examining physical, chemical, and biological impacts on aquatic animals, and aquatic ecosystem function. He leads ENVIRON's operations in the Pacific Northwest and is a key member of the firm's core natural resource and ecotoxicological services group. Prior to joining ENVIRON, Jeff completed a 2-year sabbatical posting to the US Department of State, Bureau of Oceans and International Affairs, as an American Association for the Advancement of Science Fellow, where he oversaw the invasive species portfolio and represented State on the Aquatic Nuisance Species Task Force and National Invasive Species Council. He serves both public and private clients in addressing complicated natural resource management and toxicology-related issues associated with NRDA, CERCLA, RCRA, TSCA, FERC, NEPA and ESA compliance requirements. Some of Jeff's more significant consulting and research projects are summarized below.

- Recently performed fish necropsies and provided Principal field oversight for study to ascertain tissue-specific selenium concentrations in ovarian and whole body fish tissue from a variety of warm water fishes from Zekiah swamp in southern Maryland. The purpose of the study is to establish tissue-residue based selenium water quality criteria for a reach of stream potentially impacted by elevated selenium from fly-ash leachate.
- Provided technical review of watershed analysis methods designed for the prototype analysis required under a Habitat Conservation Plan for the Pacific Lumber Company in Scotia, CA. Co-authored the Fish Habitat Module methods, and co-developed the turbidity analysis methods for inclusion into the manual. Conducted the turbidity and suspended sediment risk assessment for the Freshwater Creek watershed analysis..
- Served as expert witness (deposition) for plaintiffs in class action suit against refinery. Evaluated aquatic biological risks associated with the discharge of groundwater contaminated with polycyclic aromatic hydrocarbons into the North Platte River. Based on evidence provided that indicated potential risks from the estimated environmental concentrations, the case was settled out of court.

- Served as expert witness for Taylor Shellfish, the largest shellfish grower on the West Coast, for a land use action dispute with neighbors regarding their operations on tidelands leased by them from another neighbor. Conducted field studies to evaluate suspended sediment risks from geoduck harvests, impacts on benthic infauna and epifauna, and fish communities to support my testimony. Largely as a result of my testimony regarding the benign, and largely beneficial effects of the operations on basin water quality and habitat enhancement/creation, the case was dismissed by the hearing examiner.
- Served as project manager and lead scientist for the City of Tacoman on a project evaluating ecological and human health risks associated with dioxin-contaminated sediments in Commencement Bay. The project goal was to identify appropriate risk-based sediment guidelines for clean-up of the habitat restoration site.
- Served as Project Manager and lead author in conducting an extensive analysis of the fisheries and water quality benefits and impacts from the proposed Black Rock Reservoir in the Black Rock Valley of central Washington State. The analysis focused on storage opportunities within the valley, and the benefits and potential impacts to water quality and anadromous and resident fisheries resources of the Columbia and Yakima Rivers that could potentially follow from several proposed options for a pump-driven withdrawal from the Columbia River, and an interbasin transfer of these waters for irrigation into the Yakima Valley. Examined: (1) potential impacts from a variety of different intake locations and fish screening options, (2) potential changes to wetted usable area in the Yakima River using channel cross-sectional data from the USGS, (3) the potential for interbasin transfer of fish pathogens and hazardous materials into the Yakima basin, and (4) the temporal benefits and impacts to aquatic habitat in the Columbia River based on the potential locations and timing for withdrawal. Based on these analyses, it was concluded that stream temperatures in the Yakima River could be improved for anadromous fishes with several of the (bottom) withdrawal options, and that a near-normative hydrograph could be potentially restored in the Yakima River. Based primarily on the wetted perimeter analysis, significant extensions of spawning and rearing habitat for fall and spring Chinook salmon were considered highly probable, with additional potential for dismantling existing storage at the headwaters of the Cle Elum River, possibly permitting the reintroduction of extirpated sockeye salmon. Based on the value of the sport fish harvest alone, an improvement in the river fishery was estimated to provide a net annual economic benefit of 1 to 4 million dollars. Fishery benefits from the created reservoir were estimated to provide an additional gross economic benefit of over $3 million.
- Managed large-scale project to ascertain risks to aquatic ecological receptors exposed to arsenic and mercury-laden mine tailings following the breach of a tailings retention dam near the Sawtooth Wilderness Area of Idaho, as part of Superfund (CERCLA) driven response action. Field studies to support the baseline risk assessment included an evaluation of macroinvertebrate diversity and abundance; fish diversity, abundance and health; surface-water chemistry; sediment chemistry; and an evaluation of the physical habitat conditions associated with the site using the Washington State methods for watershed analysis, and instream flow incremental methodology (IFIM) to evaluate flow versus habitat relationships. Reduced trout densities in the tailings depositional zone were found to be the result of deficient habitat factors and not chemical contamination in this case. EPA concurred with these findings.
- Serving as principal consultant supporting the US Army Corps of Engineers in evaluating the environmental impacts and benefits associated with shellfish culture operations, for the ongoing ESA consultation on NWP 48 for WA, OR and CA.

- Evaluated potential impacts to the Topeka Shiner Minnow listed under the ESA from routine irrigation canal maintenance, for a consortium of Iowa drainage districts.
- Evaluating nutrient and carbon mitigation opportunities from shellfish for the Pacific Coast Shellfish Growers Association.
- Evaluated potential impacts of intertidal geoduck clam aquaculture, as practiced by a consortium of growers in Puget Sound, to address Endangered Species Act (ESA) compliance issues.
- Evaluated potential impacts of expanding a floating upwelling nursery unit for oysters in southern Puget Sound. Conducted survey dives beneath the existing facility and expansion zone to address existing biodiversity and consider potential impacts from shading for Section 7 ESA compliance.
- Assessed biological significance of relocating treated sewage outfall, and reviewed mixing zone analysis for its ability to protect ESA-listed salmonids. Drafted Biological Assessments for Section 7 ESA compliance. Designed off-channel fish habitat and wetland restoration plan along the upper Yakima River to mitigate for the construction of an in-river rock-drop and trench box associated with a surface water withdrawal. Examined flow vs. habitat relationship. Developed mitigation plan that involved the breaching of the dike in two locations, the construction of an off-channel oxbow, and the routing of the channel into an existing flood-channel.
- Addressed DEIS comments and concerns of agencies and the public regarding the proposed expansion of a rock quarry owned by Cadman Inc. in the Snoqualmie River valley through applied research. Multiple reaches within seven surface drainages on or near the quarry were evaluated for potential impacts from the proposed expansion. Fish abundance, physical habitat, flow and fish passage barriers were surveyed in seven area streams and ponds on and near the project site, in accordance with Washington Forest Practices Guidelines for watershed analysis. Evaluated flow and habitat relationships in select drainages for potential mitigation opportunities.
- Provided technical support to the Bureau of Indian Affairs (BIA) and Office of the Solicitor in the FERC relicensing of the Pelton-Round Butte Hydroelectric Project (Project). Reviewed studies completed by the applicant, Portland General Electric (Applicant) and assisted the BIA in the development of appropriate Section 4(e) conditions. The BIA was concerned that insufficient attention was being paid to downstream habitat potentially affected by project flows. To investigate the effects on downstream anadromous steelhead and Chinook salmon, an instream flow investigation was used to define the needs of anadromous fish in this portion of the Deschutes River.
- Provided technical and strategic support to PacifiCorp (Scottish Power) for their FERC relicensing of the Prospect 1, 2, and 4 Hydroelectric Project on the Rogue River in Oregon. The focus of the multi-year project was to evaluate fisheries impacts on three forks of the Rogue River. Jeff participated in the data collection, analysis, reporting and collaboration with stakeholders. Some of the key studies included: 1.} Instream flow using PHABSIM modeling were conducted to determine minimum flow requirements for fish. In support of this work, fish distribution, abundance, condition, and habitat studies were conducted along transects representing the range of geomorphic conditions within the reaches affected by flow regulation.
- Managed the toxicity, human health and ecological risk assessment of the use of rotenone to eradicate northern pike from Lake Davis, California as part of a comprehensive EIS/CEQA environmental impact study conducted for the California Department of Fish and Game.

- Managed and authored ecological risk assessment for the modeling of risks to estuarine organisms from the use of the herbicide imazapyr (Arsenal) to control invasive *Spartina* for the Washington State Department of Agriculture. The assessment also addressed risks to ESA-listed species throughout the estuarine areas where *Spartina* was found. The results of the assessment led to the acceptance of the safety of the herbicide for the intended application and has resulted in over a 50 percent reduction in the incidence of the invasive plant in just three years.
- Managed and authored biological assessments in accordance with Section 7 compliance requirements of the Endangered Species Act to address impacts from projects related to transportation improvements, port expansion, shellfish culture, wastewater treatment outfall placement, surface water withdrawal, stormwater discharge and other issues. Project sponsors have included private, government and tribal entities.
- Evaluated the ecological risks and developed natural resource damage assessment following spill of fire retardant in tributary of the Okanogan River that supports ESA-listed steelhead trout and chinook salmon.
- Conducted ecological risk assessment to address potential sediment-associated effects of mercury and PAH contamination in a contaminated estuary of San Francisco Bay for Chevron, as part of NRDA negotiations. Modeled the potential ecological risks to salt-marsh associated biota, fish, and marine invertebrates; risks to select terrestrial biota were examined through a food web model.
- Authored ESA-driven biological assessment of a proposed stormwater discharge into the Puyallup River from the Cascade Pole and Lumber wood treatment facility in Tacoma, WA. Principal contaminants of concern to ESA-listed salmon included copper, chromium and arsenic.
- Assisted negotiations on transboundary ecological issues associated with mine waste impacts to Lake Roosevelt (WA) sturgeon and other fisheries resources, and on the potential introduction of invasive species into Canada via the Red River, from a proposed outlet in Devils Lake, ND.

Prior to joining ENVIRON, Jeff held the following positions:

ENTRIX, Inc., Senior Fisheries Biologist Biologist & Ecotoxicologist; Olympia, WA

AAAS Science and Technology Policy Fellow—Foreign Service Environmental Science Officer, U.S. Department of State

Pentec Environmental, Senior Aquatic Biologist & EcoRisk Assessor; Edmonds, WA

Puget Sound Christian College, Adjunct Professor of Biology

U. of Connecticut., Dept. of Natural Resources, Wildlife Conservation Research Center, Postdoctoral Research Associate; Storrs, CT

NY Dept. of Health, Division of Environmental Disorders, Postdoctoral Research Associate; Albany, NY

Cornell U., Dept. Avian & Aquatic Animal Med., Grad. Res. Assoc.; Ithaca, NY

Eastern Connecticut State U., Research Assistant; Inst. of Marine & Aqua. Studies, Willimantic, CT

Stillaguamish Tribal Fisheries Dept., Hatchery Manager/Fisheries Enhancement Biologist; Arlington, WA

National Marine Fisheries Service, Foreign Fisheries Observer Program, Seattle, Washington

Fisheries Research Institute, U. of Washington, Fisheries Technician; Seattle, WA

Jeffrey P. Fisher, PhD

ADDITIONAL TRAINING

Foreign Service Institute: (1) "Communicating Across Cultures", (2) "Explaining America", (3) "Early Morning Spanish", 2004

University of Florida, Advanced Aquatic Animal Medicine, 2003

Colorado State University: Wildland Water Quality Monitoring, 1986

Woods Hole, MBL: Aqua-Vet II: Advanced Aquatic Animal Medicine, 1991

AWARDS AND HONORS

AAAS, Science & Technology Policy Diplomacy Fellow, 2003-2005

Most Significant Paper, Journal of Aquatic Animal Health, Volume 7

Honorable Mention, Most Significant Paper, Trans. of the American Fisheries Society, Vol.126

Sea Grant Scholar, 1996

Charles Stewart Mott Foundation Predoctoral Fellow, 1992-1993

NIEHS Toxicology Training Grant Recipient, 1989-1992; 1994-1995

PROFESSIONAL AFFILIATIONS & ACTIVITIES

American Fisheries Society—Former Chair of AFS Western Division environmental concern committee.

Society of Environmental Toxicology and Chemistry (SETAC)

American Association for the Advancement of Science (AAAS)

Society of Ecological Restoration

PUBLICATIONS AND PRESENTATIONS

Peer-Reviewed Journal Publications

Cohen, J.B., J.S. Barclay, A.R. Major, and J.P. Fisher. 2000. Greater scaup as bioindicators of metal contamination at national wildlife refuges in the Long Island Sound region. Archives of Environmental Contamination and Toxicology 38: 83-92.

G.A. Wooster, P. Bowser, J. P. Fisher and S. Brown. 2000. Remediation of Cayuga Syndrome in Landlocked Atlantic Salmon Salmo salar using egg and sac-fry bath treatments of thiamine hydrochloride. Journal of the World Aquaculture Society. 31:2:149-157.

Butler B.J., J.S. Barclay, and J.P. Fisher. 1999. Plant communities and flora of Robins Island, New York. Journal of the Torrey Botanical Society 126:63-76.

Fisher, J.P., S.B. Brown, G.A. Wooster, and P.R. Bowser. 1998. Maternal blood, egg and larval thiamine levels correlate with larval survival in landlocked Atlantic salmon (Salmo salar). Journal of Nutrition 128:2456-2466.

Fisher, J.P., S.B. Brown, S. Connelly, T. Chiotti, and C.C. Krueger. 1998. Interspecies comparisons of blood thiamine in salmonids from the Finger Lakes, and effect of maternal size on blood and egg thiamine in Atlantic salmon with and without Cayuga syndrome. American Fisheries Society Symposium 21:112-123, Bethesda, Maryland.

Fisher, J.P., J.D. Fitzsimons, G.F. Combs Jr., and J.M. Spitsbergen. 1996. Naturally occurring thiamine deficiency causing reproductive failure in Finger Lakes Atlantic salmon and Great Lakes lake trout. Transactions of the American Fisheries Society 125:167-178. Honorable mention: Most Significant Paper of 1996, American Fisheries Society.

Chisti, M., J.P. Fisher, and R.F. Seegal. 1996. Aroclors 1254 and 1260 reduce dopamine concentrations in rat striatal slices. NeuroToxicology 17(3): 653-660.

Fisher, J.P., J.M. Spitsbergen, T. Iamonte, E.E. Little, and A. DeLonay. 1995. Pathological and behavioral manifestations of the "Cayuga syndrome," a thiamine deficiency in larval landlocked Atlantic salmon. Journal of Aquatic Animal Health 7(4):269-283. Most Significant Paper of 1995, American Fisheries Society.

Fisher, J.P., J.M. Spitsbergen, R. Getchell, J. Symula, J. Skea, M. Babenzein, and T. Chiotti. 1995. Reproductive failure in landlocked Atlantic salmon from New York's Finger Lakes: investigations into the etiology and epidemiology of the "Cayuga syndrome." Journal of Aquatic Animal Health 7(2): 81-94.

Ostrander, G.K., J.J. Anderson, J.P. Fisher, M.L. Landolt, and R.M. Kocan. 1990. Decreased performance of rainbow trout (Oncorhynchus mykiss) emergence behaviors following embryonic exposure to benzo(a)pyrene. Fishery Bulletin 88(3):551-555.

Peer Reviewed Book Chapters, Proceedings, and Editorial Works

Mendoza, R., Fisher, J.P. and 16 additional authors. 2009. Trinational Risk Assessment Guidelines for Aquatic Alien Invasive Species: Test cases for the Snakeheads (Channidae) and Armored Catfishes (Loricariidae) in North American Inland Waters. Commission for Environmental Cooperation. Fisher, J.P. (ed.) ISBN 978-2-923358-60-4.

Fisher, J.P. 2005. An overview of international initiatives addressing invasive species. In: "Building Capacity to combat impacts of aquatic invasive alien species and associated trans-boundary pathogens in ASEAN countries. Penang, Malaysia, July 12-16. M. Phillips, P. Bueno, J. Fisher, and M. Reantaso (eds.).

Fisher, J.P. 2005. Addressing invasive species in the environmental cooperation mechanisms of free trade agreements. In, "Facilitating Safer US-Caribbean Trade: Invasive Species Issues. Port of Spain, Trinidad, June 2-4, 2004. C. Davis & W. Claussen (eds). .

Simpson, A., E. Sellers, and J. Fisher (eds.). 2004. "Experts meeting toward the implementation of a global invasive species information network." Baltimore, MD. April 5-8.

Fisher, J.P. 2004. Final U.S. Position Paper Agenda Item 6.1 (UNEP/CBD/BS/COP-MOPO/1/4. Procedures and Mechanisms for Facilitating Decision-Making By Parties of Import (Article 10 paragraph 7)

Fisher, J.P. and E. Wilson. 2004. Traditional Knowledge of Indigenous and Local Communities and Ensuring Access to Its Benefits—Article 8j of the International Convention on Biological Diversity and its Potential Relationship to Intellectual Property Rights.

Fisher, J.P. 2004. U.S. government position on article 8(j) of the CBD, and the 8(j) working group recommendations to the COP (UNEP/CBD/COP/7/7)

Fisher, J.P. and M. S. Myers. 2000. Fish necropsy. In: Handbook of Experimental Animals—The Fish, Chapter 32-pp 543-556. Academic Press, London.

Fisher, J. P.. 2000. Facilities and husbandry (large fish models). In: Handbook of Experimental Animals—The Fish, Chapter 1-pp 13-39. Academic Press, London.

Fisher, J.P., J.M. Spitsbergen. 1990. Investigations into the Cayuga Lake Atlantic salmon Salmo salar syndrome. Pages 16-19 in M. Gilbertson, editor. Proceedings of the Roundtable on Contaminant-Caused Reproductive Problems in Salmonids. ISBN 1-895085-41-1. International Joint Cammission, Windsor, Ontario.

Fisher, J.P., S. Brown, P.R. Browser, G.A. Wooster, and T. Chiotti. 1996. Continued investigations into the role of thiamine and thiaminase-rich forage in the Cayuga syndrome of New York's landlocked Atlantic salmon. Pages 79-81 in B. E. Bengtsson, C. Hill, and S. Nellbring, editors. Report from the Second Workshop on Reproduction Disturbances in Fish. ISBN 91-520-4534-2. Swedish Environmental Protection Agency, Stockholm, Sweden.

Fisher, J.P., B. Bush, and J.M. Spitsbergen. 1996. Contrasting pathologies associated with the Cayuga syndrome and PCB-induced mortality in early life stages of Atlantic salmon. Pages 87-88 in B. E. Bengtsson, C. Hill, and S. Nellbring, editors. Report from the Second Workshop on Reproduction Disturbances in Fish. ISBN 91-620-4534-2. Swedish Environmental Protection Agency, Stockholm, Sweden.

Barclay, J.S., and Fisher, J.P., (editors). 1996. Inventory of natural resources and processes on Robins Island. Wildlife Conservation Research Center, University of Connecticut Report to the Robins Island Preservation Corp., New Suffolk, New York., 222 pp.

Fisher, J.P., J.M. Spitsbergen, B. Bush, and B. Jahan-Parwar. 1994. Effect of embryonic PCB exposure on hatching success, survival, growth and developmental behavior in landlocked Atlantic salmon, Salmo salar. Pages 298-314 in J. W. Gorsuch, F. J. Dwyer, C. G. Ingersoll, and T. W. LaPoint, editors. Environmental Toxicology And Risk Assessment, 2nd Volume. ASTM STP 1216. American Society For Testing And Materials, Philadelphia, Pennsylvania.

Robin L. Garibay, REM

EDUCATION

1980 BA, Biochemistry, Rice University

1983 Graduate Studies, Plant Physiology, Texas A & M University

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Registered Environmental Manager No. 7599

EXPERIENCE

A Principal in ENVIRON's Arlington, Virginia, location, Ms. Garibay has over 25 years of experience in wastewater and water quality management issues, particularly activities in support of strategic planning for facility changes and permitting, complaince planning, and providing technical advocacy in wastewater and water quality rulemaking.

Ms. Garibay's specific expertise includes water quality criteria development, watershed and facility source surveys, fate and effects studies, bioavailability assessments, toxicity reduction evaluations, removal credit applications, antidegradation demonstrations, variance requests, strategic planning for operational changes, and permit negotiations.

Highlights of her project experience follow:

- Review implementation of regulations by participating in work groups, and commenting on water quality and wastewater-related guidance documents and methods, policy directives, compliance costs, and technical databases.
- Participated in stakeholder work groups in Illinois, Indiana, West Virginia, and Wisconsin on various regulatory issues including adoption of GLI rules, establishment of anti-degradation rules and procedures, development of TMDLs, creation of statewide mercury variance rules, and derivation of site-specific water quality criteria.
- Directed sampling and analytical tasks for the chemical identification, mixing zone delineation studies, assimilative capacity studies, reviews of toxicology and fate information to determine environmental risks, preparation of sampling and analysis plans for CWA and RCRA activities.
- Preparation of 404 Applications, 401 Certifications, CZM Applications, NPDES Permit Applications, IU Permit Applications, Land Application Permit Applications, and Plans in support of BMP, PMP, SWP3, SPCC and/or FRP.
- Directing and conducting in-plant sewer source surveys and development of water and mass balances.
- Assistance in wastewater management audits and wastewater management training

Ms. Garibay has significant experience consulting with iron and steel mills, petroleum refineries, pulp and paper manufacturers, organic chemical manufacturers, power generation stations, food manufacturing, and industrial trade associations.

Previous experience includes the analysis of formulations and groundwater samples for pesticide identity and serving on an agricultural chemicals and groundwater task force for the development of a groundwater protection act and chemigation rule.