STATE OF NEW MEXICO
NEW MEXICO WATER QUALITY CONTROL COMMISSION

In the Matter of:
PROPOSED AMENDMENTS TO STANDARDS FOR INTERSTATE AND INTRASTATE WATERS, 20.6.4 NMAC

No. WQCC 20-51 (R)

AMIGOS BRAVOS' NOTICE OF INTENT TO PRESENT DIRECT TESTIMONY

Pursuant to 20.6.1.202.A NMAC and the Procedural Order issued in this matter, Amigos Bravos hereby files its Notice of Intent to Present Direct Testimony. As required by the applicable regulations and Procedural Order, Amigos Bravos provides the following information in this notice:

1. Identify the person for whom the witnesses will testify:

The two witnesses identified below, Rachel Conn and Jamie C. DeWitt, Ph.D., DABT, will testify on behalf of Amigos Bravos, a New Mexico non-profit water conservation organization dedicated to protecting and restoring the waters of the state.

2. Identify each technical witness the person intends to present, and state the qualifications of that witness, including a description of their educational and work background:

Amigos Bravos intends to present Rachel Conn, Projects Director for Amigos Bravos, and Jamie C. DeWitt, Ph.D., DABT, Associate Professor in the Department of Pharmacology and Toxicology of the Brody School of Medicine at East Carolina University. Ms. Conn's educational and work background is set forth in her resume, which is Amigos Bravos' Exhibit 2, and Dr. DeWitt's background is set forth in her curriculum vitae, which is Amigos Bravos' Exhibit 8.

3. Include a copy of the direct testimony of each technical witness in narrative form, and state the estimated duration of the direct oral testimony of that witness:

As required by the Procedural Order, ¶ 3, Amigos Bravos submits the full written direct testimony of Ms. Conn in Exhibit 3 and of Dr. DeWitt in Exhibit 9. Each witness will limit their oral direct testimony at hearing to a summary of their testimony not to exceed 30 minutes, as provided for in the Procedural Order, ¶ 3.

4. Include the text of any recommended modifications to the proposed regulatory change:

A text of the modifications to 20.6.4 NMAC proposed by Amigos Bravos is attached as Exhibit 1.

5. List and attach all exhibits anticipated to be offered by that person at the hearing:

Below is a list of all exhibits to be offered by Amigos Bravos in support of its direct testimony, which are attached, and the page number in the PDF document for each exhibit. Amigos Bravos reserves the right to offer rebuttal and sur-rebuttal exhibits.

Exhibit	Description	PDF page
Ex. 1	Amigos Bravos' Proposed Amendments to 20.6.4 NMAC	5
Ex. 2	Resume of Rachel Conn	10
Ex. 3	Direct Testimony of Rachel Conn	13
Ex. 4	USGS-NMED PFAS Sampling Results – Surface Water (Aug.-Sept. 2020)	29
Ex. 5	Amigos Bravos Valle De Oro Community Water Quality Sampling Results	31
Ex. 6	NMED - Pharmaceuticals in Water (July 28, 2017)	46
Ex. 7	Dec. 19, 2006 letter from R. Conn, Amigos Bravos, to S. Barash, EPA, re Effluent-Dependent Waters Strawman Document	83
Ex. 8	Curriculum Vitae of Jamie C. DeWitt	91
Ex. 9	Direct Testimony of Jamie C. DeWitt, Ph.D., DABT	123

Respectfully submitted,

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Certificate of Service

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AMIGOS BRAVOS' EXHIBIT 1

AMIGOS BRAVOS' PROPOSED AMENDMENTS TO 20.6.4 NMAC[1]

Climate Change

Amigos Bravos proposes to add the following at 20.6.4.6.C NMAC and to delete the New Mexico Environment Department's (NMED) proposed 20.6.4.6.D NMAC:

20.6.4.6 OBJECTIVE:

. . .

C. The quality of New Mexico surface waters is being affected by climate change. New Mexico's climate is getting hotter and drier, resulting in earlier springs, hotter summers, and less predictable winters. New Mexico is experiencing more intense droughts and a greater proportion of precipitation falling as rain instead of snow. Snowpack is shrinking and earlier snowmelts contribute to lower stream flows at critical times of the year when the reduced availability of water has greater environmental consequences. Increased water temperatures resulting from increased air temperatures tend to lead to lower levels of dissolved oxygen in water, resulting in increased stress on the fish, insects, crustaceans and other aquatic animals that rely on oxygen. More intense precipitation events and increased evaporation rates lead to increased runoff and more pollution, including increased nutrients sediment, and salt that wash into surface waters. Development of New Mexico surface water quality standards should take into account the importance of protecting of water quality in light of climate change.

D.~~C.~~ Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.

~~D. These surface water quality standards serve to address the inherent threats to water quality due to climate change.~~

[1] Amigos Bravos' proposed changes to the regulations are shown in blue, the New Mexico Environment Department's proposed changes are in red, and the existing regulations are in black.

Contaminants of Emerging Concern

Amigos Bravos proposes to amend NMED's proposed definition of "contaminants of emerging concern" at 20.6.4.7.C(8) NMAC[2] as follows:

20.6.4.7 DEFINITIONS

. . .

C. Terms beginning with the letter "C".

. . .

(8) "Contaminants of emerging concern" or "CECs" refer to water contaminants including, but not limited to, per- and polyfluoroalkyl substances, pharmaceuticals and personal care products that may cause significant ecological or human health effects at low concentrations and are not already considered "toxic pollutants" by the department. CECs are generally chemical compounds that, although suspected to potentially have impacts, may not have regulatory standards, and the concentrations to which negative impacts are observed have not been fully studied.

Amigos Bravos proposes adding the following at 20.6.4.14.F NMAC:

20.6.4.14 SAMPLING AND ANALYSIS

. . .

F. The department may include sampling and monitoring of contaminants of emerging concern as a condition in a federal permit under Section 401 of the federal Clean Water Act.

[2] NMED proposed adding this definition at 20.6.4.7.C**(7)** NMAC, after the definition of "coldwater" at 20.6.4.7.C(5) NMAC and before the definition of "coolwater" at 20.6.4.7.C(6) NMAC, but the definitions are ordered alphabetically, and therefore a new definition for "contaminations of emerging concern" should be placed after the definition of "commission" at 20.6.4.7.C(7) NMAC and "criteria" at 20.6.4.7.C(8) NMAC. Amigos Bravos proposes the definition for "contaminants of emerging concern" to be placed at 20.6.4.7.C**(8)** NMAC, taking into account NMED's new proposed definition for "climate change," which Amigos Bravos supports.

Baseflow and Effluent Dominated

Amigos Bravos proposes that the Commission **not** adopt NMED's new proposed definitions for "baseflow" at 20.6.4.7.B(1) NMAC and "effluent dominated" at 20.6.4.7.E(2) NMAC:

20.6.4.7 DEFINITIONS

. . .

B. Terms beginning with the letter "B".

~~**(1) "Baseflow"** refers to the sustained flow volume of a stream or river. In natural systems, baseflow is comprised from regional groundwater inflow and local shallow subsurface inflow that is temporarily stored in the watershed during snowmelt and rain events and slowly released to the stream or river over time. In effluent dominated systems, baseflow is comprised predominantly from effluent with limited subsurface contributions. Baseflow in both scenarios is critical for sustaining flow in streams and rivers over seasonal and longer timeframes.~~

. . .

E. Terms beginning with the letter "E".

. . .

~~**(2) "Effluent dominated"** refers to a water that has, over a 12-month average, more than three-quarters of its baseflow attributed to discharges from a permitted effluent discharge. Waters that are effluent dominated are of significant value by providing aquatic life and wildlife habitat.~~

Alternatively, Amigos Bravos proposes that the Commission **not** adopt NMED's new proposed definition for "effluent dominated" at 20.6.4.7.E(2) NMAC, and amend NMED's proposed definition for "baseflow" at 20.6.4.7.B(1) NMAC as follows:

20.6.4.7 DEFINITIONS

. . .

B. Terms beginning with the letter "B".

(1) "Baseflow" refers to the sustained flow volume of a stream or river. In natural systems, baseflow is comprised from regional groundwater inflow and local shallow subsurface inflow that is temporarily stored in the watershed during snowmelt and rain events and slowly released to the stream or river over time. ~~In effluent dominated systems, baseflow is comprised predominantly from effluent with limited subsurface contributions. Baseflow in both scenarios is critical for sustaining flow in streams and rivers over seasonal and longer timeframes.~~

Existing Use

Amigos Bravos proposes to amend the current definition of "existing use" as follows:

20.6.4.7 DEFINITIONS

. . .

E. Terms beginning with the letter "E".

. . .

(3) "Existing use" means a use actually attained in a surface water of the state on or after November 28, 1975, whether or not it is a designated use. An existing use can be established by demonstrating that fishing, swimming, or other uses have actually occurred since November 28, 1975; or that the water quality is suitable to allow the use to be attained.

AMIGOS BRAVOS' EXHIBIT 2

RACHEL L. CONN
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Experience – Water Quality and Environmental Policy

Projects Director, Amigos Bravos, Taos, NM 2010-present
Oversees projects in all three of Amigos Bravos' program areas – Holding Polluters Accountable, Restoring Watershed Health, and Building a Water Protection Movement for the Future. Provides technical oversight and leadership to various projects such as addressing stormwater contamination at Los Alamos National Laboratory; monitoring and advocating for solutions to water discharges at Chevron/Molycorp Mine; monitoring water quality in four streams in Taos County; overseeing wetland and riparian restoration projects. Monitors and participates in state and federal regulatory processes such as the New Mexico copper rulemaking process, New Mexico dairy rulemaking process, triennial review of New Mexico water quality standards; antidegradation policy decisions; and EPA rulemaking related to water quality.

Clean Water Circuit Rider, Amigos Bravos, Taos, NM, 2002-2010
Provided training on the Clean Water Act including topics such as water quality standards, total maximum daily loads (TMDLs), nation pollutant discharge elimination system (NPDES), and antidegradation including Outstanding National Resource Waters. Provided capacity building support to individuals and communities wanting to protect rivers. Helped coordinate legal and technical resources for watershed and community groups. Tracked and commented on state and national water regulations and policies. Organized and facilitated multiple community coalitions, including coordinating and facilitating meetings, tracking budget items, communicating with the media and assisting with strategic planning.

Project Associate, Amigos Bravos, Taos, NM 2001-2002
Coordinated a project that examined the economic benefits of mine reclamation. Assisted with an investigation into the potential health impacts of mining practices in a community impacted by molybdenum mining. Assisted with writing press releases, coordinating meetings and representing Amigos Bravos at community events. Organized annual art auction that grossed over $15,000.

Co-Chair, New Mexico Mining Act Network 2013-present
Leads program to implement and strengthen the mine permitting and reclamation requirements of the New Mexico Mining Act.

Vice Chair, Clean Water Network, 2010-2013
Helped oversee financial, organizational and programmatic aspects of the Clean Water Network, a national coalition of conservation organizations devoted to protecting clean water. Chaired the Water Quality Standards Workgroup of the Network, which analyzed and participated in rulemaking procedures that impacted water quality.

Board of Directors, Red River Restoration Group, 2003-2012
Led the formation of the Red River Restoration Group (formally Rio Colorado Reclamation Committee) and participated in overseeing the financial, organizational and programmatic direction of the group. Reviewed technical documents, hired and oversaw technical experts, organized public meetings, and tracked regulatory requirements and compliance related to the Chevron/Molycorp mine in Questa, NM

Project Director, Costilla County Committee for Environmental Soundness, San Luis, CO, 1999-2000
Directed year-long project related to water contamination from a gold mine, funded through an environmental justice grant from the Environmental Protection Agency (EPA). Analyzed water quality data, coordinated experts and drafted a plan outlining options to the town in the event of contamination of their drinking water. Edited and wrote articles for the group's monthly newsletter. Performed accounting and grant reporting tasks. Served as an interface between the state and federal government to ensure that community needs and concerns were addressed.

Environmental Analyst, Massachusetts Department of Environmental Protection, Boston, 1998-1999

Worked on information management practices in the four different bureaus within the Department. Conducted interviews and facilitated meetings to determine what information was necessary for the many different programs including the toxic use reduction program, the air quality programs, and the solid waste program.

Field Researcher, Sevielleta National Wildlife Refuge, 1997
Worked and lived on the refuge at the University of New Mexico's field station. Measured percent cover, and identified flora as part of the plant research crew. Learned to identify by sight over a hundred different species of southwest plants.

Education

Colorado College, Colorado Springs, CO May 1997
Bachelor of Arts in Environmental Biology

Technical Testimony Experience

Triennial Review of Water Quality Standards, New Mexico Water Quality Control Commission, 2013, 2009 2003 – Presented technical testimony on Clean Water Act requirements, public participation components, antidegradation including Outstanding National Resource Waters, and applicability of water segment specific uses and criteria.

Dairy Rulemaking, New Mexico Water Quality Control Commission, 2010 – Presented technical testimony on public notice requirements.

Outstanding National Resource Water Hearing, New Mexico Water Quality Control Commission, 2010 – Presented technical testimony on New Mexico's antidegradation policy and Clean Water Act requirements.

Antidegradation Hearing, New Mexico Water Quality Control Commission, 2007 – Presented technical testimony on New Mexico's antidegradation policy and proposed to changes to the policy.

Minimal Impact Mining Hearing, New Mexico Mining Commission, 2013 – Presented technical testimony on the impacts to communities from extractive industries and the need for public processes such as conducting environmental analysis before initiating large scale mining.

AMIGOS BRAVOS' EXHIBIT 3

DIRECT TESTIMONY OF RACHEL CONN

I. QUALIFICATIONS

My name is Rachel Conn and I am the Projects Director for Amigos Bravos. Amigos Bravos is a non-profit water conservation organization dedicated to protecting and restoring the waters of New Mexico. Amigos Bravos has been working for 30 years to protect water quality in the state.

I have worked for the past 23 years in the environmental field, with my primary focus on water quality policy and protections. I began my professional career working for the Massachusetts Department of Environmental Protection as a consultant assessing the data management needs of the various bureaus in the department. I also worked for a non-profit in Colorado assessing and addressing water quality problems associated with gold mining. I have a B.A. in Environmental Biology from Colorado College.

For the past 21 years, I have worked for Amigos Bravos on New Mexico water quality policy and protection. As Projects Director, I direct the organization's projects in all three Amigos Bravos program areas: watershed protection and policy, holding polluters accountable, and building a water protection movement for the future. As part of this work I help New Mexico communities learn about and use the Clean Water Act ("CWA") and New Mexico Water Quality Act ("WQA") to protect and clean up their rivers, streams, and other waters by giving trainings around the state on water quality standards, Total Maximum Daily Loads, National Pollutant Elimination System permits, Outstanding National Resource Waters ("ONRW" or "Outstanding Waters"), and other CWA and WQA topics. I led a surface water quality monitoring program in Northern New Mexico that gathered water quality data from seven streams annually for the past 14 years. As part of this work I train volunteers on sampling methods and protocols. I have also

served on the Advisory Board of the national Clean Water Network for nine years, where I assist in guiding national CWA advocacy. I have provided technical testimony related to CWA and WQA requirements before the Water Quality Control Commission ("Commission") on many occasions, including during the last three Triennial Reviews, as well as the rulemakings designating and promulgating rules governing Outstanding Waters. My resume is attached as Amigos Bravos' Exhibit 2.

II. CLIMATE CHANGE: OBJECTIVES (20.6.4.6.C NMAC) and DEFINITION (20.6.4.7.C(4) NMAC)

In its Amended Petition, the New Mexico Environment Department ("NMED") has proposed adding a reference to climate change in the Objective section of the standards at 20.6.4.6 NMAC and including a definition of "climate change" at 20.6.4.7.C(4) NMAC. It is appropriate for the Commission to begin to take climate change into consideration in promulgating surface water standards in light of the documented impacts from climate change we have begun to see and those we expect to see to New Mexico's waters. New Mexico is the sixth fastest warming state in the nation, with the average temperature increasing 2.7°F between 1970 and 2015.[1] This trend is expected to continue with average annual temperatures expected to rise another 3.5 to 8.5°F by 2100.[2] These increased temperatures are already having outsized impacts on New Mexico's surface waters. Between 2001 and 2010, flows in the Rio Grande were 23% below the century average[3] and flows to the Rio Grande are expected to decrease on

[1] Union of Concerned Scientists (UCS). 2016. *Confronting Climate Change in New Mexico* at 2. Available at www.ucsusa.org/NewMexicoClimateChange.

[2] *Id.*

[3] *Id.* at 3.

average by one-third by the end of the century.[4] In New Mexico climate change is expected to impact the timing of the spring runoff, shifting peak runoff earlier in the spring.[5] This earlier runoff results in lower stream flows during critical times of the year.[6] Acequias are already shifting their spring cleaning earlier to make the use of the spring runoff that is arriving earlier. In addition, much of the precipitation that we do get in New Mexico is expected to fall in extreme events on drought-hardened soils that can result in increased flooding.[7]

Water quality is being and will be impacted by climate change. When intense rain events fall on either drought-hardened or wildfire disturbed soil, there is increased runoff and increased pollutant transport. Climate change is causing increased wildfire risk across the West with New Mexico expected to see a 400% increase in burned areas.[8] We have seen these impacts in the Upper Rio Grande with severe flooding and sediment transport in 2011, 2012, and 2013 in places that were burned by the 2011 Las Conchas Fire. Climate change is expected to increase concentrations of nutrients, suspended solids, and salt in New Mexico's surface water.[9] Increased levels of nutrients can lead to more harmful algae growth which in turn, along with warmer water temperatures, results in decreases of dissolved oxygen in streams and lakes.[10]

Given the current and anticipated impacts on surface water quality from climate change, the Commission should include as an overarching objective of the surface water quality

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[4] U.S. Department of Interior (USDI), Bureau of Reclamation. 2013. *West-Wide Climate Risk Assessment: Upper Rio Grande Risk Assessment* at S-iv. Albuquerque. Available at https://www.usbr.gov/watersmart/baseline/docs/urgia/URGIAMainReport.pdf.

[5] *Id.*

[6] USC 2016 at 1.

[7] *Id*. at 4.

[8] *Id*. at 6.

[9] USDI 2013 at S-v.

[10] USC. June 24, 2010. *Water and Climate Change.* Available at https://www.ucsusa.org/resources/water-and-climate-change.

regulations protection of water quality in light of this serious threat. Amigos Bravos proposes the following language to be included at 20.6.4.6.C NMAC:

> **20.6.4.6 OBJECTIVE:**
> . . .
> **C.** The quality of New Mexico surface waters is being affected by climate change. New Mexico's climate is getting hotter and drier, resulting in earlier springs, hotter summers, and less predictable winters. New Mexico is experiencing more intense droughts and a greater proportion of precipitation falling as rain instead of snow. Snowpack is shrinking and earlier snowmelts contribute to lower stream flows at critical times of the year when the reduced availability of water has greater environmental consequences. Increased water temperatures resulting from increased air temperatures tend to lead to lower levels of dissolved oxygen in water, resulting in increased stress on the fish, insects, crustaceans and other aquatic animals that rely on oxygen. More intense precipitation events and increased evaporation rates lead to increased runoff and more pollution, including increased nutrients sediment, and salt that wash into surface waters. Development of New Mexico surface water quality standards should take into account the importance of protecting of water quality in light of climate change.[11]

NMED proposed adding the following language to the Objective section at 20.6.4.6.D NMAC: "These surface water quality standards serve to address the inherent threats to water quality due to climate change." However, it is not accurate that the surface water quality standards "address" climate change either in the sense that the standards resolve the threats climate change poses to water quality or that the standards adequately respond to the threats of climate change. Therefore, Amigos Bravos does not support including this language in the regulations. Amigos Bravos' proposed language, on the other hand, encourages NMED to develop and propose and the Commission to adopt surface water quality standards that respond to the very real threat of climate change based on the evolving science.

[11] Throughout this notice, Amigos Bravos' proposed changes to the regulations are shown in blue, NMED's proposed changes are in red, and the existing regulations are in black.

NMED has proposed to add a definition for "climate change" at 20.6.4.7.C(4) NMAC, which provides:

> **(4) "Climate change"** refers to any significant change in the measures of climate lasting for an extended period of time, typically decades or longer, and includes major changes in temperature, precipitation, wind patterns or other weather-related effects. Climate change may be due to natural processes or human-caused changes of the atmosphere, or a combination of the two.

Amigos Bravos supports adding a definition for "climate change" in the water quality standards for reasons similar to why it supports referring to climate change in the Objection section. NMED's proposed definition is consistent with leading climate science organizations' definitions, including the Intergovernmental Panel on Climate Change ("IPCC")[12] and the U.S. Global Research Program[13], although the IPCC notes that the U.N. Framework Convention on Climate Change defines climate change as "a change of climate which is attributed directly or

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[12] The IPCC definition provides::
Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes.
https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_Annexes.pdf.

[13] The U.S. Global Change Research Program defines "climate change" as:
Changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events, and changes to other features of the climate system.
https://www.globalchange.gov/climate-change/glossary.

indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

In that regard, it's important to acknowledge the consensus among climate scientists that human activity is the primary cause of climate change. According to the U.S. Global Research Program, "Earth's climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities.[14] The IPCC finds that, "Human influence on the climate system is clear, and recent anthropogenic emissions of green-house gases are the highest in history."[15] The Union of Concerned Scientists concludes that, "Scientists worldwide agree that global warming is happening, and that human activity causes it."[16] The fact is multiple independent lines of evidence and the vast body of peer-reviewed science demonstrate that the greenhouse gases emitted by human activities are the primary driver of climate change.[17]

Because climate change is primarily human-caused, the Commission should consider a definition of climate change that, like the U.N. Framework Convention on Climate Change, distinguishes between climate change causes by human activity and natural climate variability. And NMED, when interpreting terms like "natural background" and "natural causes" in the water quality standards, should rely on the best science available in determining whether conditions that affect water quality, such as increases in temperature, are attributable to natural variability or human-caused climate change.

III. DEFINITION AND MONITORING OF CONTAMINANTS OF EMERGING CONCERN (20.6.4.7.C(8) NMAC and 20.6.4.14.F NMAC)

[14] https://www.globalchange.gov/climate-change.

[15] *IPCC Fifth Climate Assessment Report* at https://www.ipcc.ch/report/ar5/syr/.

[16] USC. Updated Jan. 9, 2018. *Scientists Agree: Global Warming is Happening and Humans are the Primary Cause*. Available at https://www.ucsusa.org/resources/global-warming-happening-and-humans-are-primary-cause.

[17] *Id.*

NMED has proposed adding a definition for contaminants of emerging concern ("CECs") in its Amended Petition. Amigos Bravos supports adding a definition for CECs – a category of contaminants recognized by EPA[18] -- and proposes adding the following to NMED's definition at 20.6.4.7.C(8) NMAC[19]:

> **(8) "Contaminants of emerging concern" or "CECs"** refer to water contaminants including, but not limited to, per- and polyfluoroalkyl substances, pharmaceuticals and personal care products that may cause significant ecological or human health effects at low concentrations and are not already considered "toxic pollutants" by the department. CECs are generally chemical compounds that, although suspected to potentially have impacts, may not have regulatory standards, and the concentrations to which negative impacts are observed have not been fully studied.

In her direct testimony, Dr. Jamie C. DeWitt, Associate Professor in the Department of Pharmacology and Toxicology of the Brody School of Medicine at East Carolina University, provides her expert opinion and basis why per- and polyfluoroalkyl substances ("PFAS") should be included as an example of CECs in the proposed definition and why NMED should have the authority to monitoring of CECs in federal permits issued under the federal Clean Water Act and certified by NMED. *See* Amigos Bravos' Exhibit 9. In my testimony, I will discuss (1) the fact that PFAS are being detected in more and more New Mexico's waters, raising human health, ecological, and economic concerns across the state; (2) NMED's efforts to monitor PFAS

[18] https://www.epa.gov/wqc/contaminants-emerging-concern-including-pharmaceuticals-and-personal-care-products.

[19] NMED proposed adding this definition at 20.6.4.7.C**(7)** NMAC, after the definition of "coldwater" at 20.6.4.7.C(5) NMAC and before the definition of "coolwater" at 20.6.4.7.C(6) NMAC, but the definitions are ordered alphabetically, and therefore a new definition for "contaminations of emerging concern" should be placed after the definition of "commission" at 20.6.4.7.C(7) NMAC and "criteria" at 20.6.4.7.C(8) NMAC. Amigos Bravos proposes the definition for "contaminants of emerging concern" to be placed at 20.6.4.7.C**(8)** NMAC, taking into account NMED's new proposed definition for "climate change," which Amigos Bravos supports.

contamination in the state; and (3) why NMED should have the authority to require monitoring of CECs in federal permits certified by NMED.

NMED has identified PFAS contamination as a top priority in the state, observing that "research indicates that some PFAS may affect reproductive health, increase the risk of some cancers, affect childhood development, increase cholesterol levels, affect the immune system, and interfere with the body's hormones."[20] According to NMED: "PFAS are known as 'forever' chemicals because they do not easily degrade in the environment due to their chemical properties. Thus, PFAS can accumulate over time in soil, water, and living organisms and have been found in water sources around the world."[21]

In the last several years PFAS levels have been detected in numerous locations in New Mexico. PFAS contamination of groundwater has been documented at the Cannon and Holloman Air Force Bases. Contamination at Cannon Air Force Base was monitored at levels more than 370 times what federal regulators consider safe for a lifetime of exposure. Nearby private drinking wells are also contaminated. Near Holloman, PFAS was found at levels up to 1,294,000 parts per trillion—more than 27,000 times the lifetime advisory level.[22] In addition, the water utility for Clovis has detected PFAS in some of its municipal drinking water wells.[23] PFAS contamination has threatened dairies in the area. Art Schaap, a dairy farmer near Clovis, has been

[20] NMED PFAS website: https://www.env.nm.gov/pfas/main/.

[21] https://www.env.nm.gov/wp-content/uploads/2021/01/2021-01-18-Two-new-PFAS-efforts-underway.pdf.

[22] NM PBS. Mar. 24, 2020. *Pentagon IDs Four More NM Sites at Risk of PFAS Contamination.* Available at https://www.newmexicopbs.org/productions/newmexicoinfocus/pentagon-identifies-four-more-new-mexico-sites-at-risk-of-pfas-contamination/.

[23] *Id.*

dumping the milk from his cows since 2018 when the contamination was discovered. According Mr. Schaap,

> There's other farms down the plume. There's other big businesses–one of the largest cheese plants in the United States is down the plume. You've got the community's water supply [in Clovis] down the plume. You got another community, Portales's water supply down the plume.[24]

During the 2020 legislative session, the New Mexico Legislature appropriated $1 million to NMED to begin sampling, monitoring, and studying the size and movement of the ground water plumes around the communities of Clovis and Alamogordo.

PFAS have also been detected in New Mexico's surface waters. An August-September 2020 joint U.S. Geological Survey and NMED study[25] detected PFAS in numerous New Mexico river systems including the Rio Grande, Gila, Canadian, Animas, Pecos, Rio Puerco, and San Juan rivers. USGS -NMED PFAS Sampling Results – Surface Water [Amigos Bravos' Ex. 4].

NMED is currently directing sampling for PFAS in 19 New Mexico counties. This sampling effort, which started in mid-2020 and continues through mid-2021, focuses on multiple ground and surface water supplies in these counties. According to NMED Water Protection Division Director Rebecca Roose, "The first step toward addressing PFAS contamination in New Mexico is finding out where these chemicals are."[26]

Other CECs such as pharmaceuticals and personal care products ("PPCPs") have been detected in New Mexico's surface waters. In 2018, a University of Texas study detected over 40

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[24] NM PBS. Mar. 21, 2021. *Art Schaap's Dairy Dilemma.* Available at https://www.newmexicopbs.org/productions/newmexicoinfocus/art-schaaps-dairy-dilemma/.

[25] Memorandum of Agreement between the New Mexico Environment Department and the United States Geological Survey Amendment #1 at https://www.env.nm.gov/pfas/wp-content/uploads/sites/21/2019/04/2020-12-09-A1-USGS-PFAS-MOA-21-667-2080-0001_USGS-Executed.pdf.

[26] https://www.env.nm.gov/wp-content/uploads/2021/01/2021-01-18-Two-new-PFAS-efforts-underway.pdf.

PPCPs including carbamazepine, erythromycin, gemfibrozil, ofloxacin, sulfamethoxazole, and trimethoprim in the Rio Grande and documented negative impacts to aquatic life from the detected concentrations.[27] A 2014-2017 Amigos Bravos educational monitoring project detected 17 PPCPs in the Rio Grande in the South Valley. Amigos Bravos Valle De Oro Community Water Quality Sampling Results [Amigos Bravos' Ex. 5]. NMED has found PPCPs in several wastewater treatment effluent streams in northern New Mexico. NMED - Pharmaceuticals in Water [Amigos Bravos' Ex. 6].

In addition to adding a definition of CEC's to New Mexico's water quality standards, as NMED has proposed, NMED should have the regulatory authority to require dischargers under permits issued under the federal Clean Water Act to monitor for these compounds. Detecting PFAS in New Mexico waters is a priority of the state legislature and NMED. Given this priority and the widespread occurrence of both PFAS and PPCPs in New Mexico's water resources, and the health, aquatic life, and economic threats from these CECs, it is critical that the state have the authority to require federal permittees to monitor for CECs in order to detect these contaminants and identify potential sources. Amigos Bravos proposes the following language to be added at 20.6.4.14.F NMAC:

20.6.4.14 SAMPLING AND ANALYSIS

. . .

F. The department may include sampling and monitoring of contaminants of emerging concern as a condition in a federal permit under Section 401 of the federal Clean Water Act.

[27] Garcia, Enrique David, "Detection of Pharmaceuticals and Personal Care Products in the Rio Grande and Their Effects on a Model Aquatic Invertebrate (Rotifera, Monogononta: Plationus Patulus)" (2018). *ETD Collection for University of Texas, El Paso*. AAI13424718.

IV. DEFINITIONS OF "EFFLUENT DOMINATED" (20.6.4.7.E(2) NMAC) and "BASEFLOW" (20.6.4.7.B(1) NMAC)

NMED has proposed adding a definition of "effluent dominated" at 20.6.4.7.E(2) NMAC and "baseflow" at 20.6.4.7.B(1) NMAC. However, except within these two definitions, there is no other reference in the surface water quality regulations to the two terms "effluent dominated" or "baseflow". Therefore, adding these two definitions serves no regulatory purpose and there is no reason to add them.

Furthermore, adding a definition of "effluent dominated" is problematic beyond the fact that it attempts to "fix a problem that doesn't exist." Creating a definition of "effluent dominated" could represent the first step in setting up a framework in which some waters may be considered less important or less worthy of protection than other waters. All waters in New Mexico are a critically important resource and it is counterproductive to start down the road of setting up a two tier system designating a lower class of waters that may receive fewer protections in the future. According to the latest report from the Office of the State Engineer, surface water accounted for 30.76% of all withdrawals for public water supply use and 21.43% for commercial use.[28] In New Mexico, much of this water is ultimately discharged from wastewater treatment facilities creating perennial flows in smaller stream systems. As NMED recognizes in its proposed definition of "effluent dominated" and as Secretary Kenney put it in NMED's comments to the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers in their proposed rulemaking defining "waters of the U.S.": ". . . in the arid West, effluent-dominated and effluent-dependent waters provide critical wildlife and aquatic habitat,

[28] New Mexico Office of the State Engineer. 2015. *Technical Report 55. New Mexico Water Use by Categories*. Available at https://www.ose.state.nm.us/WUC/wucTechReports/2015/pdf/2015%20WUR%20final_05142019.pdf.

and in some cases create wetlands, and help recharge aquifers for future use."[29] Effluent dominated waters should not be to be singled out for potential treatment as less deserving of protection than the same water that was originally diverted for public and commercial use.

My concern with singling out effluent dominated/dependent waters stems from my involvement in a 2006 West-wide stakeholder process sponsored by the U.S. Environmental Protection Agency ("EPA") where stakeholders met on multiple occasions and reviewed and discussed EPA "strawman" documents on effluent dependent waters. At the time EPA was considering allowing lower standards for these waters due to pressure from industrial stakeholders. Pushing for less protective standards, these stakeholders were effectively threatening to stop discharging if standards weren't lowered. They argued that any water is a benefit in the arid West even it if is dirty water and these stakeholders were, in my opinion, using the need for water supply as leverage to obtain less protective requirements for their discharges. I prepared comments on behalf of Amigos Bravos, attached as Amigos Bravos' Exhibit 7, on this strawman document outlining concerns with the proposal to weaken water quality standards for effluent dependent waters. The entire effort was focused on mechanisms to weaken standards for effluent dependent waters. Ultimately, mostly due to a change in the federal administration, EPA abandoned this ill-conceived effort.

The definition of "baseflow" does not raise the same level of concern as the definition of "effluent dominated", except that the definition of "baseflow" includes the term "effluent dominated." However, because neither term is otherwise referred to in the regulations, Amigos Bravos proposes to delete both proposed definitions.

[29] https://www.env.nm.gov/wp-content/uploads/sites/25/2019/04/2019-04-15-Final-NMED-WOTUS-Comments-v2.pdf.

Alternatively, Amigos Bravos proposes to delete the NMED proposed "effluent dominated" definition and revise the "baseflow" definition to remove reference to "effluent dominated":

> **B. Terms beginning with the letter "B".**
> **(1) "Baseflow"** refers to the sustained flow volume of a stream or river. In natural systems, baseflow is comprised from regional groundwater inflow and local shallow subsurface inflow that is temporarily stored in the watershed during snowmelt and rain events and slowly released to the stream or river over time. ~~In effluent-dominated systems, baseflow is comprised predominantly from effluent with limited subsurface contributions. Baseflow in both scenarios is critical for sustaining flow in streams and rivers over seasonal and longer timeframes.~~

V. DEFINTION OF EXISTING USE (20.6.4.7.E(3) NMAC)

"Existing use" is currently defined in the standards as "a use actually attained in a surface water of the state on or after November 28, 1975, whether or not it is a designated use." 20.6.4.7.E(3) NMAC. This definition is vague and difficult to implement because it relies on the word "attained," a term used throughout 20.6.4 NMAC that has different meanings in different contexts in the regulations.[30] The definition of "existing use" needs clarification.

In its Water Quality Standards Handbook, EPA more clearly explains "existing use." According to EPA:

> An "existing use" can be established by demonstrating that:
>
> - fishing, swimming, or other uses have actually occurred since November 28, 1975; or
> - that the water quality is suitable to allow the use to be attained—unless there are physical problems, such as substrate or flow, that prevent the use from being attained.[31]

[30] For example, "attainable" has its own definition that has a different meaning than how "attained" is used in the definition of "existing use." *See* 20.6.4.7.A(7) NMAC.

[31] US EPA, Water Quality Standards Handbook, Ch. 4 – Antidegradation, at 4. Available at https://www.epa.gov/sites/production/files/2014-10/documents/handbook-chapter4.pdf.

EPA underlined the "or" in its Handbook, stressing that an existing use can be determined either by showing that fishing or swimming has occurred in the water body or that the water quality is suitable for the use.

EPA's formulation actually describes past practice of the Commission and NMED in determining "existing use." During the 2005 Triennial Review, Amigos Bravos provided evidence to the Commission and NMED of current and historic swimming in the Gallinas River near the Montezuma Hot Springs outside Las Vegas through photographs. Based on this evidence, NMED proposed to upgrade the recreational use in this segment of the river from secondary to primary contact in its proposed amendments. The Commission adopted NMED's proposal, referencing Amigos Bravos' evidence as a reason for upgrading the designated use in its final Statement of Reasons for the 2005 Triennial Review.[32]

Amigos Bravos proposes to rely on EPA's more precise language to clarify the definition of "existing use." Amigos Bravos proposes the following language at 20.6.4.7.E(3) NMAC, which mirrors EPA's language:

> **(3) "Existing use"** means a use actually attained in a surface water of the state on or after November 28, 1975, whether or not it is a designated use. An existing use can be established by demonstrating that fishing, swimming, or other uses have actually occurred since November 28, 1975; or that the water quality is suitable to allow the use to be attained.

VI. LANL WATERS (20.6.4.140 NMAC)

During the 2015 Triennial Review, Amigos Bravos asserted that LANL's intermittent waters were not protected under 20.6.4.128 NMAC consistent with the requirements of the

[32] The Commission stated, "The Commission adopts NMED's proposal to designate the primary contact use because the evidence indicates that swimming near the hot springs is an existing use." Commission Triennial Review Statement of Reasons, p. 69, ¶ 272 (April 12, 2005).

federal Clean Water Act and proposed amendments to the segment to address this issue. As a result of Amigos Bravos' advocacy, Amigos Bravos, NMED, and Los Alamos National Laboratory ("LANL") entered into a Joint Stipulation Regarding Proposed Changes to 20.6.4.128 NMAC on October 9, 2015. In that stipulation, Amigos Bravos agreed to withdraw its proposed amendments in exchange for an agreement from NMED and LANL to engage in a process to review the protections set forth in 20.6.4.128 NMAC and assess which waters should be included in that segment with the goal of reaching agreement on protections for LANL waters consistent with the Clean Water Act. The stipulation did not waive the parties' right to propose changes to 20.6.4.128 NMAC at any time in the future.

Over the past five years, the parties have met and conducted field studies to determine the appropriate level of protections for LANL waters. While there is still disagreement among the parties, there is consensus on the propriety of protecting three intermittent waters -- Effluent Canyon from Mortandad Canyon to its headwaters, S-Site Canyon from MSC 16-06293 to Martin Spring, and Two Mile Canyon from its confluence with Pajarito Canyon to upper Two Mile Canyon -- in NMED's new proposed segment at 20.6.4.140 NMAC. Based on the scientific analyses conducted, Amigos Bravos supports NMED's proposed designated uses of livestock watering, wild life, marginal warmwater aquatic life, and secondary contact for these intermittent segments.

This ends my testimony, which is accurate to the best of my knowledge.

April 30, 2021

Rachel Conn — Date

AMIGOS BRAVOS' EXHIBIT 4

USGS PFAS Sampling Results – Surface Water
August-September 2020

USGS Stream Gage Name and Location	USGS Site ID	County	Date	PFSA (ng/L)							PFCA (ng/L)											FOSA (ng/L)	FOSAA (ng/L)		FTSA (ng/L)			Replacement/Other (ng/L)				PFOA+ PFOS (ng/L)	ΣPFAS (ng/L)
				PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFNS	PFDS	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFTeDA	PFOSA	N-MeFOSAA	N-EtFOSAA	4:2 FTS	6:2 FTS	8:2 FTS	9Cl-PF3ONS	11Cl-PF3OUdS	ADONA	HFPO-DA		
Canadian River near Sanchez, NM	07221500	San Miguel	2020-09-02	2.6				0.9 E			11.4	1.9																			--	15.9
Canadian River below Conchas Dam, NM	07224500	San Miguel	2020-09-29	1.4 E				1.2 E			6.9			1.0 E																	--	6.9
Rio Grande below Taos Junction Bridge, NM	08276500	Taos	2020-08-26																												--	--
Rio Chama below Abiquiu Reservoir	08287000	Rio Arriba	2020-08-20	1.7 E																											--	--
Rio Grande above Buckman Diversion, NM	08313150	Santa Fe	2020-08-28	1.0 E																											--	--
Rio Grande above Buckman Diversion, NM	08313150	Santa Fe	2020-09-17	2.3																											--	2.3
Rio Grande above Buckman Diversion, NM	08313150	Santa Fe	2020-09-28	1.8 E								1.0 E																			--	--
Rio Grande at Alameda Bridge, NM	08329918	Bernalillo	2020-08-19								2.0 E	2.2																			--	2.2
Rio Grande at Alameda Bridge, NM	08329918	Bernalillo	2020-09-16	2.8								0.9 E																			--	2.8
Rio Grande at Valle de Oro, NM	08330830	Bernalillo	2020-08-31									5.8	2.9																		--	8.7
Rio Grande at Valle de Oro, NM	08330830	Bernalillo	2020-09-16	93.0		1.2 E		2.6			12.3	27.9	12.5	1.7 E	4.9																7.5	153.2
Rio Puerco near Bernardo, NM	08353000	Socorro	2020-09-13	2.3 E				3.1			23.9	3.2	1.4 E	1.8 E																	3.1	30.2
Rio Grande Floodway at San Marcial, NM	08358400	Socorro	2020-08-24	4.9		1.5 E		2.9			4.1 E	2.4																			2.9	10.2
Rio Grande at El Paso, TX	08364000	Doña Ana/El Paso Cty, TX	2020-08-25	4.3		1.7 E		3.7			3.1 E	2.4	1.4 E		1.2 E																3.7	10.4
Rio Grande at El Paso, TX	08364000	Doña Ana/El Paso Cty, TX	2020-09-15	10.1		1.7		2.0			4.7	3.5	1.8 E		1.4 E																2.0	22.0
Pecos River near Puerto de Luna, NM	08383500	Guadalupe	2020-08-27																												--	--
Pecos River near Puerto de Luna, NM	08383500	Guadalupe	2020-09-24																												--	--
Pecos River near Artesia, NM	08396500	Eddy	2020-08-26	2.6		1.5 E		2.1 E			4.0 E	2.3	1.5 E		1.5 E																--	4.9
Pecos River near Artesia, NM	08396500	Eddy	2020-09-16	1.3 E							3.5 E	1.0 E																			--	--
Pecos River near Red Bluff, NM	08407500	Eddy	2020-08-26			1.1 E		1.5 E			1.9 E	2.0	1.0 E																		--	2.0
San Juan River near Archuleta, NM	09355500	San Juan	2020-08-12																												--	--
San Juan River near Archuleta, NM	09355500	San Juan	2020-09-22	2.7																											--	2.7
Animas River at Farmington, NM	09364500	San Juan	2020-08-13	2.1 E																											--	--
Animas River at Farmington, NM	09364500	San Juan	2020-09-23	3.1		1.0 E		1.5 E				1.7 E																			--	3.1
San Juan River near Fruitland, NM	09367540	San Juan	2020-08-12	2.0 E																											--	--
San Juan River near Fruitland, NM	09367540	San Juan	2020-09-23	2.0								1.4 E																			--	2.0
Gila River near Gila, NM	09430500	Grant	2020-09-10	18.5							30.0	2.1	0.9 E	2.0																	--	52.6

E: estimated concentration falling between the laboratory reporting limit and method detection limit. These values are not included in summed concentrations (last two columns).

NOTE: ng/L (nanograms per liter) is equivalent to parts per trillion.

AMIGOS BRAVOS' EXHIBIT 5

Amigos Bravos Valle de Oro Community Water Quality Sampling Results

Rio Grande

- Phosphorus: 10/11 events had results that exceeded standards
  - Value Range: 0.034 – 1.00 mg/l (Standard: 0.10 mg/l)

- Aluminum, Total: 6/8 events had results that exceeded standards
  - Value Range: 1,800 – 8,500 ug/l (Standards based on hardness calculation)

- *E. coli:* Always present, 2/11 events had results that exceeded standards
  - Value Range: 46 – 7,270 MPN/100 ml (Standard: PC: 410 MPN/100 ml for single sample; SC: 2,507 MPN/100 ml, both with pH range of 6.6 - 9.0)

East Riverside Drain

- Phosphorus: 10/10 events had results that exceeded standards
  - Value Range: 0.10 – 0.32 mg/l (Standard: 0.10 mg/l)

- Aluminum, Total: 1/7 events had results that exceeded standards
  - Value Range: 220 – 4,000 ug/l (Standards based on hardness calculation)

- *E. coli:* Always present, 2/10 events had results that exceeded standards
  - Value Range: 56 – 4,884 MPN/100 ml single sample (Standard: PC: 410 MPN/100 ml for single sample; SC: 2,507 MPN/100 ml, both with pH range of 6.6 - 9.0)

Williams Lateral

- Phosphorus: 4/7 events had results that exceeded standards
  - Value Range: 0.10 – 0.18 mg/l (Standard: 0.10 mg/l)

- Aluminum, Total: 2/6 events had results that exceeded standards
  - Value Range: 1,100 – 6,300 ug/l (Standards based on hardness calculation)

- *E. coli:* Always present, 2/7 events had results that exceeded standards)
  - Value Range: 132 – 7,270 MPN/100 ml single sample (Standard: PC: 410 MPN/100 ml for single sample; SC: 2,507 MPN/100 ml, both with pH range of 6.6 - 9.0)

Stormwater – No PCBs detected (used both Congener and Aroclor methods)

- EPA 8270C SIM: PCB Congeners (209 total different congeners = chemical compound found in PCBs) $375/sample

- EPA 8082: PCB Aroclor (9 total different aroclors = Monsanto's trade name for PCBs) $70/sample
  - EPA 1668A: PCB Congeners ~$750/sample

Radionuclides – Gross Alpha and Beta

- Gross Alpha detected in Rio Grande and East Riverside Drain
  - Value range of: 3.4 – 11 pCi/L (Standard: 15 pCi/L)

- Gross Beta
  - Value range of: 3.2 – 15 (No standard listed)

Pharmaceuticals and Personal Care Products: 3/26/2015 Event (96 Constituents tested, Results in Detected/Non Detected; if detected, units = ng/l = 1 ppt)

- **Rio Grande**
  - 17 detected: Sugar Subs, Antibiotics, Surfactants, X-ray Contrast Agents, Flame Retardant, Herbicides, Beta-Blockers, Analgesics, Anti-Seizure Meds, Anti-Inflammatory Meds

- **Bosque Stormwater Detention Pond**
  - 10 detected: Sugar Subs, Surfactants, Flame Retardant, Anti-Seizure Meds, X-ray Contrast Agents, Analgesics, Anti-Inflammatory Meds

- **East Riverside Drain**
  - 7 detected: Sugar Subs, Surfactants, X-ray Contrast Agents, Anti-Seizure Meds, Analgesics

EPA Grant/Talking Talons WQ Event #1
3/26/15

ΦField Parameters	East Riverside Drain Time: 1012	Bosque Outfall Pond Time: 1130	Rio Grande Time: 1335	Unit
River Flow (USGS# 08330000)	1660	1680	1680	cfs
Weather Conditions	clear, cool, calm	clear, cool, calm	clear, cool, calm	observation
Air Temperature	9.4	11.7	17.9	°C
Barometric Pressure	25.35	25.35	25.31	inHg
Water Appearance	turbid brown	clear	very turbid brown	observation
Water Temperature	10.7	11.3	12.3	°C
pH	8.48	8.31	8.52	SU
Specific Conductivity	417.3 µS/cm	878 µS/cm	343.1 µS/cm	µS/cm
Total Dissolved Solids (TDS)	271.1	572	222.9	mg/L
Salinity	0.2	0.43	0.17	ppt
Dissolved Oxygen	8.3	5.83	9.57	mg/L
Dissolved Oxygen Saturation	88.2	63	105.6	%
Turbidity	40.6	3	271	NTU

ΦField Parameter Results from YSI Professional Plus Multi-Parameter Water Quality Meter, HACH 2100Q Turbidimeter , and Kestrel Weather Meter

Lab Results (Eurofins Eaton Analytical Labs)

Analyte Test	East Riverside Drain	Bosque Outfall Pond	Rio Grande	Unit
Alpha, Gross	ND	-	11	pCi/L
Alpha, Min Detectable Activity	3	1.3	3	pCi/L
Alpha, Two Sigma Error	3	0.22	3.8	pCi/L
Beta, Gross	4.6	11	10	pCi/L
Beta, Min Detectable Activity	1.3	1.5	1	pCi/L
Beta, Two Sigma Error	1.6	1.9	1.7	pCi/L
Gross Alpha + adjusted error	ND	3.7	14	pCi/L
Gross Alpha by Coprecipitation	-	3.5	-	pCi/L
Nitrate as Nitrogen by IC	0.18	ND	0.67	mg/L
Nitrite Nitrogen by IC	ND	ND	ND	mg/L
Aluminum dissolved ICAP/MS	ND	ND	ND	ug/L

Antimony dissolved ICAP/MS	ND	ND	ND	ug/L
Arsenic dissolved ICAP/MS	4.4	ND	12	ug/L
Cadmium dissolved ICAP/MS	ND	ND	ND	ug/L
Chromium dissolved ICAP/MS	ND	1.2	ND	ug/L
Lead dissolved ICAP/MS	ND	ND	ND	ug/L
Nickel dissolved ICAP/MS	ND	ND	5	ug/L
Selenium dissolved ICAP/MS	ND	ND	ND	ug/L
Zinc dissolved ICAP/MS	ND	45	ND	ug/L
Ammonia Nitrogen	ND	ND	ND	mg/L
Mercury	ND	ND	ND	ug/L
Total Dissolved Solids (TDS)	280	580	580	mg/L
Kjeldahl Nitrogen	0.22	0.59	0.59	mg/L
Total Suspended Solids (TSS)	42	10	10	mg/L
Silver dissolved ICAP/MS	ND	ND	ND	ug/L
Aluminum Total ICAP/MS	1000	32	32	ug/L
Antimony Total ICAP/MS	ND	ND	ND	ug/L
Arsenic Total ICAP/MS	4.6	12	1.5	ug/L
Cadmium Total ICAP/MS	ND	ND	ND	ug/L
Chromium Total ICAP/MS	ND	ND	ND	ug/L
Lead Total ICAP/MS	1.1	ND	ND	ug/L
Nickel Total ICAP/MS	ND	5.1	ND	ug/L
Selenium Total ICAP/MS	ND	ND	**9.8**	ug/L
Silver Total ICAP/MS	ND	ND	ND	ug/L
Zinc Total ICAP/MS	ND	ND	ND	ug/L
Total phosphorus as P	**0.10**	0.034	0.034	mg/L
E. coli (NMSLD)	56.3	24.6	46.4	MPN/100 ml
Total Coliform (NMSLD)	1,732.9	>2419.6	>2,419.6	MPN/100 ml

Pharmaceuticals and Personal Care Products (PPCPs)

Analyte Test	East Riverside Drain	Bosque Outfall Pond	Rio Grande	Unit
2,4-D	ND	ND	**50**	ng/L
4-nonylphenol - semi quantitative	**430**	**360**	**310**	ng/L

4-tert-Octylphenol	210	230	140	ng/L
Acesulfame-K	68	280	97	ng/L
Bendroflumethiazide	ND	ND	ND	ng/L
BPA	ND	ND	ND	ng/L
Butalbital	ND	5	ND	ng/L
Butylparaben	ND	ND	ND	ng/L
Chloramphenicol	ND	ND	ND	ng/L
Clofibric Acid	ND	ND	ND	ng/L
Diclofenac	ND	7.2	6.2	ng/L
Estradiol	ND	ND	ND	ng/L
Estrone	ND	ND	ND	ng/L
Ethinyl Estradiol - 17 alpha	ND	ND	ND	ng/L
Ethylparaben	ND	ND	ND	ng/L
Gemfibrozil	ND	ND	ND	ng/L
Ibuprofen	ND	ND	ND	ng/L
Iohexal	16	17	290	ng/L
Iopromide	ND	ND	110	ng/L
Isobutylparaben	ND	ND	ND	ng/L
Methylparaben	ND	ND	ND	ng/L
Naproxen	ND	ND	ND	ng/L
Propylparaben	ND	ND	ND	ng/L
Sucralose	1100	4200	2200	ng/L
Triclocarban	ND	ND	ND	ng/L
Triclosan	ND	ND	ND	ng/L
Warfarin	ND	ND	ND	ng/L
1,7-Dimethylxanthine	ND	ND	ND	ng/L
Acetaminophen	ND	ND	ND	ng/L
Albuterol	ND	ND	ND	ng/L
Amoxicillin (semi-quantitative)	ND	ND	1200	ng/L
Andorostenedione	ND	ND	ND	ng/L
Atenolol	ND	ND	29	ng/L
Atrazine	ND	ND	30	ng/L
Bezafibrate	ND	ND	ND	ng/L
Bromacil	ND	ND	ND	ng/L
Caffeine	ND	ND	ND	ng/L

Carbadox	ND	ND	ND	ng/L
Carbamazepine	15	69	25	ng/L
Carisoprodol	ND	ND	ND	ng/L
Chloridazon	ND	ND	ND	ng/L
Chlorotoluron	ND	ND	ND	ng/L
Cimetidine	ND	ND	ND	ng/L
Cotinine	ND	ND	ND	ng/L
Cyanazine	ND	ND	ND	ng/L
DACT	ND	ND	ND	ng/L
DEA	ND	ND	ND	ng/L
DEET	ND	ND	ND	ng/L
Dehydronifedipine	ND	ND	ND	ng/L
DIA	ND	ND	ND	ng/L
Diazepam	ND	ND	ND	ng/L
Dilantin	ND	ND	ND	ng/L
Diltiazem	ND	ND	ND	ng/L
Diuron	ND	ND	ND	ng/L
Erythromycin	ND	ND	ND	ng/L
Flumeqine	ND	ND	ND	ng/L
Isoproturon	ND	ND	ND	ng/L
Ketoprofen	ND	ND	ND	ng/L
Ketorolac	ND	ND	ND	ng/L
Lidocaine	5.5	15	28	ng/L
Lincomycin	ND	ND	ND	ng/L
Linuron	ND	ND	ND	ng/L
Lopressor	ND	ND	61	ng/L
Meclofenamic Acid	ND	ND	ND	ng/L
Meprobamate	ND	ND	ND	ng/L
Metazachlor	ND	ND	ND	ng/L
Metolachlor	ND	ND	6.4	ng/L
Nifedipine	ND	ND	ND	ng/L
Norethisterone	ND	ND	ND	ng/L
OUST (Sulfameturon,methyl)	ND	ND	ND	ng/L
Oxolinic acid	ND	ND	ND	ng/L
Pentoxifylline	ND	ND	ND	ng/L

Phenazone	ND	ND	ND	ng/L
Primidone	ND	ND	ND	ng/L
Progesterone	ND	ND	ND	ng/L
Propazine	ND	ND	ND	ng/L
Quinoline	ND	ND	ND	ng/L
Simazine	ND	ND	ND	ng/L
Sulfachloropyridazine	ND	ND	ND	ng/L
Sulfadiazine	ND	ND	ND	ng/L
Sulfadimethoxine	ND	ND	ND	ng/L
Sulfamerazine	ND	ND	ND	ng/L
Sulfamethazine	ND	ND	ND	ng/L
Sulfamethizole	ND	ND	ND	ng/L
Sulfamethoxazole	ND	ND	**60**	ng/L
Sulfathiazole	ND	ND	ND	ng/L
TCEP	ND	ND	ND	ng/L
TCPP	ND	**180**	**140**	ng/L
TDCPP	ND	ND	ND	ng/L
Testosterone	ND	ND	ND	ng/L
Theobromine	ND	ND	ND	ng/L
Theophylline	ND	ND	ND	ng/L
Thiabendazole	ND	ND	ND	ng/L
Trimethoprim	ND	ND	ND	ng/L
Fluoxetine	ND	ND	ND	ng/L
Azithromycin	ND	ND	ND	ng/L

ND = not detected
NMSLD = New Mexico Scientific Laboratory Division
†PC = primary contact
‡SC = secondary contact

¥Standards
-
n/a
n/a
n/a
n/a
≤ 32.2° C (~ 90° F)
6.6 - 9.0
not listed
≤ 1,500 mg/L
not listed
≥ 5.0 mg/L
not listed
variable

¥Standards from: NMED, Title 20, Chapter 6, Part 4: 20.6.4.105: Rio Grande Basin - The main stem of Rio Grande from the headwaters of Elephant Butte resevoir to Alameda Bridge (Corrales bridge), excluding waters on Isleta Pueblo

*Standards	Testing Method
15	EPA 900.0
not listed	EPA 900.0
not listed	EPA 900.0
not listed	EPA 900.0
not listed	EPA 900.0
not listed	EPA 900.0
15 (very close to standard)	EPA 900.0
15	
10	EPA 300.0
not listed	EPA 300.0
N/A for Dissolved	EPA 200.8

not listed	EPA 200.8
not listed	EPA 200.8
hardness-based; did not test for hardness	EPA 200.8
only Chromium III is listed in NMED standards	EPA 200.8
hardness-based; did not test for hardness	EPA 200.8
hardness-based; did not test for hardness	EPA 200.8
not listed	EPA 200.8
hardness-based; did not test for hardness	EPA 200.8
pH and temperature-based	EPA 350.1
0.77	EPA 245.1
≤ 1,500 mg/L	E160.1/SM2540C
not listed	EPA 351.2
not listed	SM 2540D
hardness-based; did not test for hardness	EPA 200.8
hardness-based; did not test for hardness	EPA 200.8
not listed	EPA 200.8
not listed	EPA 200.8
N/A for Total	EPA 200.8
N/A for Total	EPA 200.8
N/A for Total	EPA 200.8
N/A for Total	EPA 200.8
5	EPA 200.8
N/A for Total	EPA 200.8
N/A for Total	EPA 200.8
0.10	SM4500-PE/EPA 365.1
†PC = 126 (monthly mean); 410 (single sample) ‡SC = 548 (monthly mean); 2,507 (single sample)	QuantiTray
-	QuantiTray

***Standards from: NMED, Title 20, Chapter 6, Part 4: 20.6.4.900: Criteria applicable to existing, designated or attainable uses unless otherwise specified in 20.6.4.97 through 20.6.4.899 NMAC**

Standards	**Testing Method**
none	LC-MS-MS
none	LC-MS-MS

none	LC-MS-MS
none	LC-MS-MS
none	LC-MS-MS
none	LC-MS-MS
none	LC-MS-MS
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none	LC-MS-MS
none	LC-MS-MS
none	LC-MS-MS
none	LC-MS-MS
none	LC-MS-MS

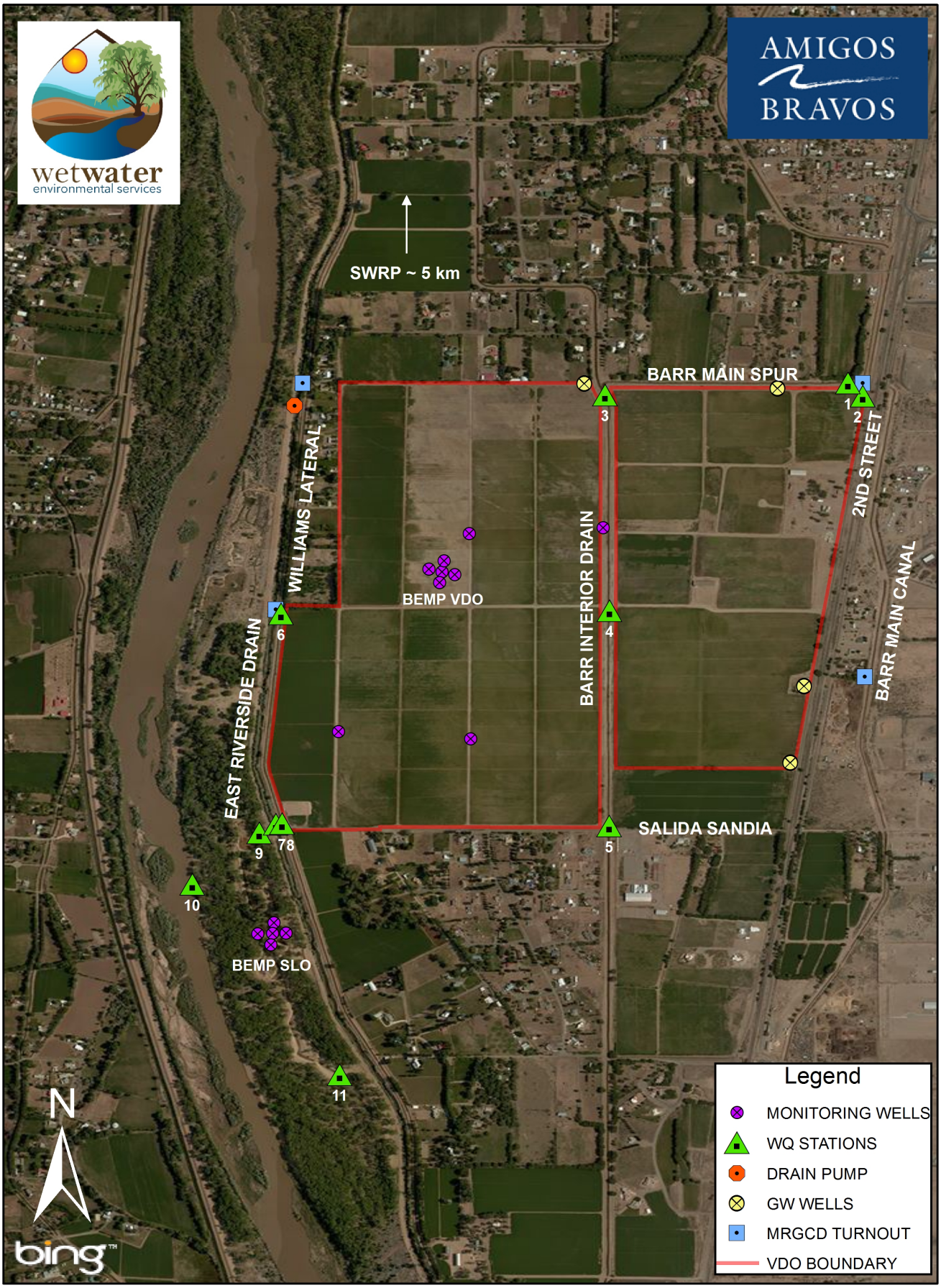
Outstanding Waters and Water Policy in New Mexico

12/5/20-12/31/21

Amigos Bravos - 2021

		Water Foundation Support 2021
INCOME		
Hearing Costs		20,000
Tribal Outreach		30,000
Water Policy and ONRW Organiziing		50,000
TOTAL INCOME		100,000
EXPENSES		
Salaries		
Salaries and related (Project Manager, Project Staff, Support Staff)	$	38,000
Subotal Salaries & Related	**$**	**38,000**
Professional Fees		
Tribal Outreach	$	27,000
Media Consultants (Storymap, factsheet, photos)	$	2,000
Technical Consultant Triennial Review	$	5,000
Expert Witnesses - Pecos and Recreational ONRW petitions	$	3,000
Subtotal Total Professional Fees	**$**	**37,000**
Non-Personnel Expenses		
Hearing Costs - Court Reporter/transciipts	$	14,000
Hearing Costs - Hearing Officer	$	5,000
Public Notice	$	1,000
Subtotal Non-Personnel Expenses	**$**	**20,000**
Travel		
Ground		
Meals		
Subtotal Total Travel	**$**	**-**
Overhead	**$**	**5,000**
TOTAL EXPENSES	**$**	**100,000**

VALLE DE ORO NATIONAL WILDLIFE REFUGE VICINITY MAP



0 250 500 1,000 Meters

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

AB EX. 5

Rev: 032315

AMIGOS BRAVOS' EXHIBIT 6

NMED
New Mexico Environment Department

PHARMACEUTICALS IN WATER

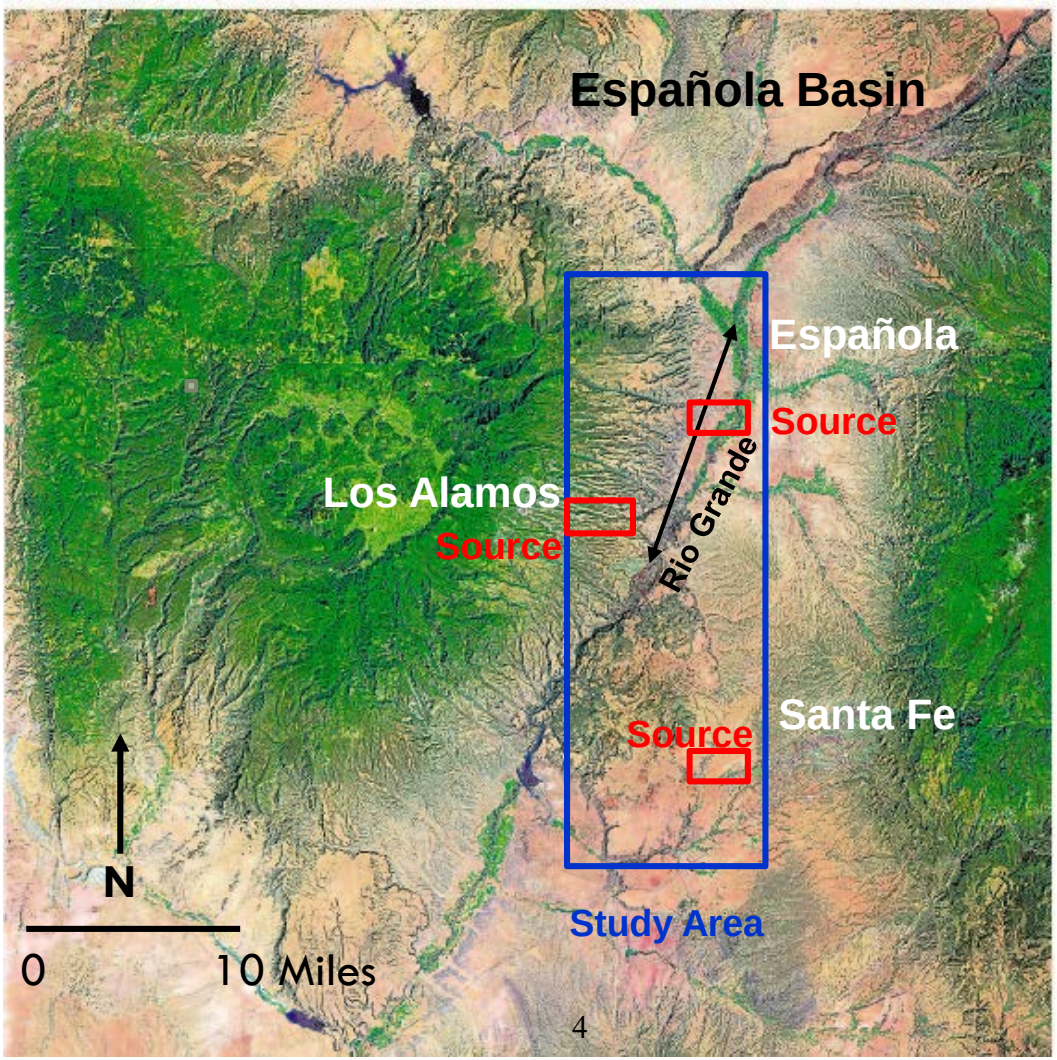
July 28, 2017

Patrick Longmire, Ph.D. and David Fellenz

AB EX. 6

PHARMACEUTICALS IN WATER

PHARMACEUTICALS IN WATER

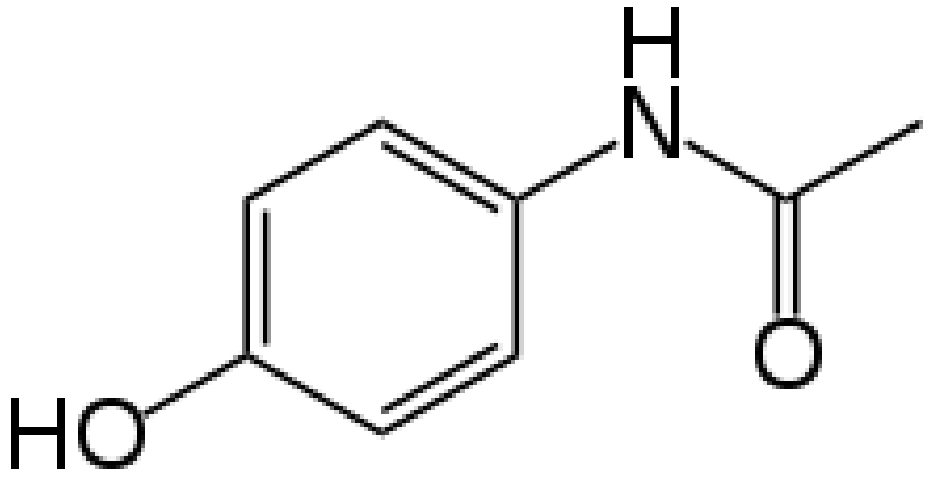

Española Basin
Española
Source
Rio Grande
Los Alamos
Source
Santa Fe
Source
N
0
10 Miles
Study Area

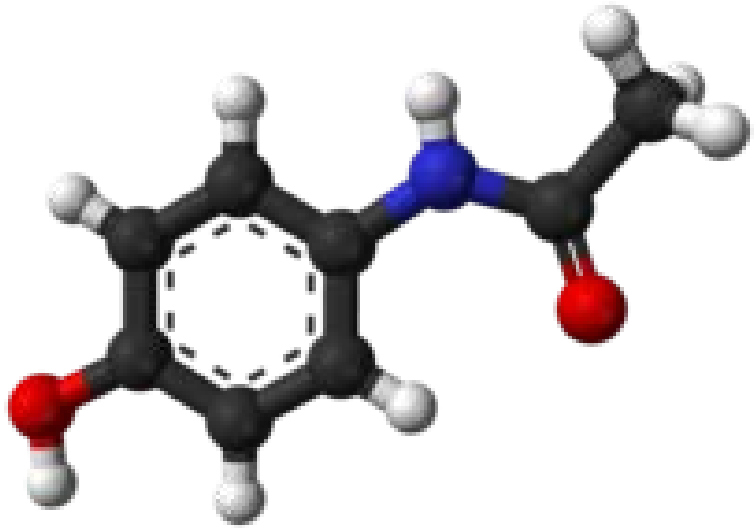
AB EX. 6

Analytical Method

Compound	Common Name(s)	Use	Date first available
Acetaminophen	Tylenol	Pain reliever/fever reducer	1950; 1959 (OTC)
Bisphenol-A	Bisphenol A	BPA is employed to make certain plastics and epoxy resins	1957
Caffeine	NA	Stimulant	NA
DEET	NA	Insect repellent	1957 commercial use
Diazepam	Valium	Anxiety, alcohol withdrawal syndrome, and trouble sleeping	1963
Fluoxetine	Prozac	Antidepressant	1986
Ibuprofen	Advil/ Motrin	Pain reliever/fever reducer, nonsteroidal anti-inflammatory drug (NSAID)	1974; 1984(OTC)
Salicylic Acid	Aspirin	Pain reliever/fever reducer; skin care products	1915 (asprin);
Sulfamethoxazole	Bactrim, Septrin	Antibiotic	1961

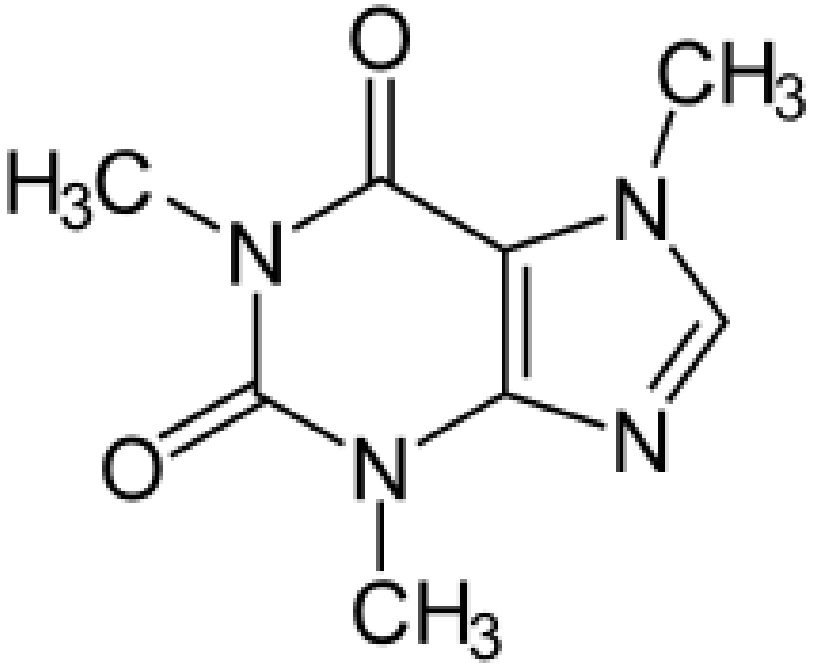
ACETAMINOPHEN

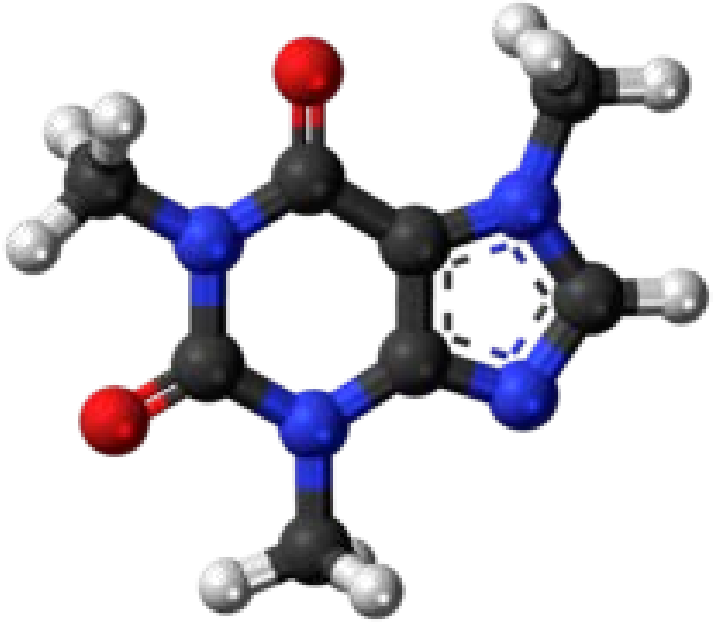




Use: Pain reliever/fever reducer

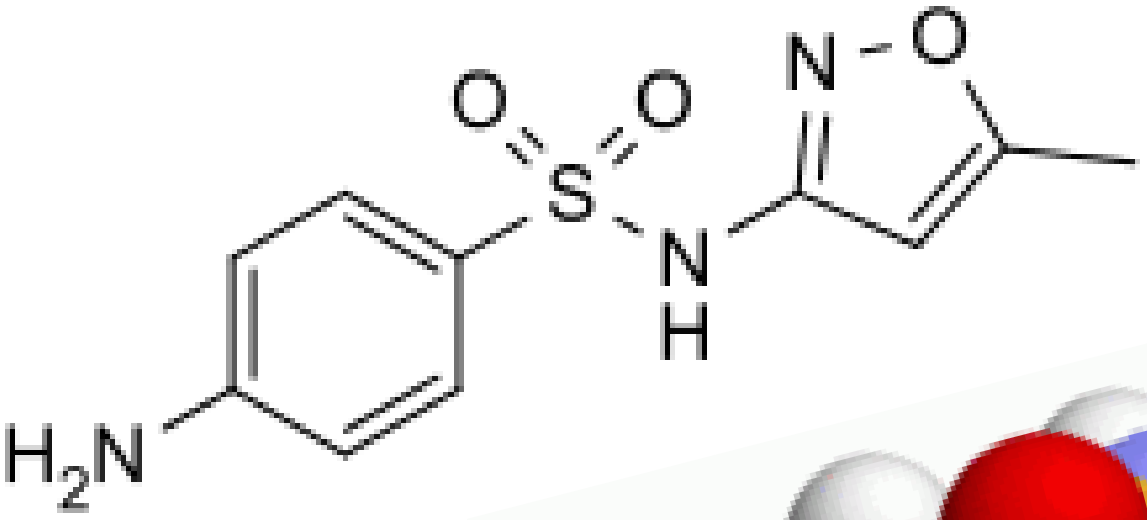
CAFFEINE

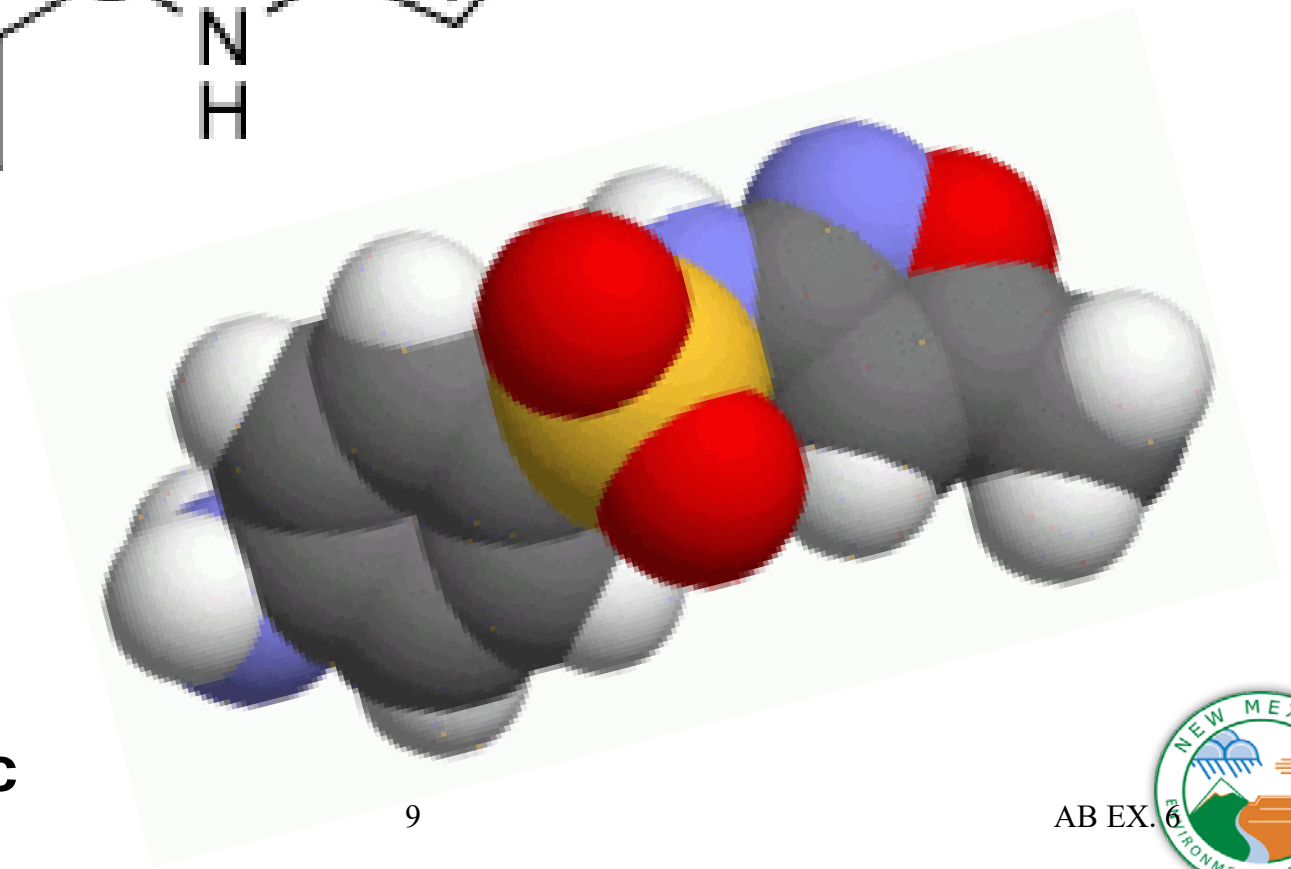




Use: Stimulant

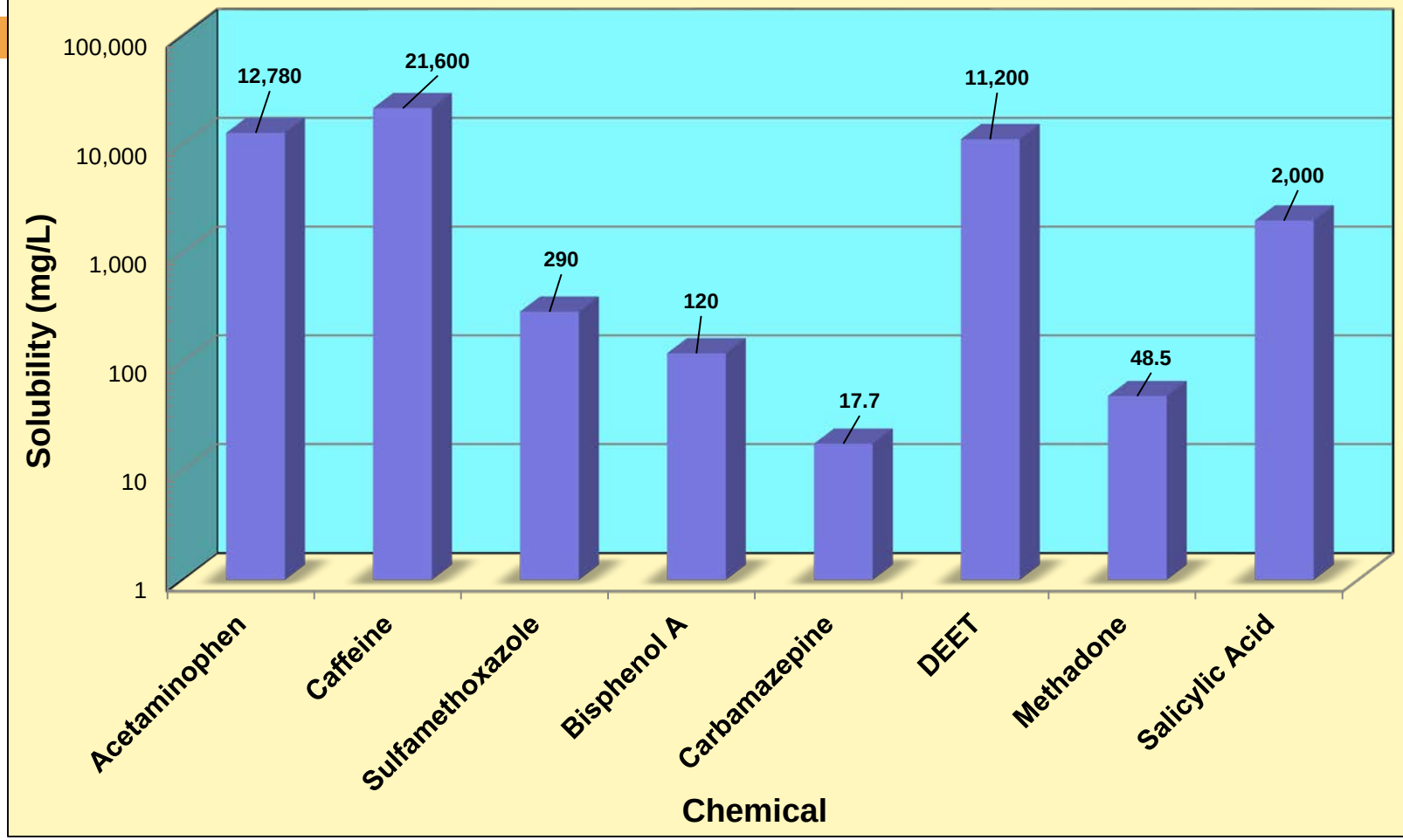
SULFAMETHOXAZOLE



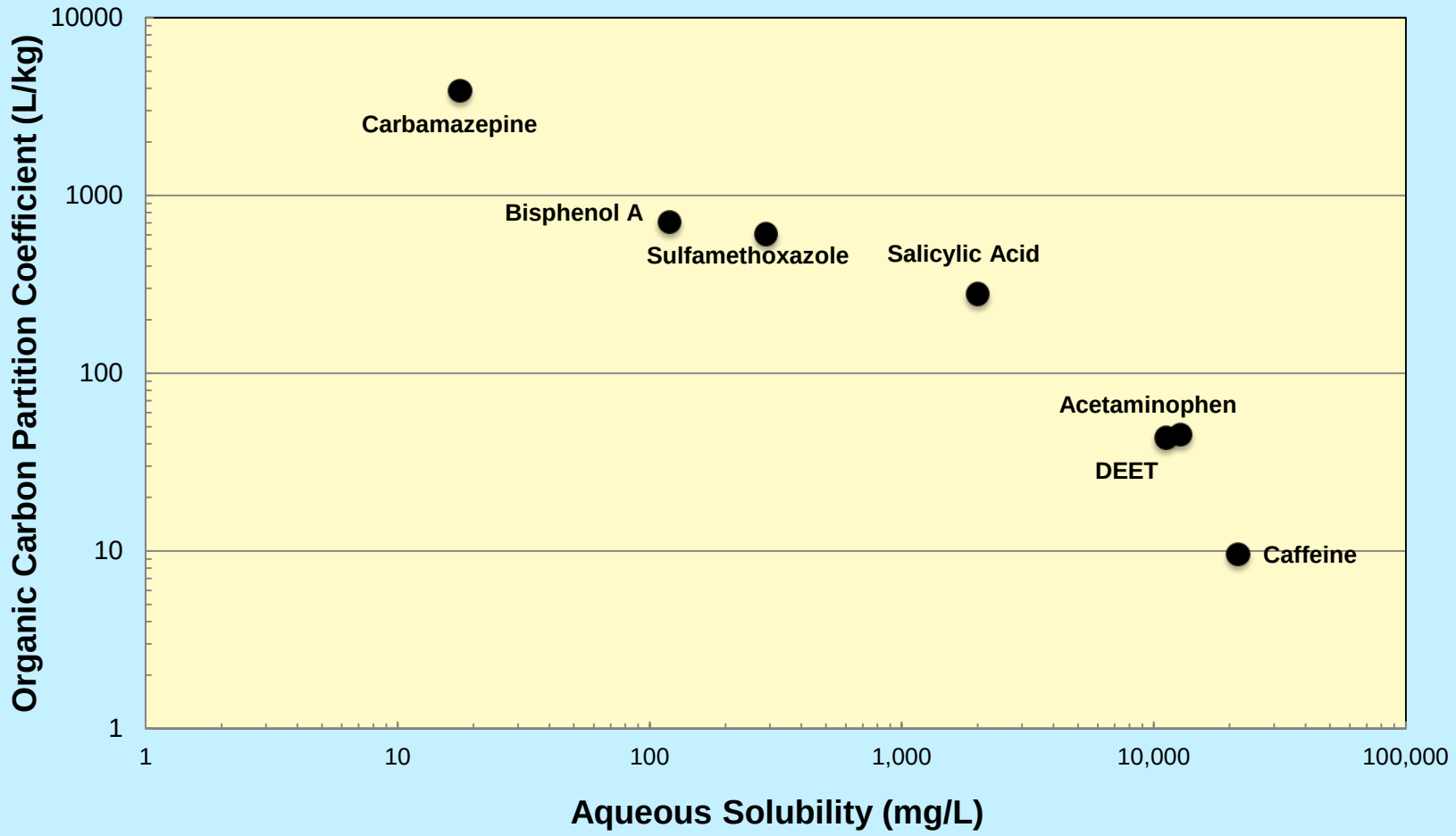


Use: Antibiotic

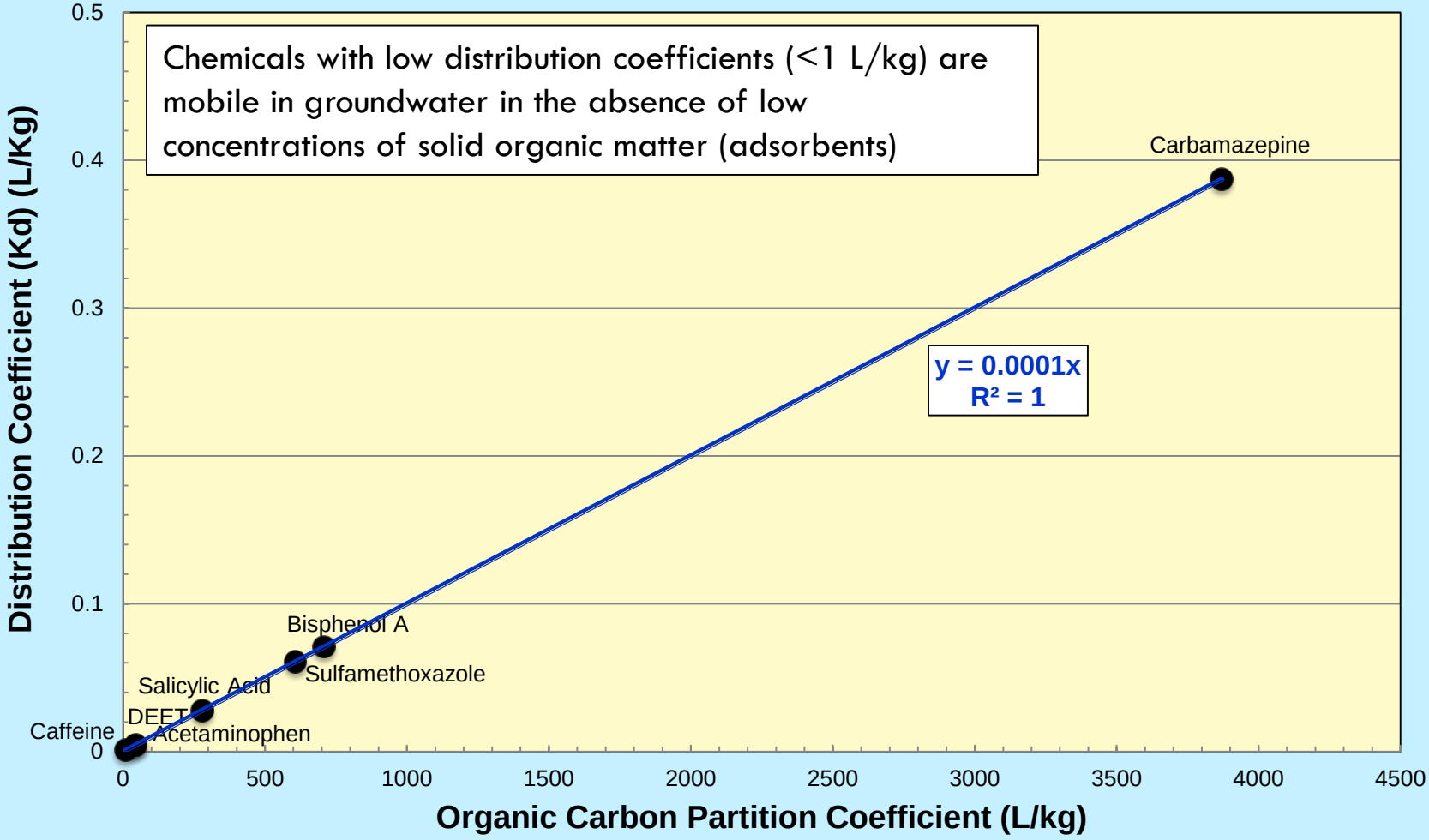
Aqueous Solubilities of Selected Pharmaceutical and Personal Care Products at 20-25°C

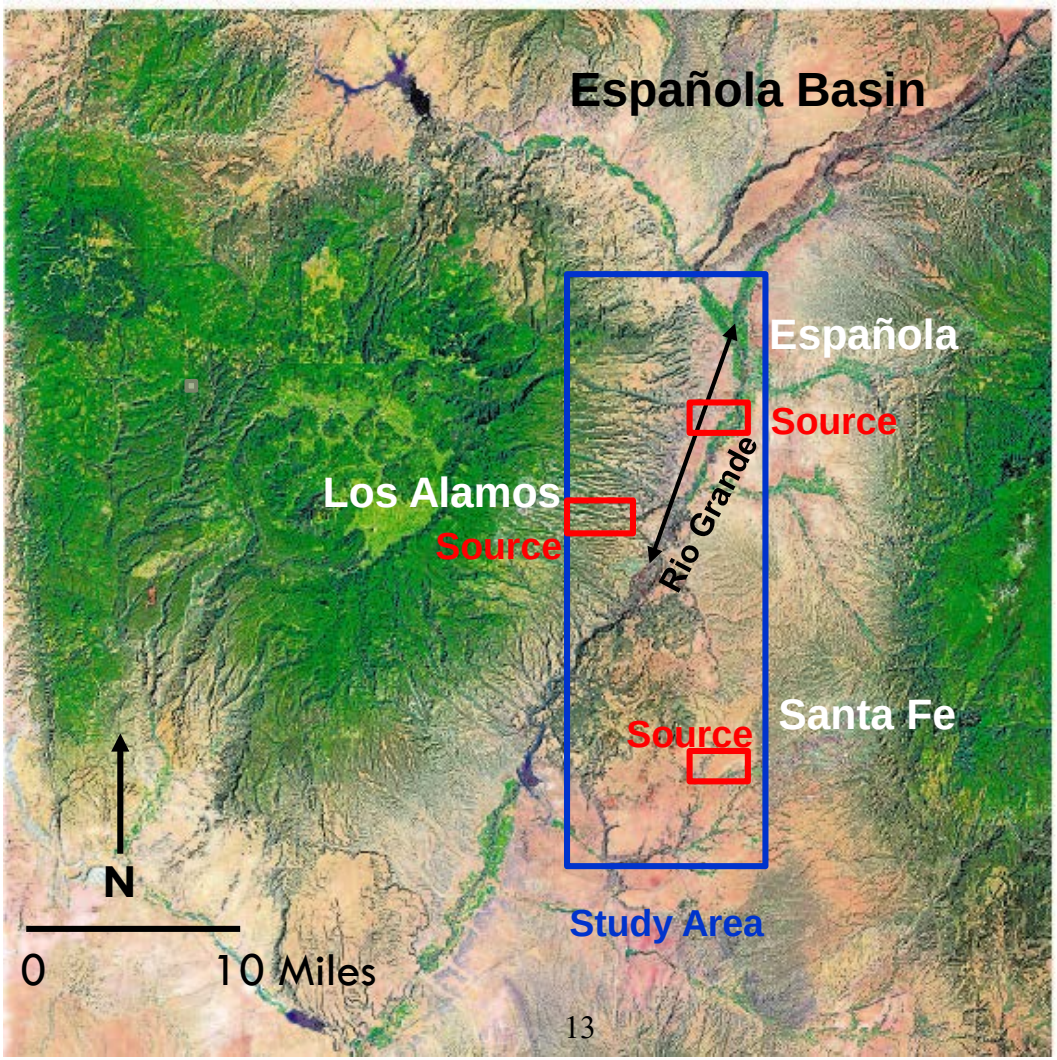


Aqueous Solubility Versus Organic Carbon Partition Coefficient for Selected Pharmaceuticals and Personal Care Products

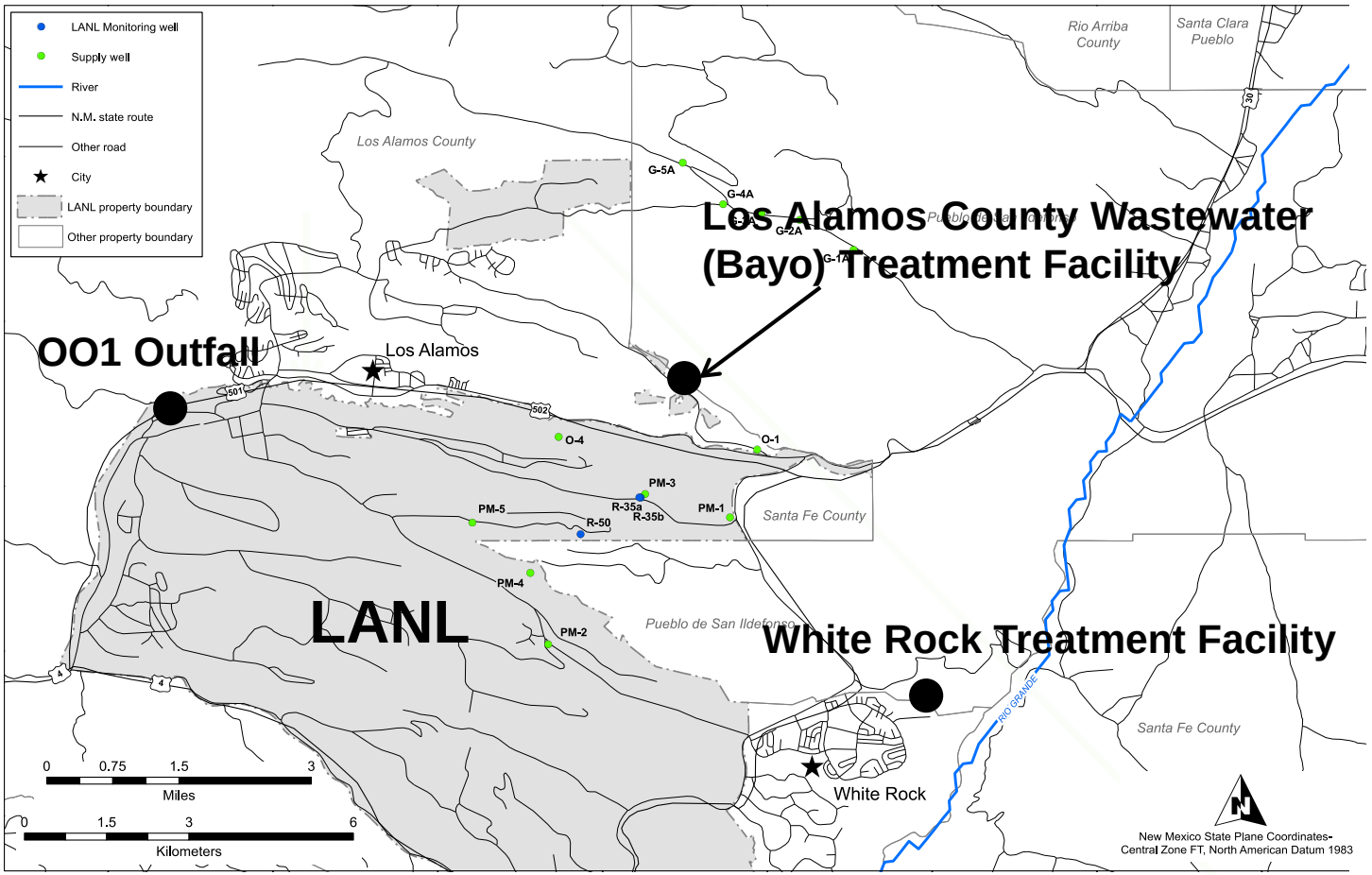


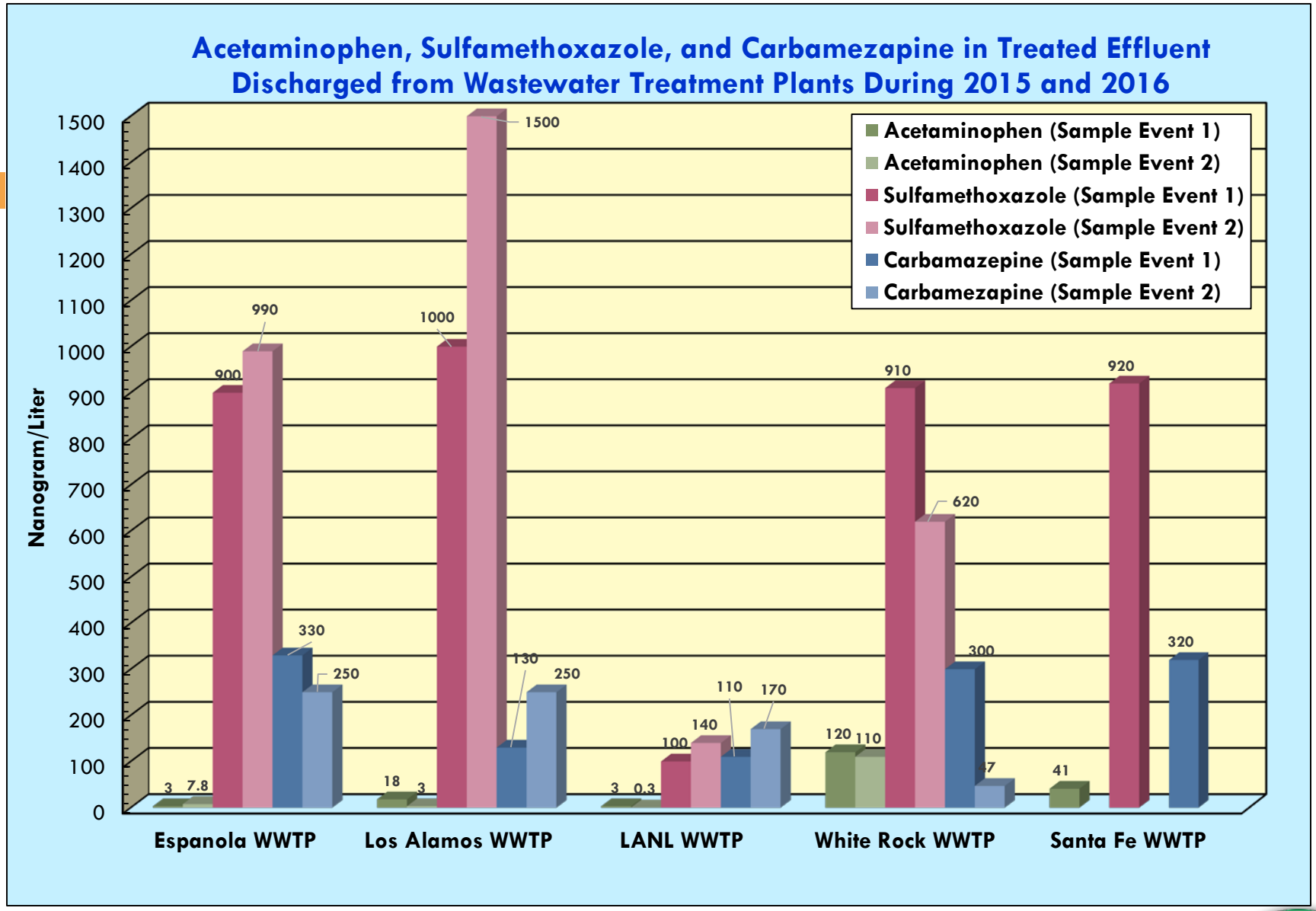
Organic Partition Coefficient (KOC) Versus Calculated Distribution Coefficient (L/kg) for Selected Pharmaceutical Compounds and Personal Care Products (Fraction of Organic Carbon = 0.0001)

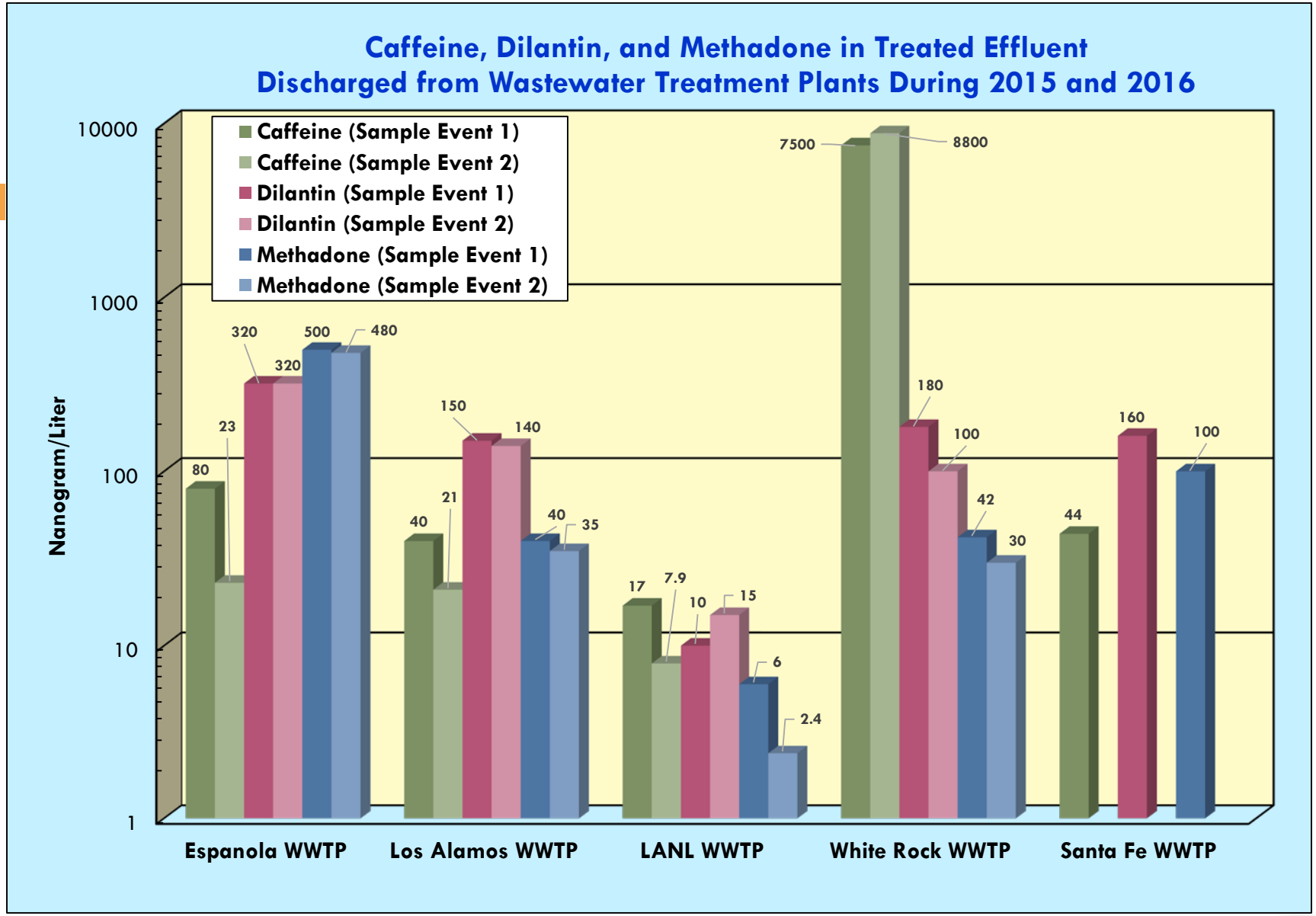


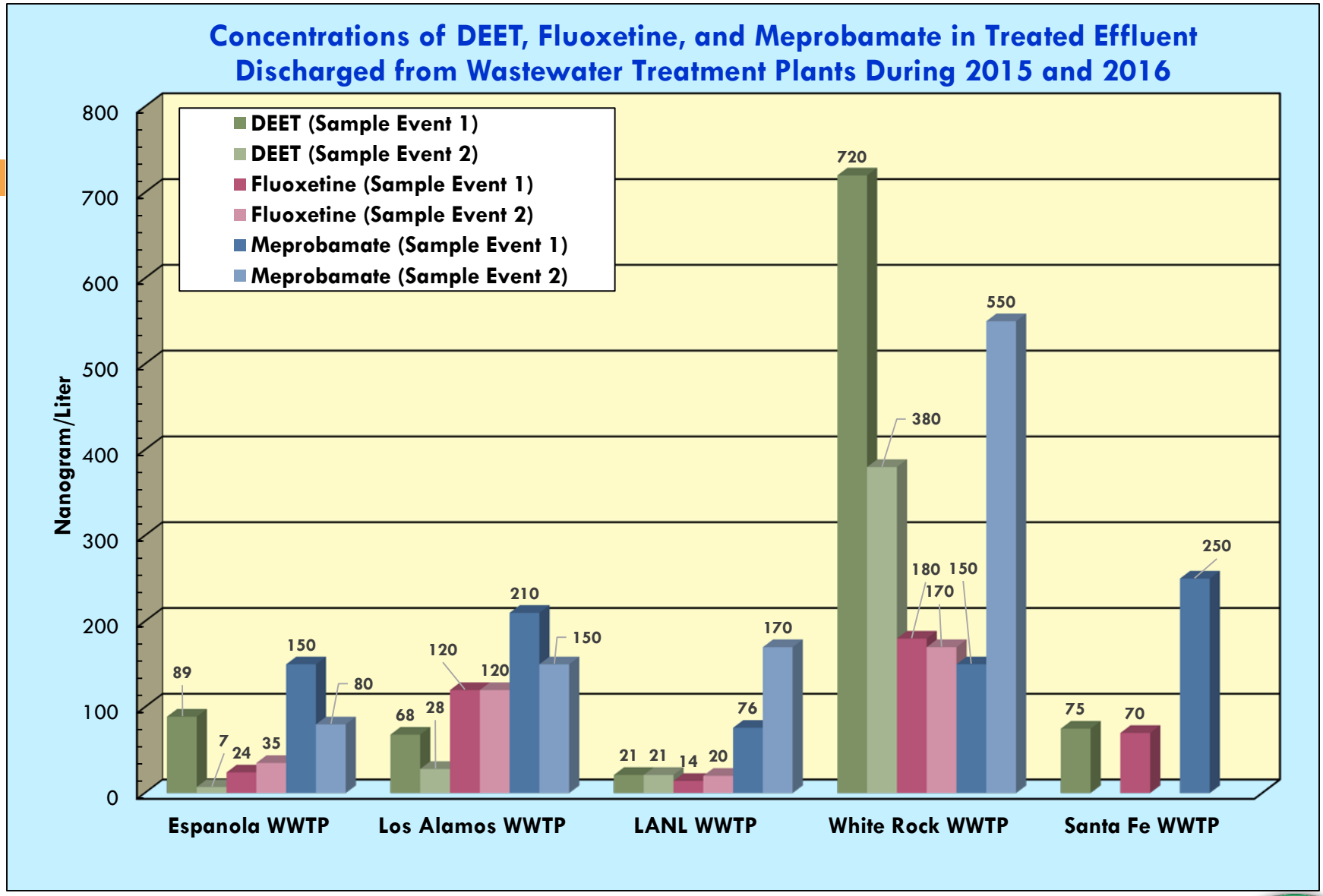

Española Basin
Española
Source
Los Alamos
Source
Rio Grande
Santa Fe
Source
N
0
10 Miles
Study Area

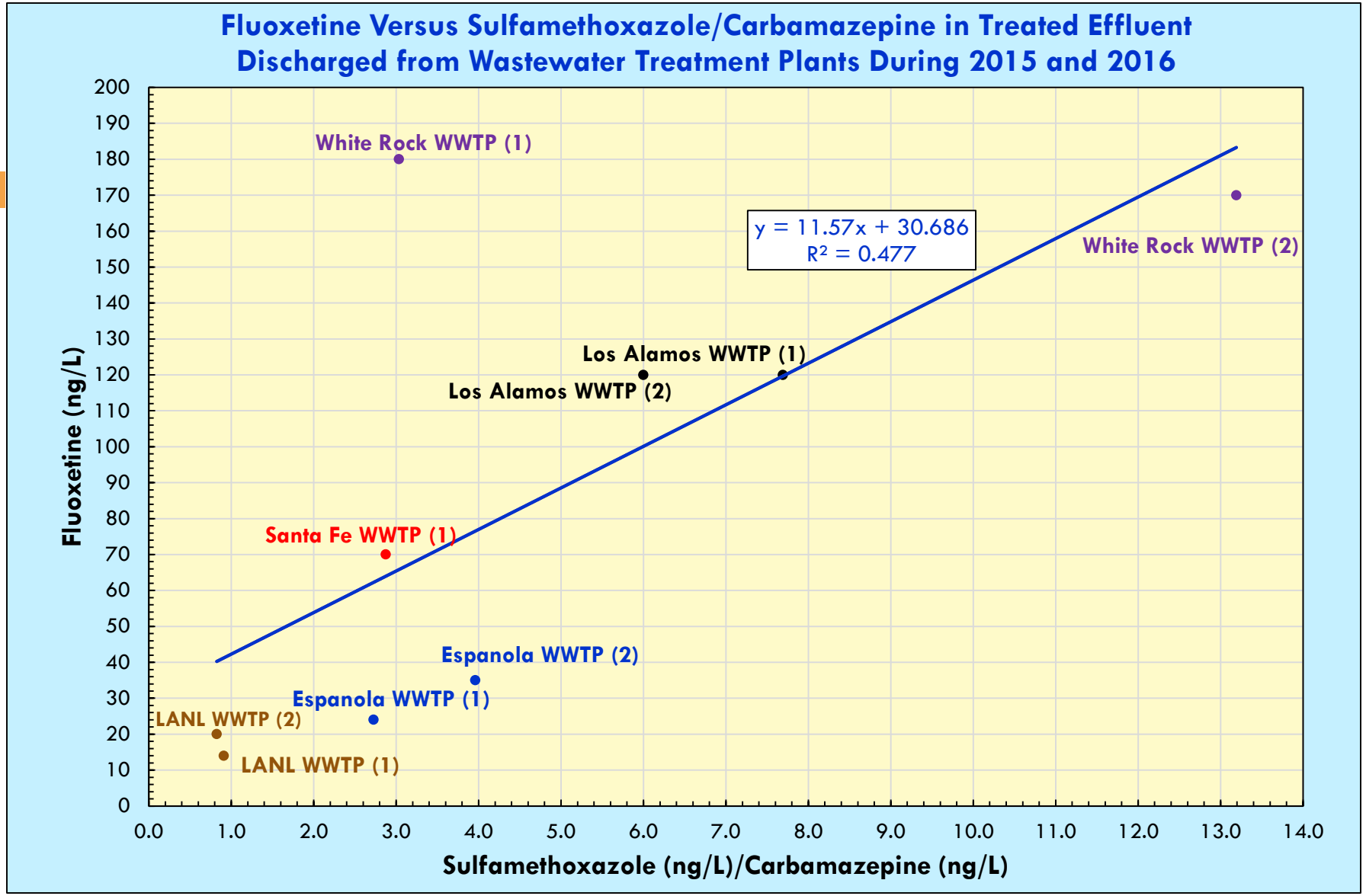
Location Map of Wastewater Treatment Facilities, Los Alamos County, New Mexico




Acetaminophen, Sulfamethoxazole, and Carbamezapine in Treated Effluent Discharged from Wastewater Treatment Plants During 2015 and 2016
Nanogram/Liter
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Acetaminophen (Sample Event 1)
Acetaminophen (Sample Event 2)
Sulfamethoxazole (Sample Event 1)
Sulfamethoxazole (Sample Event 2)
Carbamazepine (Sample Event 1)
Carbamezapine (Sample Event 2)
3
7.8
900
990
330
250
18
3
1000
1500
130
250
3
0.3
100
140
110
170
120
110
910
620
300
47
41
920
320
Espanola WWTP
Los Alamos WWTP
LANL WWTP
White Rock WWTP
Santa Fe WWTP


Caffeine, Dilantin, and Methadone in Treated Effluent
Discharged from Wastewater Treatment Plants During 2015 and 2016
Caffeine (Sample Event 1)
Caffeine (Sample Event 2)
Dilantin (Sample Event 1)
Dilantin (Sample Event 2)
Methadone (Sample Event 1)
Methadone (Sample Event 2)
Nanogram/Liter
10000
1000
100
10
1
80
23
320
320
500
480
40
21
150
140
40
35
17
7.9
10
15
6
2.4
7500
8800
180
100
42
30
44
160
100
Espanola WWTP
Los Alamos WWTP
LANL WWTP
White Rock WWTP
Santa Fe WWTP


Concentrations of DEET, Fluoxetine, and Meprobamate in Treated Effluent Discharged from Wastewater Treatment Plants During 2015 and 2016
DEET (Sample Event 1)
DEET (Sample Event 2)
Fluoxetine (Sample Event 1)
Fluoxetine (Sample Event 2)
Meprobamate (Sample Event 1)
Meprobamate (Sample Event 2)
Nanogram/Liter
800
700
600
500
400
300
200
100
0
89
7
24
35
150
80
68
28
120
120
210
150
21
21
14
20
76
170
720
380
180
170
150
550
75
70
250
Espanola WWTP
Los Alamos WWTP
LANL WWTP
White Rock WWTP
Santa Fe WWTP


Fluoxetine Versus Sulfamethoxazole/Carbamazepine in Treated Effluent Discharged from Wastewater Treatment Plants During 2015 and 2016
Fluoxetine (ng/L)
Sulfamethoxazole (ng/L)/Carbamazepine (ng/L)
y = 11.57x + 30.686
R² = 0.477
White Rock WWTP (1)
White Rock WWTP (2)
Los Alamos WWTP (1)
Los Alamos WWTP (2)
Santa Fe WWTP (1)
Espanola WWTP (2)
Espanola WWTP (1)
LANL WWTP (2)
LANL WWTP (1)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
0.0
1.0
2.0
3.0
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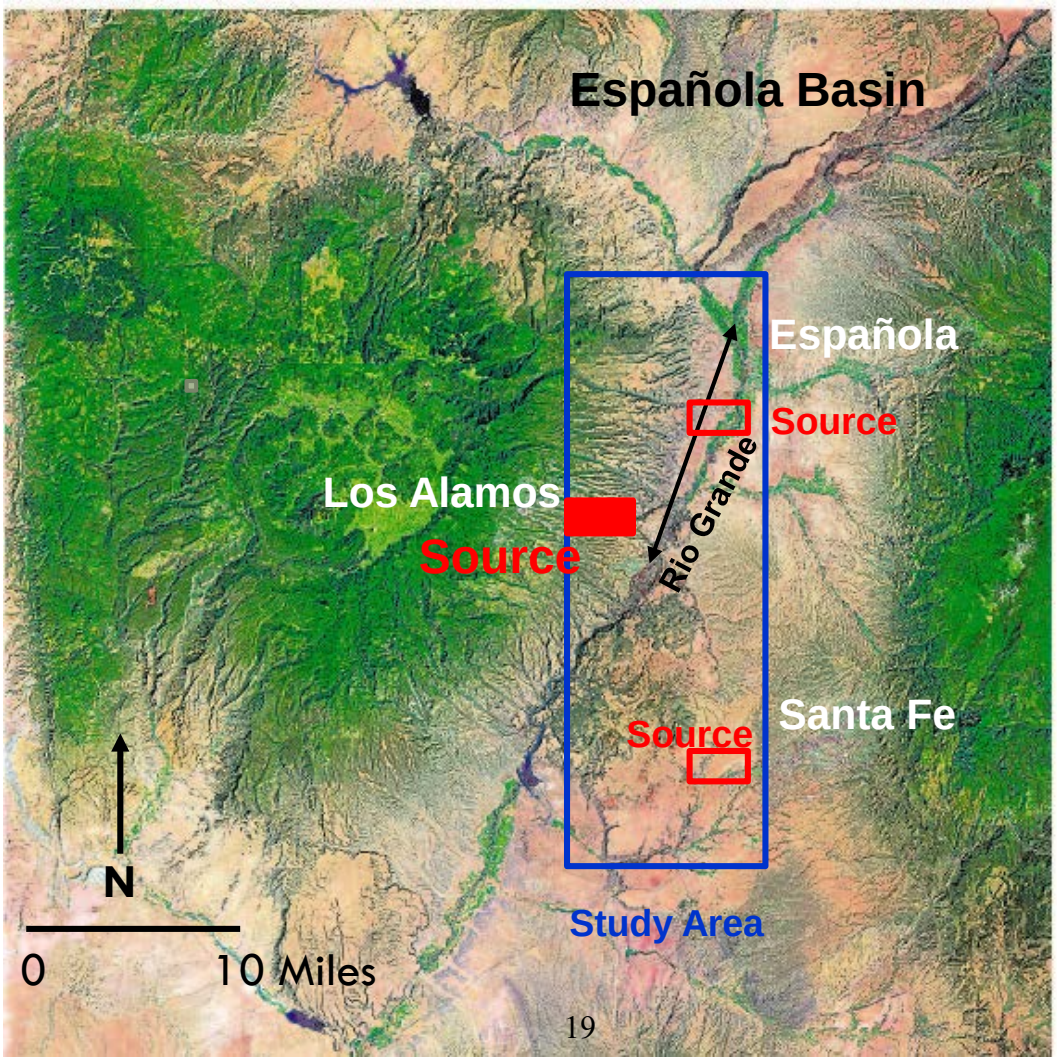
8.0
9.0
10.0
11.0
12.0
13.0
14.0


Española Basin
Española
Source
Rio Grande
Los Alamos
Source
Santa Fe
Source
N
0
10 Miles
Study Area

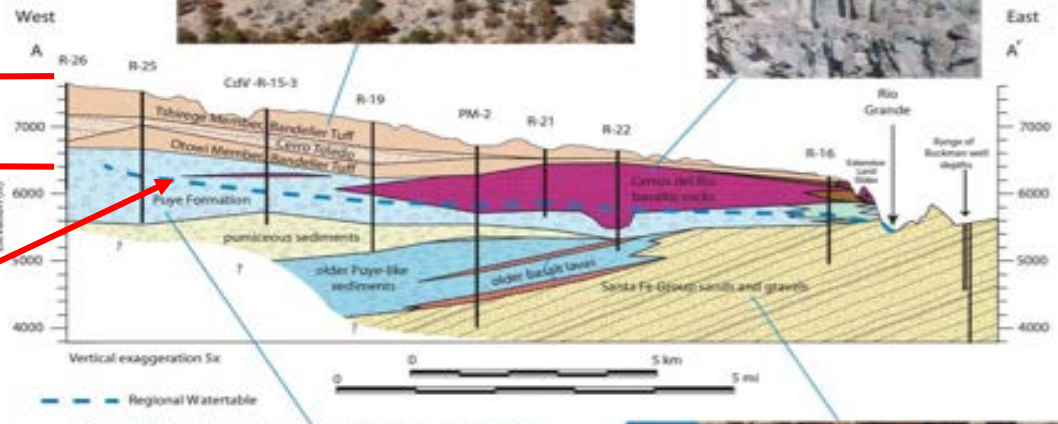
Hydrostratigraphy of the Pajarito Plateau

Bandelier Tuff

Localized Perched Zones

Perched Zones and Regional Aquifer

Cerros del Rio Basalt



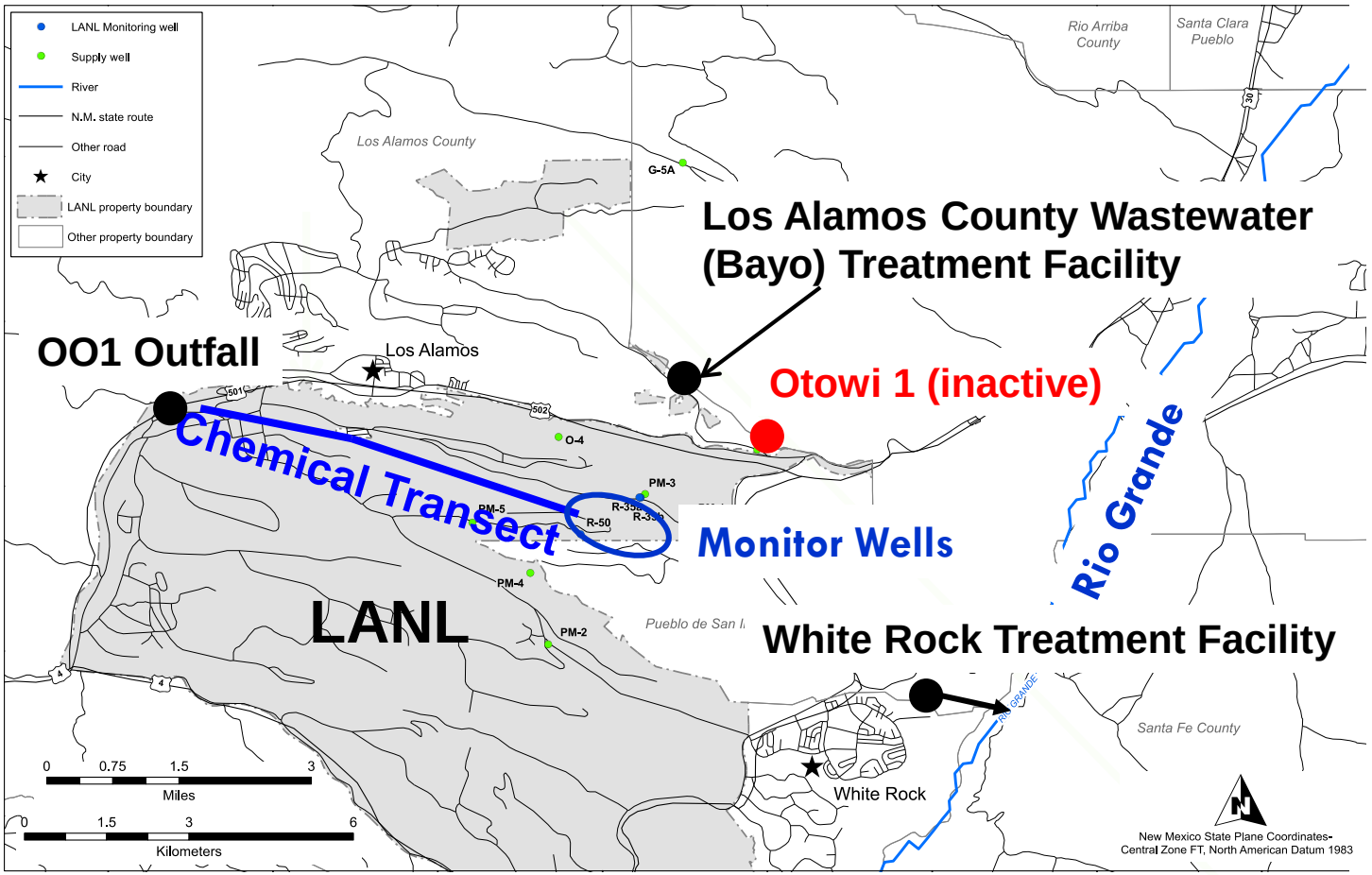
Vadose Zone

Regional Water Table

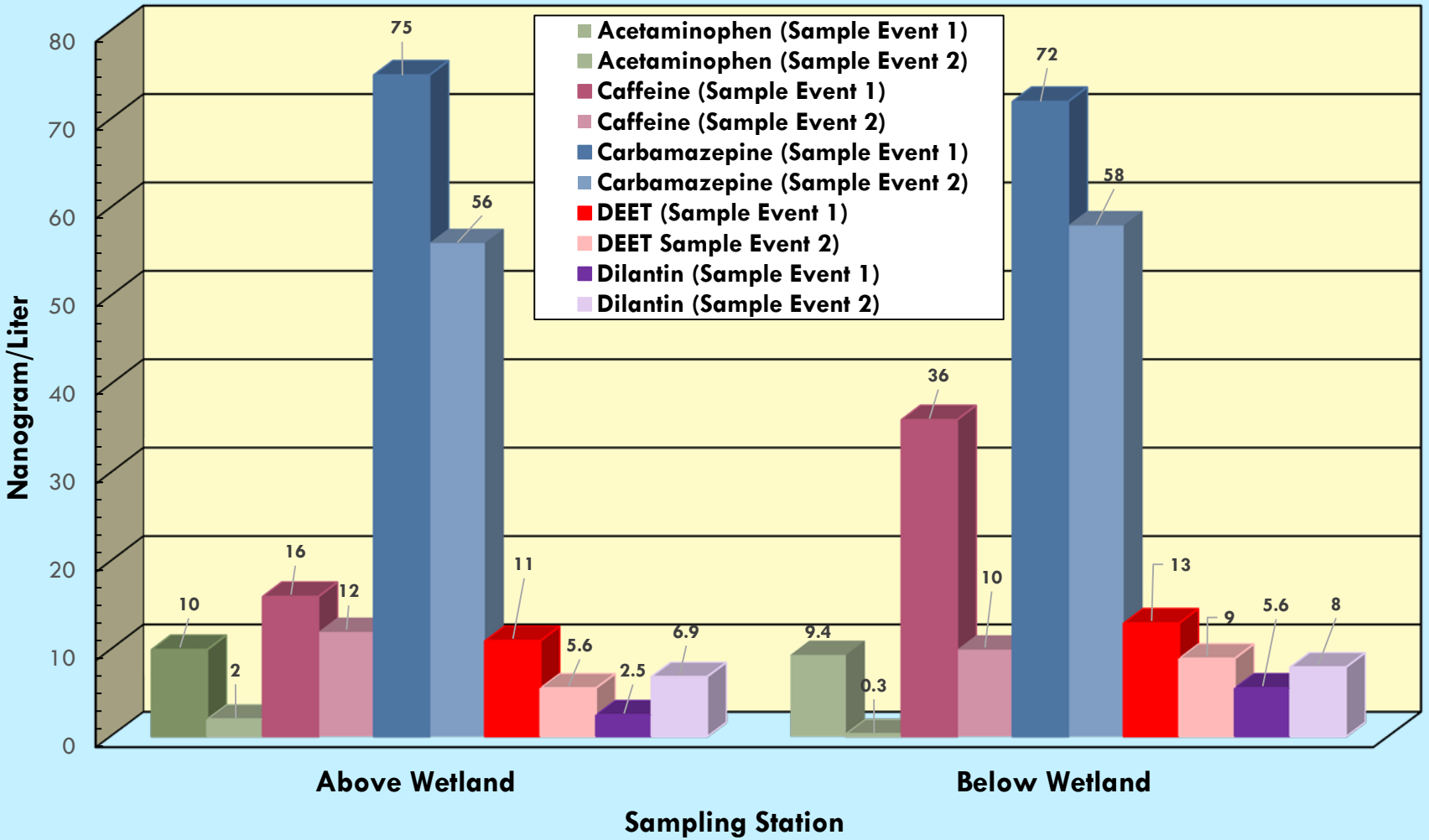
Puye Formation

Santa Fe Group

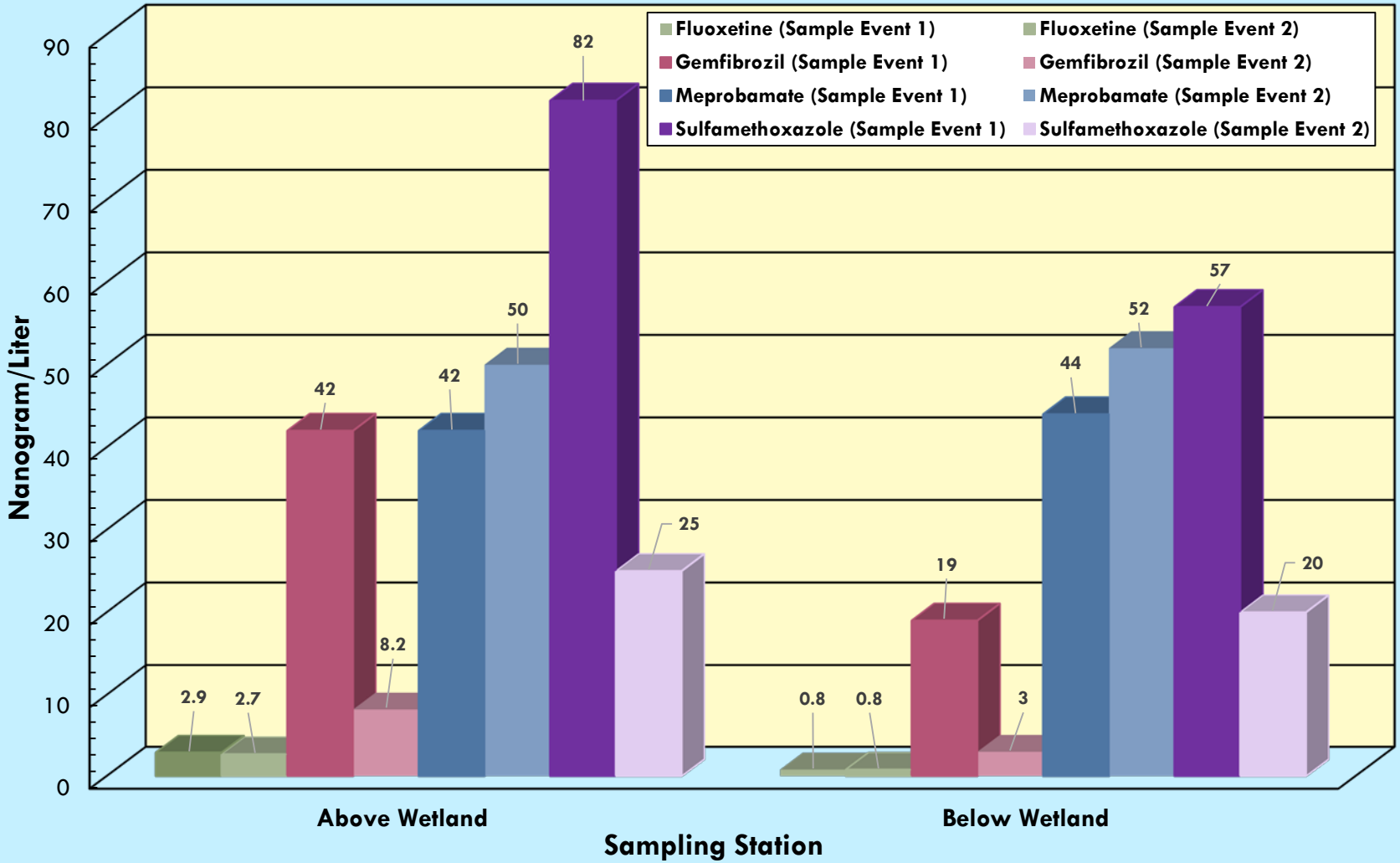
Location Map of Wastewater Treatment Facilities And Inactive Supply Well, Los Alamos County, NM

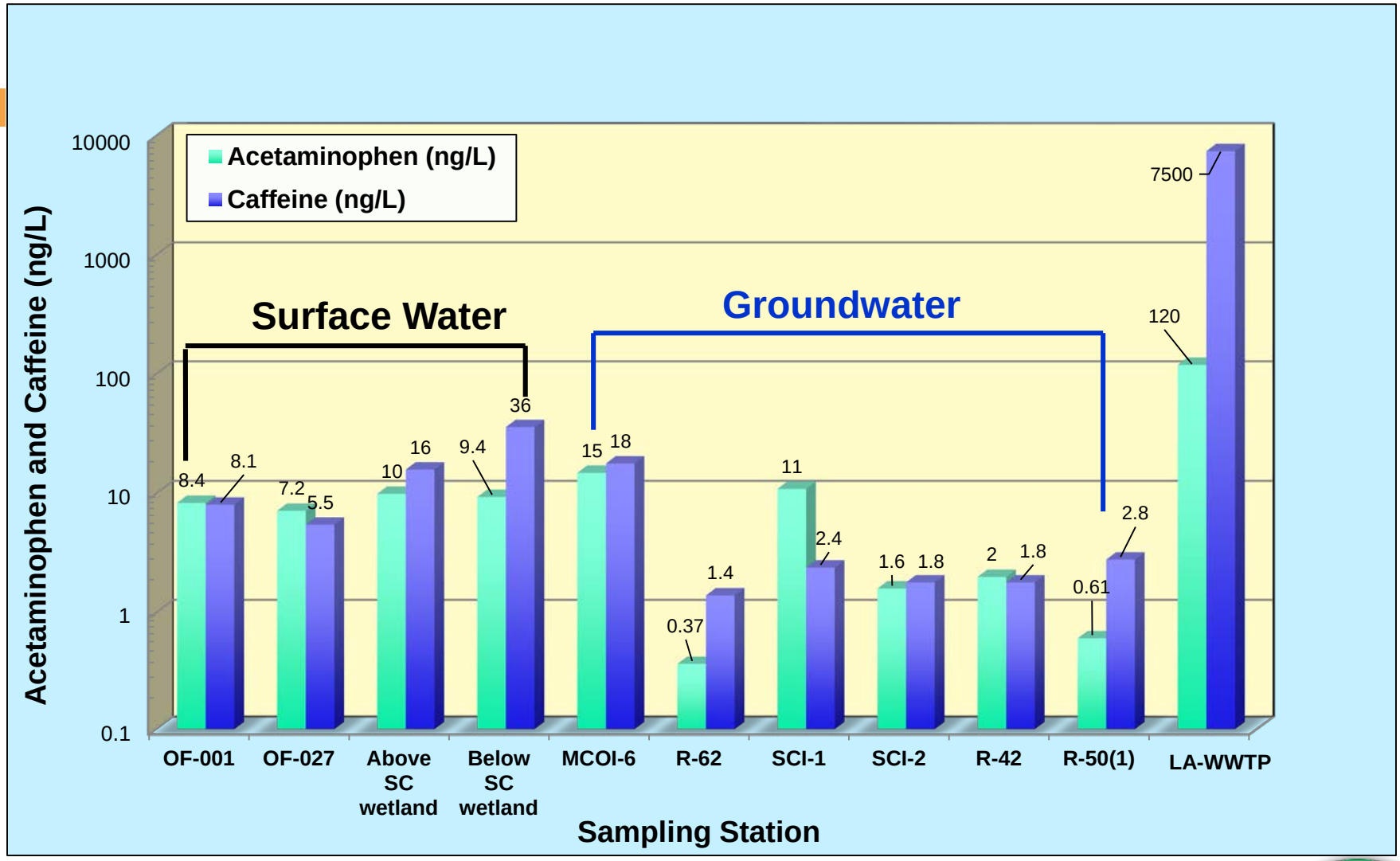


Selected Pharmaceutical Compounds and Personal Care Products Above and Below Sandia Canyon Wetland, Los Alamos National Laboratory, NM

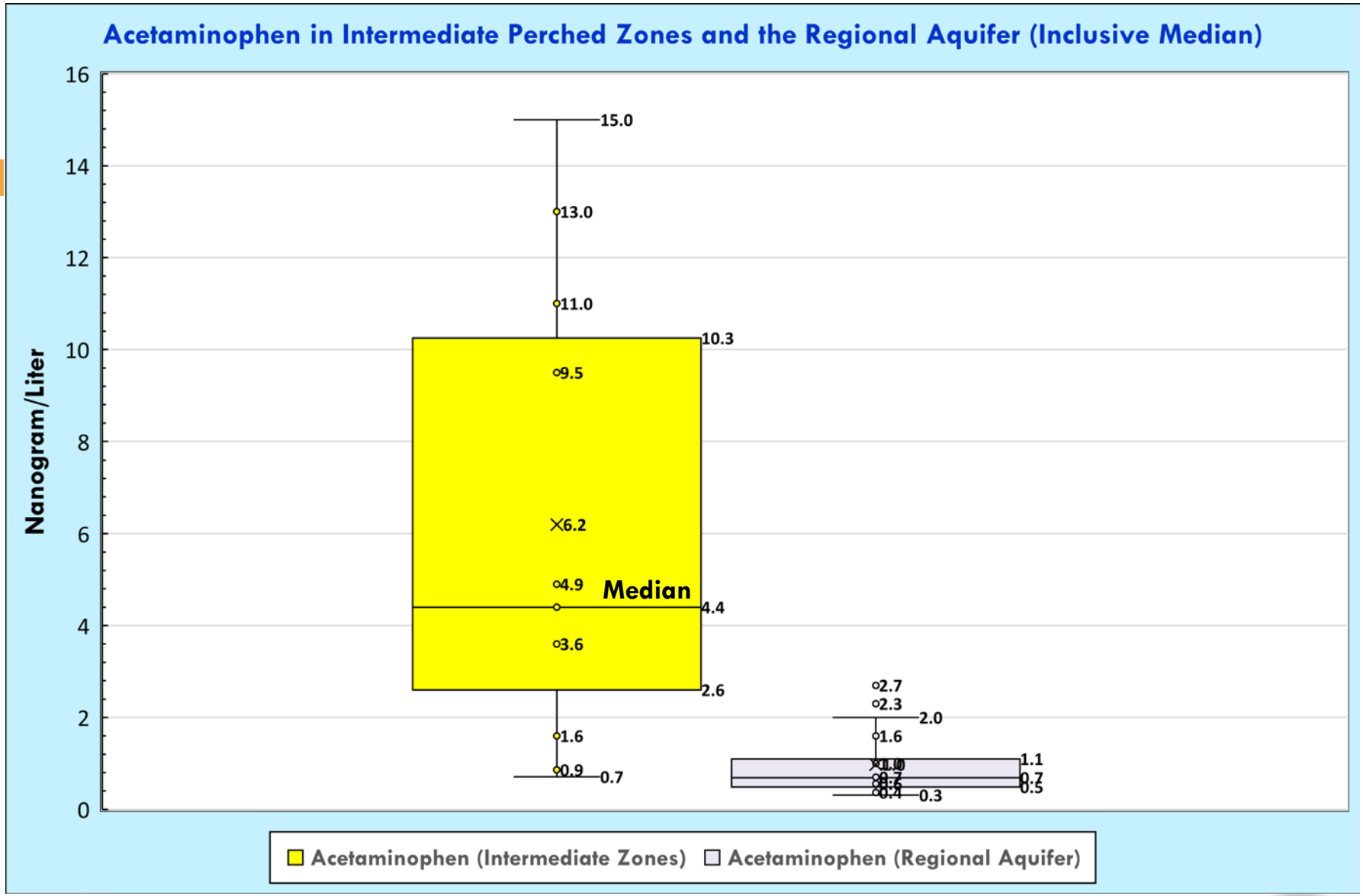


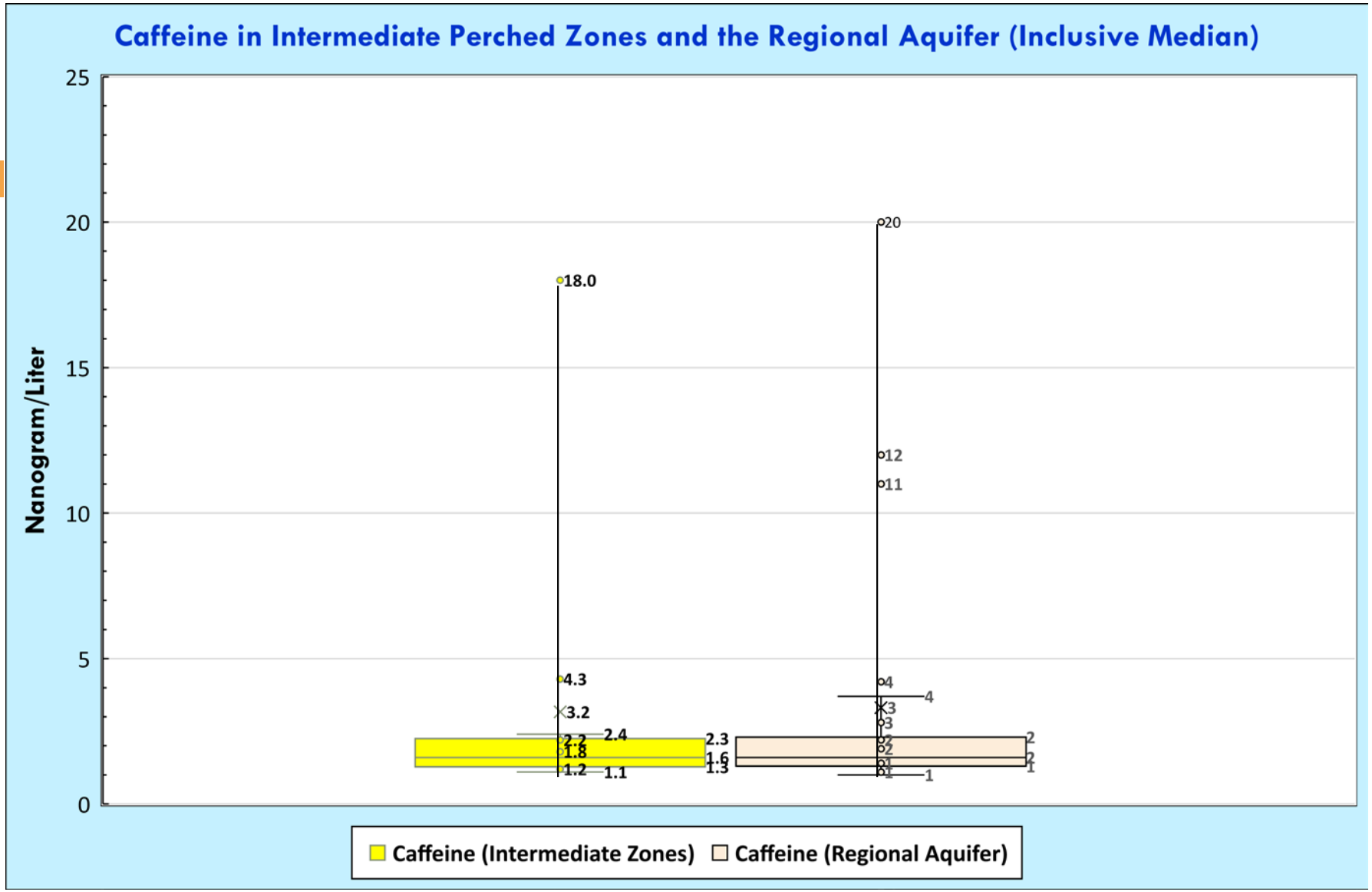
Selected Pharmaceutical Compounds and Personal Care Products Above and Below Sandia Canyon Wetland, Los Alamos National Laboratory, NM



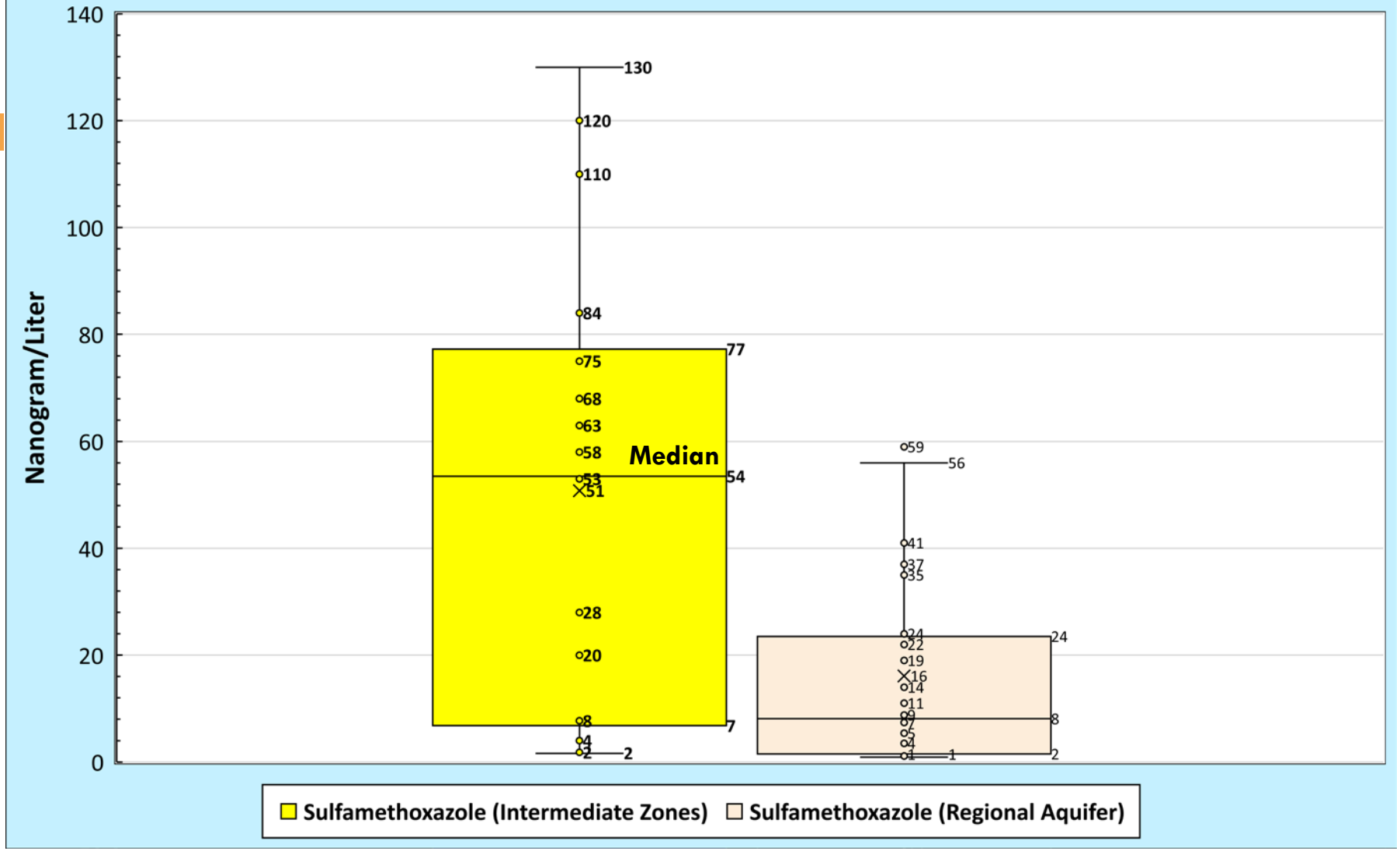

Acetaminophen (ng/L)
Caffeine (ng/L)
Surface Water
Groundwater
Acetaminophen and Caffeine (ng/L)
10000
1000
100
10
1
0.1
8.4
8.1
7.2
5.5
10
16
9.4
36
15
18
0.37
1.4
11
2.4
1.6
1.8
2
1.8
0.61
2.8
120
7500
OF-001
OF-027
Above SC wetland
Below SC wetland
MCOI-6
R-62
SCI-1
SCI-2
R-42
R-50(1)
LA-WWTP
Sampling Station

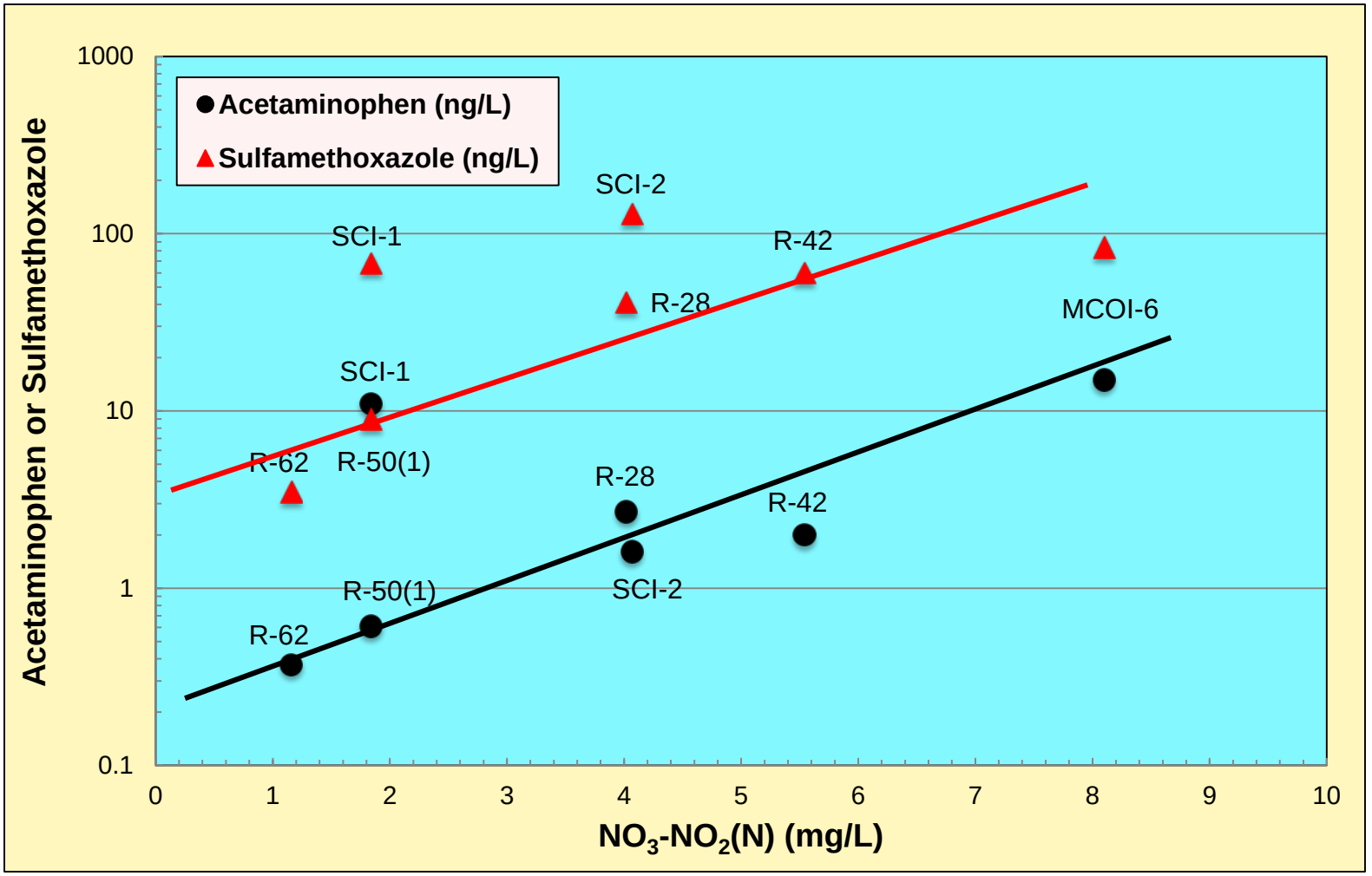
Acetaminophen in Intermediate Perched Zones and the Regional Aquifer (Inclusive Median)




Caffeine in Intermediate Perched Zones and the Regional Aquifer (Inclusive Median)
Nanogram/Liter
25
20
15
10
5
0
18.0
4.3
3.2
2.4
2.2
1.8
1.2
1.1
2.3
1.6
1.3
20
12
11
4
3
2
1
Caffeine (Intermediate Zones)
Caffeine (Regional Aquifer)

Sulfamethoxazole in Intermediate Perched Zones and the Regional Aquifer (Inclusive Median)



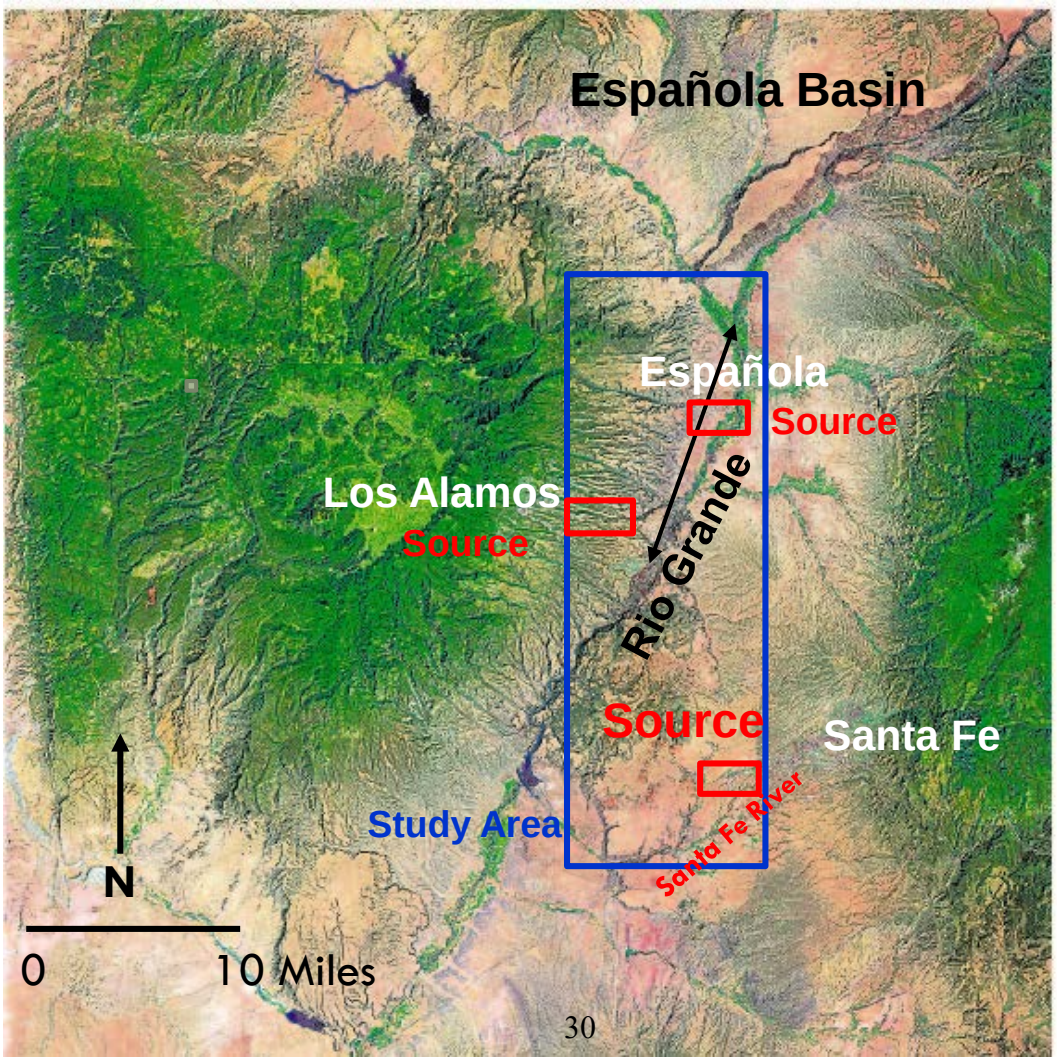

Acetaminophen (ng/L)
Sulfamethoxazole (ng/L)
Acetaminophen or Sulfamethoxazole
1000
100
10
1
0.1
0
1
2
3
4
5
6
7
8
9
10
NO3-NO2(N) (mg/L)
SCI-2
SCI-1
R-42
R-28
MCOI-6
SCI-1
R-62
R-50(1)
R-28
R-42
SCI-2
R-50(1)
R-62

Pharmaceuticals Detected in Treated Sewage Effluent at Los Alamos County (Bayo) WWTP and at Inactive Well O-1

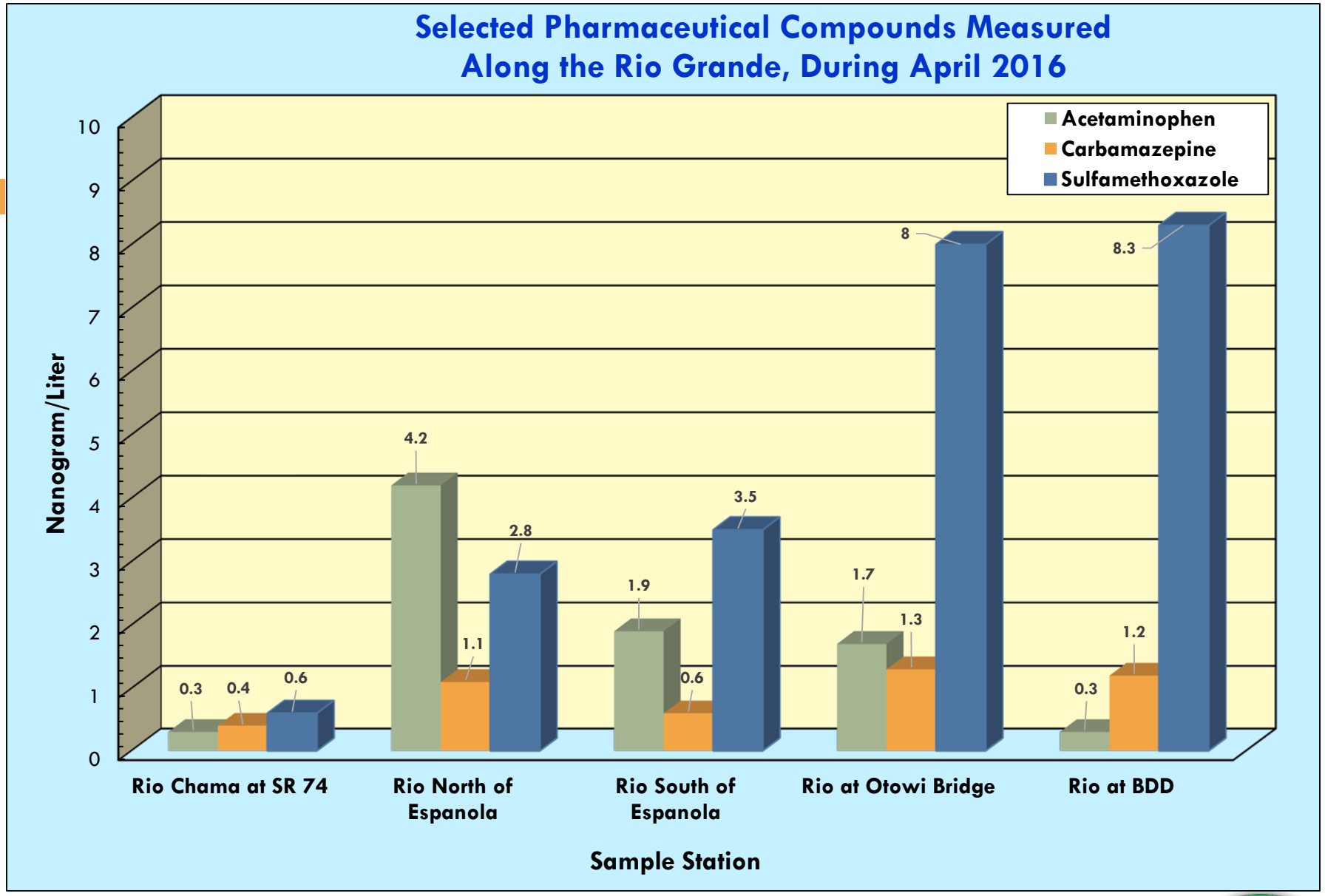
Chemical (ng/L)	LA County WWTP (04/21/15)	O-1 (05/20/15)	O-1 (12/09/15)
Acetaminophen	18, J	1.1, J	1.8, J
Bisphenol-A	<40,U	<4, U	5.0, J
Caffeine	40	<1, U	1.6, J
Carbamazepine	130	<0.4, U	<1.0, U
DEET	68	<0.72, U	<0.70, U
Dilantin	150	<1, U	<2.0, U
Ibuprofen	12	<0.4, U	<0.70, U
Sulfamethoxazole	1,000	<0.6, U	<1.0, U

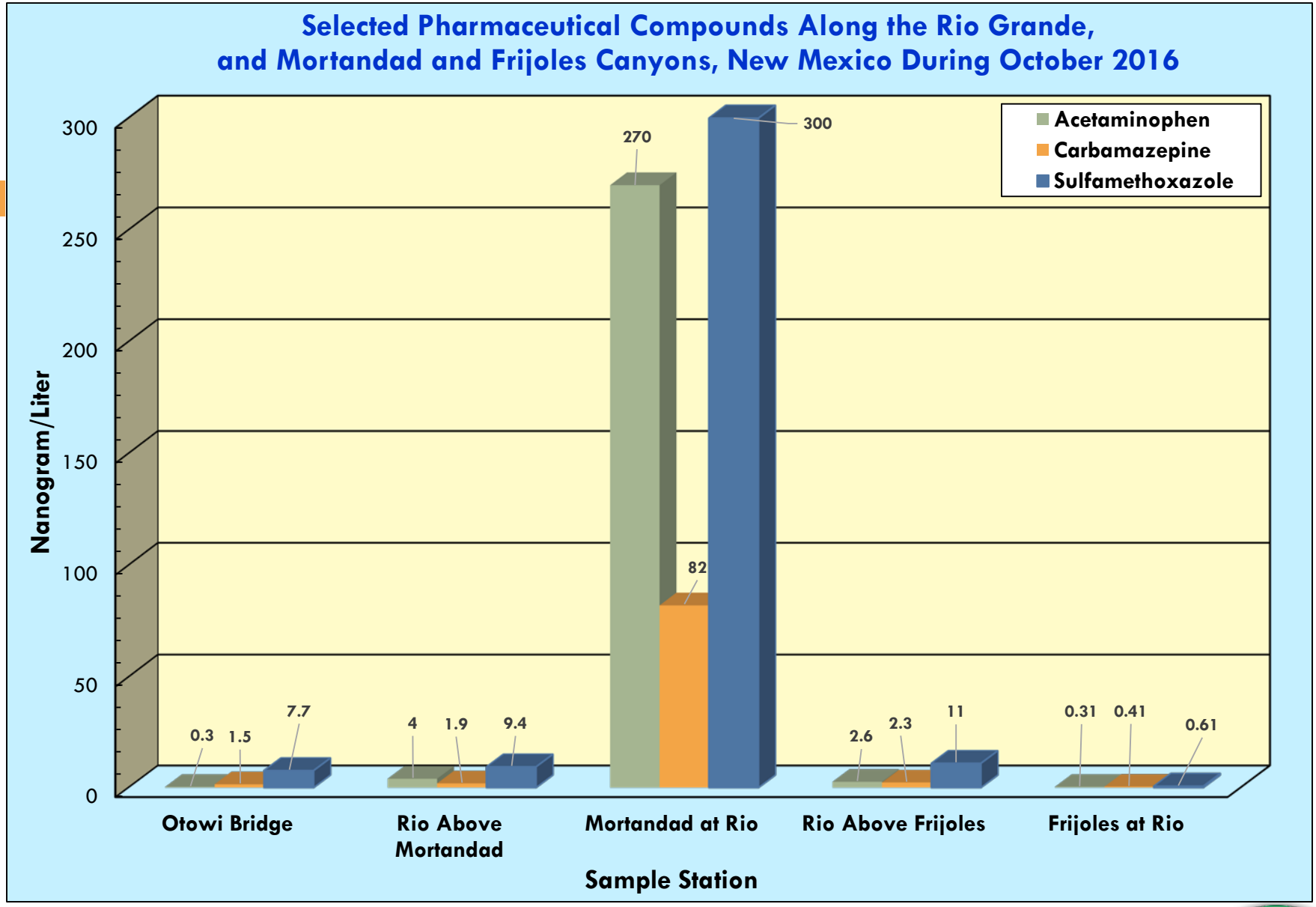
Note: ng/L means nanogram/liter; U means not detected; J means detected above method detection limit but below quantitation limit (approximate value).

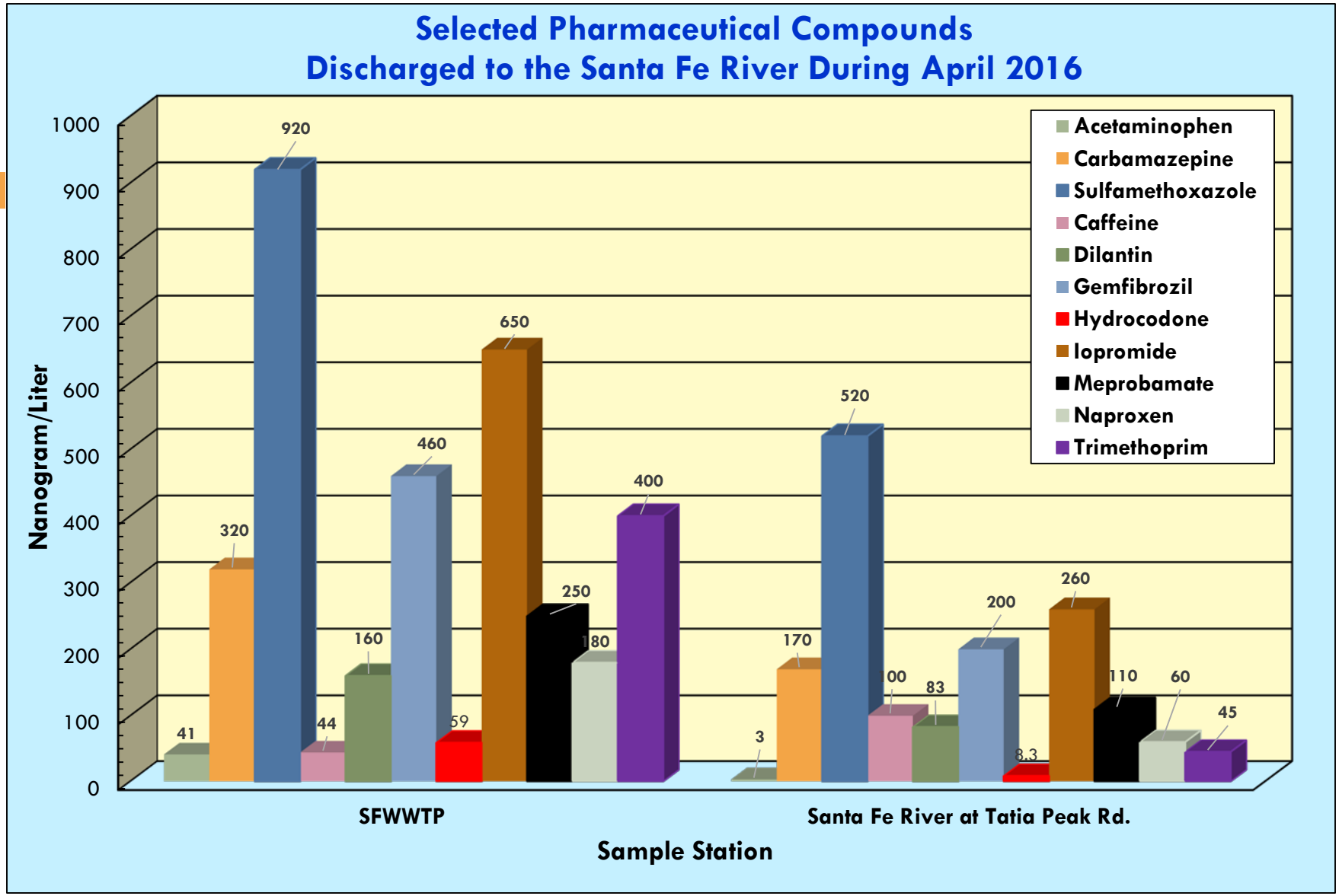
One nanogram/liter (part per trillion) is equivalent to one second in 31,688 years!


Española Basin
Española
Source
Los Alamos
Source
Rio Grande
Source
Santa Fe
Study Area
Santa Fe River
N
0
10 Miles

AB EX. 6


Selected Pharmaceutical Compounds Measured
Along the Rio Grande, During April 2016
Acetaminophen
Carbamazepine
Sulfamethoxazole
Nanogram/Liter
0
1
2
3
4
5
6
7
8
9
10
0.3
0.4
0.6
4.2
1.1
2.8
1.9
0.6
3.5
1.7
1.3
8
0.3
1.2
8.3
Rio Chama at SR 74
Rio North of Espanola
Rio South of Espanola
Rio at Otowi Bridge
Rio at BDD
Sample Station


Selected Pharmaceutical Compounds Along the Rio Grande,
and Mortandad and Frijoles Canyons, New Mexico During October 2016
Acetaminophen
Carbamazepine
Sulfamethoxazole
Nanogram/Liter
300
250
200
150
100
50
0
0.3
1.5
7.7
4
1.9
9.4
270
82
300
2.6
2.3
11
0.31
0.41
0.61
Otowi Bridge
Rio Above Mortandad
Mortandad at Rio
Rio Above Frijoles
Frijoles at Rio
Sample Station


Selected Pharmaceutical Compounds
Discharged to the Santa Fe River During April 2016
Nanogram/Liter
1000
900
800
700
600
500
400
300
200
100
0
Acetaminophen
Carbamazepine
Sulfamethoxazole
Caffeine
Dilantin
Gemfibrozil
Hydrocodone
Iopromide
Meprobamate
Naproxen
Trimethoprim
41
320
920
44
160
460
59
650
250
180
400
3
170
520
00
83
200
8.3
260
110
60
45
SFWWTP
Santa Fe River at Tatia Peak Rd.
Sample Station

The initial phase of this investigation identified pharmaceutical compounds and personal care products in surface and groundwater at Los Alamos and surrounding areas, NM.

Caffeine, acetaminophen, and sulfamethoxazole are commonly observed in groundwater in the parts-per-trillion (ng/L) range.

Treated sewage effluent present in groundwater likely contains pharmaceutical compounds and personal care products.

Pharmaceutical compounds and personal care products are excellent groundwater tracers for identifying contaminant sources (treated sewage effluent).

The New Mexico Environment Department will continue to monitor pharmaceutical compounds and personal care products in groundwater at Los Alamos and adjacent areas.

SUPPLEMENTAL MATERIAL

PHARMACEUTICALS OF INTEREST

Compound	Common Name(s)	Use
Pentoxifylline	Sanofi	Improves blood flow due to narrowing of the arteries
Acetaminophen	Tylenol	Pain reliever/fever reducer
Hydrocodone	NA	Cough suppressant
Oxybenzone	NA	Component of sunscreen
DEET	NA	Insect repellent
Diclofenac	Aclonac, Cataflam, Voltaren	Arthritis, nonsteroidal anti-inflammatory drug (NSAID)
Ibuprofen	Advil/ Motrin	Pain reliever/fever reducer, nonsteroidal anti-inflammatory drug (NSAID)
Atrazine	NA	Herbicide
Naproxen	Aleve	Pain reliever/fever reducer, nonsteroidal anti-inflammatory drug (NSAID)
Gemfibrozil	Lopid	Cholesterol medication
Carbamazepine	Tegretol	Seizure reducer, bipolar treatment
Triclosan	NA	Antibacterial and antifungal agent found in soaps and detergents
Diazepam	Valium	Anxiety, alcohol withdrawal syndrome, and trouble sleeping
Estriol	NA	Natural estrogen hormone
17b-Estradiol	Climara, Menostar	Oral contraceptive
Estrone	NA	Natural estrogen hormone
Fluoxetine	Prozac	Antidepressant
Diethylstilbestrol	DES	Synthetic nonsteroidal estrogen; given to pregnant women to reduce pregnancy complications; banned in US in 1971
Dilantin (Trade name)	Phenytoin (compound)	Seizure reducer, treatment of abnormal heart rhythms
Meprobamate	Miltown	Tranquilizer
17a-Ethynyl Estradiol	NA	Oral contraceptive
Progesterone	NA	Endogenous steroid hormone
17a-Estradiol	Climara, Menostar	Oral contraceptive
Caffeine	NA	Stimulant
Testosterone	Androderm, Delatestryl	Steroid hormone
Androstenedione	Andro	Androgenic-anabolic steroids, performance enhancing drug
Salicylic Acid	Aspirin	Pain reliever/fever reducer
Sulfamethoxazole	Bactrim, Septrin	Antibiotic
Iopromide	Ultravis	Contrast medium for CT scans
Trimethoprim	Proloprim, Monotrim, Triprim	Antibiotic
Methadone	Dolophine	Synthetic opioid used for treatment of opioid dependency
Bisphenol-A	Bisphenol A	BPA is employed to make certain plastics and epoxy resins

AMIGOS BRAVOS' EXHIBIT 7

AMIGOS BRAVOS *Friends of the Wild Rivers*
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Fax: 505.758.7345

December 19, 2006

Shari Barash
U.S. EPA, Office of Water
Barash.Shari@epamail.gov

Re: Effluent-Dependent Waters Strawman Document

Dear Ms. Barash:

Amigos Bravos provides the following comments on the "EPA Positions - Water Quality Standards Issues – Effluent-Modified Waters and Effluent-Restored Waters" strawman document hereafter referred to as the "strawman" document.

Amigos Bravos is a nationally recognized river conservation organization guided by social justice principles. Amigos Bravos' mission is to protect and restore the rivers of New Mexico, and ensure that those rivers provide a reliable source of clean water to the communities and farmers that depend on them, as well as a safe place to swim, fish, and go boating. Amigos Bravos works locally, statewide and nationally to ensure that the waters of New Mexico are protected by the best policy and regulations possible. In this capacity Amigos Bravos works to make sure that New Mexico's water quality standards in all of New Mexico's waters are protective enough to support the diverse human and non-human uses of our state's water resources. The strawman document proposed by EPA raises a number of concerns for us. Specifically we are concerned about the potential impacts this document could have on the water quality of New Mexico's waters. According to the USFWS over 60% of vertebrate wildlife species in New Mexico depend upon intermittent and ephemeral waters, wetlands, and riparian areas. In addition, USFW has determined that amphibians are the most common vertebrate aquatic life form found in the intermittent and ephemeral waters of New Mexico. They also determined that amphibians are more often than not more sensitive to pollutants than fish species. [1] This information indicates that water quality standards for ephemeral streams need to be as protective as standards for perennial waters. It is crucial for New Mexico in particular,

[1] United States Department of the Interior, U.S. Fish and Wildlife Service. Technical Testimony submitted to the New Mexico Water Quality Control Commission re triennial review of water quality standards in ephemeral and intermittent waters in New Mexico. October 31, 2003

where over 90% of our water courses are non-perennial,[2] that there be strong protective water quality standards for ephemeral and intermittent waters.

Our comments have been organized into two sections, the first section describes some of our broad over-arching concerns and the second section describes our concerns about specific language in the strawman.

Broad Concerns:

Amigos Bravos has a number of over-arching concerns:

1. There is No Need for the Strawman Document
Amigos Bravos does not understand the pressing need for the document and the lengthy process that has accompanied it. While some of the questions raised by the strawman are important and should be considered, there are many more pressing needs in implementing the Clean Water Act (CWA) and protecting the Nation's waters. For example, there is a desperate need to address non-point source pollution's impacts on our nation's waters. The 319 and TMDL programs have proved to be inadequate and there is a great need to develop better tools for addressing these problems.

In on-the-ground implementation how often does this problem of conflicting uses occur? While there may be some confusion on dischargers part at to what use must be protected, this confusion should be able to be quickly cleared up by the EPA as the CWA is clear that water quality standards must protect the most sensitive use that has occurred in the waterbody since 1975. Not many states have established biocriteria so the actual criteria that protect ephemeral and perennial streams are usually the same chemical criteria. Perhaps as states develop biocriteria, a discussion on these topics may be appropriate. In fact, Amigos Bravos believes that it is in the context of developing biocriteria, not in the context of how to downgrade uses through UAAs, that this discussion of two conflicting existing uses is more appropriate.

As the strawman points out, some waters that were historically ephemeral and are now artificially perennial could have two potentially conflicting designated uses. Because ephemeral waters in many cases have the same chemical criteria applied to them as perennial waters (and if they don't, in most cases they should, as testified to by USFWS[3]), the only case that a difference in protection (or in application of the two different uses), would come into play on-the-ground would be if States or EPA considered flow a pollutant and denied permits based on potential impacts to the aquatic life use of the stream from increased flow. While Amigos Bravos believes that the States and EPA should exert this authority we are skeptical that they frequently actually do, which once again raises the question of the need of this strawman document. Is the EPA, in spending resources and time producing this document acknowledging the need and CWA authority for protecting the unique characteristics of ephemeral streams by denying permits based on projected impacts from increased flow? If so, Amigos Bravos is in

[2] Ducks Unlimited, SWANCC Final Report, 2001

support. But for now the problem of conflicting uses appears to be more of a theoretical concern.

2.Don't Turn the Clean Water Act into a Water Quantity Hostage

Our second overarching concern is that we have witnessed, in discussions at meetings and in the documents themselves, a tendency to fall into the trap of forcing the Clean Water Act into the role of a water quantity hostage. A false argument has been presented that if we don't lower the water quality standards in these effluent dependent streams then the discharger will remove the discharge altogether. Giving credence to this way of thinking is, in our opinion, a dangerous road to embark upon. The role of the Clean Water Act is to protect the necessary water quality to support designated uses in our water resources, *not* to protect water quality to the level dictated by the discharger in return for keeping water in the river. Falling into this trap, at best, will keep lower quality water in water bodies for a limited amount of time. As water becomes more and more scarce and valuable, many of these dischargers will cease to discharge regardless of the water quality standards in the river. The only thing that will keep water in the river is whatever water right obligations to downstream users these dischargers may have. Lowering water quality standards to keep water in the river is selling the integrity of the Clean Water Act forever for at best the questionable short term gain of keeping dirty water in the rivers for a limited amount of time. Amigos Bravos urges the EPA not to fall into this trap.

This discussion brings up questions about what role does the Clean Water Act have in protecting flow in the nation's waters. Amigos Bravos believes that flow is essential to the 101(a) CWA objectives to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Flow is a critical physical factor that is essential for maintaining healthy water bodies. Without flow, none of the designated uses of any given water body are met. Using this argument, it would be logical to require flow criteria for our Nation's waters. This of course would result in many 303d listings and, in most cases, no on-the-ground changes in flow regime as the Clean Water Act in 101(g) itself states that the Act does not have authority to supercede water quantity allocations by States. Yet a policy of requiring flow criteria would have the benefit of correctly identifying the problem and it could inform states of the implications of water quantity decisions and practices on State's rivers and other water resources. Regardless, Amigos Bravos believes it is dangerous for EPA to address the flow issue halfway, as is attempted in the strawman document, by trying to tweak the application of the CWA by bending water quality standards for the purpose of trying to encourage dischargers to leave more water in the river. This way of thinking leads to serious questions about implementing 101(a)(2) of the CWA, which is where the first goal of the Act is identified as the complete elimination of discharges of pollutants in the Nation's waters. Strawman documents that encourages downgrading of uses to encourage dischargers to continue to discharge is in direct conflict with this first goal of the CWA.

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[3] United States Department of the Interior, U.S. Fish and Wildlife Service. Technical Testimony submitted to the New Mexico Water Quality Control Commission re triennial review of water quality standards in ephemeral and intermittent waters in New Mexico. October 31, 2003

3. Backward Approach to Protecting Water Quality
The strawman comes at protecting water quality from a backwards approach that is not consistent with the CWA. The CWA directs States to develop water quality protections based on existing and designated uses, not based how much of the river is made up of effluent. The strawman is precariously close to, if not over, the line of creating a waste transport or waste assimilation use, which is specifically prohibited by the CWA 40 CFR 131.10(a). The strawman approaches water quality protection by first asking if the water body is effluent dependent, effluent modified, or dewatered effluent restored. This is wrong question to be asking first. The first question should be - what are the designated uses for the water body? The second question should be - are these designated uses protecting the existing uses in the waterbody? Basing water quality protections on whether or not the water has been modified by human activities is not appropriate.

4.EPA Should Develop Guidance and Documents that Result in Cleaner Rivers Not in More Relaxed Standards
Amigos Bravos believes that a much more helpful and appropriate strawman document would be one that helps States set biocriteria for aquatic life uses for historically ephemeral waters that have been flow modified. Or how about a document that outlines how States can deny permits based on potential negative impacts to the aquatic life uses of ephemeral streams? To our knowledge a permit has never been denied on the basis that the discharge will impact or destroy the existing ephemeral aquatic life use. Guidance to States on how to develop biocriteria for waters that have two conflicting aquatic life uses or on how deny permit applications on flow impacts is lacking at this time and could be very helpful to States and if applied, could result in better water quality. In contrast, Amigos Bravos does not see how the current strawman document will result in better on-the-ground water quality.

Specific Comments:

Document Wide: For clarity sake the phrase "best use" should be replaced with the phrase "most sensitive use". While both phrases imply a value judgment, "most sensitive use" is more descriptive, plus it is the phrase that is more commonly used in Clean Water Act implementation. In addition, the phrase, "best use", especially out west, often implies an economic factor that is inappropriate when discussing water quality standards.

Section IV: This section brings up the question of how States determine what is an existing use and what is a designated use. Amigos Bravos' experience is that most designated uses *are* existing uses. By basically skipping over this important determination and jumping into a lengthy detailed discussion about all the different scenarios that could occur after jumping this first hurdle, the strawman seems to be assuming that there are many circumstances where you have a designated use that is not an existing use. Amigos Bravos strongly disagrees with this assumption and thinks that the strawman could result in many states brushing over this first, and in our opinion very substantial hurdle. At the very least, the Strawman document should include a disclaimer

that the document is a theoretical exercise unless a State has made a conclusive determination that the use in question is not an existing use.

Section IV(A)(a): Phrases like "for some time" or "for a long time" are vague and should be more clearly defined.

Section IV(A)(b):

- The word "stakeholders" should be changed to "some stakeholders".
- The fact that some States have flow criteria and have thus already determined that flow is an important indicator of water quality should be mentioned in this section.
- The use of the word "marginal" is confusing. New Mexico's water quality standards have six separate aquatic life uses two of which include the word "marginal" (marginal coldwater and marginal warmwater). In the context of NM water quality standards the word marginal is used to describe an aquatic life use of predominately perennial watercourses. EPA policy clearly states that all waters should have a recreation and aquatic life use (101(a)(2)) and therefore all waters should have an aquatic life use. The use of the word "marginal" in the application of this questionable concept of removing or denying an aquatic life use to waters is not appropriate. It is especially confusing and inappropriate in the context of NM Water Quality Standards as it could be construed to mean that waterbodies that currently have a designated marginal coldwater aquatic life may not need or require an aquatic life use .
- Footnote 6 is misleading in that it states, "where the ephemeral stream is not found to be a water of the US under the CWA then there is no existing aquatic life use". In most cases this is not true as many States are protecting waters of the state that are no longer considered waters of the US with aquatic life uses.
- The story about Wyoming, included in this section, is confusing and should either be expanded upon or removed. The broad statement that "EPA has approved the determination that the aquatic life use is not an existing use" is stated without a qualifier of what type of aquatic life use or for what water body. Amigos Bravos has questions about EPA's support of and citing of Wyoming's criteria for determining where aquatic life is not an existing use in ephemeral waters. The lack of "no more than infrequent wetland occurrences" seems vague and subject to a very qualitative determination. Amigos Bravos would argue that, in New Mexico at least, there are many ephemeral streams that support aquatic life at least part of the year that do not exhibit wetland occurrences. In addition the official Army Corp of Engineers definition of "wetlands" is very narrowly applied in New Mexico and excludes lush boggy meadows and willow thickets that are directly adjacent to watercourses. Amigos Bravos is concerned that if other states, and especially New Mexico, were to adopt this criteria for determining when an aquatic life is an existing use, many water courses would loose an aquatic life use in one fell swoop. We suggest taking out the Wyoming example to simplify the section.

Section IV(B)(2): Again, the phrase "best use" should be changed to "most sensitive use". Amigos Bravos asserts that IV(B)(2)(a) is the only legally defensible option of the two options outlined in this section.

Section V: Again, there should be more emphasis on mentioning that an existing use cannot be removed in an UAA. Specifically, the first sentence should read: "In general, if a UAA demonstrates that the current designated use is not an existing use and is not attainable, the state would then consider revising its water quality standards." Or language such as "the highest attainable use is, at a minimum, the most sensitive existing use."

Section V(A): The first sentence is misleading in that states shouldn't be able to *choose* an existing use. Existing uses are not a choice; they are a reflection of the historic use and water quality of the water body.

Section V(B): The last paragraph of this section seems to be saying that a UAA can remove an existing use of a historically perennial water body if it has since been dewatered. The law is very clear that an existing use (a use that has occurred since 1975 cannot be removed) this paragraph seems to be in contradiction to the law, as a water that was dewatered after 1975 has an existing use associated with the perennial pre-dewatered stream.

Section VI:

- Again, Amigos Bravos believes that EPA should clearly state that the highest attainable use includes, at a minimum, the most sensitive existing use.
- Amigos Bravos strongly opposes the concept of developing "criteria … that will protect the expected biological condition with the stressor in place." Another way of stating this would be say the EPA is encouraging the development of "aquatic life that is resistant to pollution use". This approach encourages a situation where the only aquatic life that is protected is that which can survive in a polluted stream. Water quality standards are not meant to be developed on a sliding scale based on how much pollution is being discharged into the system.

Section VII(B): Again, this section includes language indicating that the State has the discretion to choose what the existing use should be. As indicated earlier in these comments, Amigos Bravos does not believe that existing use designations are something that the state gets to choose.

Section IX: All questions that ask the State decision maker to determine if not relaxing the water quality standards would result in the removal of the discharge should be removed. As mentioned in the beginning of this document, Amigos Bravos does not support the concept of turning the Clean Water Act into a water quantity hostage.

Thank you for opportunity to comment on the strawman document and including Amigos Bravos in the meetings and discussions about this issue.

Sincerely,

Rachel Conn
Amigos Bravos

AMIGOS BRAVOS' EXHIBIT 8

Jamie C. DeWitt

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EDUCATION & CERTIFICATIONS

Diplomate, American Board of Toxicology. 2017.

Ph.D., Environmental Science and Neural Science.
School of Public and Environmental Affairs and Program in Neural Science. Indiana University, Bloomington, IN. 2004.
Concentrations: Environmental and developmental neurotoxicology and risk assessment
Dissertation title: Developmental intoxication of dioxins and polychlorinated biphenyls in an avian model: Correlations of brain asymmetry, behavior, and related developmental effects

B.S., Environmental Science and Biology.
Lyman Briggs College. 1992. Michigan State University, East Lansing, MI. 1992.

PROFESSIONAL EXPERIENCE

Adjunct Associate Professor
Toxicology Program, Biological Sciences, North Carolina State University, Raleigh, NC.
March 2018-present.

Associate Professor of Pharmacology and Toxicology
Department of Pharmacology and Toxicology, Brody School of Medicine, East Carolina University, Greenville, NC.
July 2015-present.

Adjunct Associate Professor of Public Health
Department of Public Health, Brody School of Medicine, East Carolina University, Greenville, NC.
July 2015-July 2017.

Adjunct Assistant Professor of Public Health
Department of Public Health, Brody School of Medicine, East Carolina University, Greenville, NC.
July 2012-July 2014.

Affiliated Member
The Harriet and John Wooten Laboratory for Alzheimer's and Neurodegenerative Disease Research, East Carolina University, Greenville, NC.
July 2011-present.

Assistant Professor of Pharmacology and Toxicology

Department of Pharmacology and Toxicology, Brody School of Medicine, East Carolina University, Greenville, NC.
July 2008-July 2015.

Postdoctoral Trainee in Immunotoxicology

University of North Carolina at Chapel Hill in cooperation with the U.S. Environmental Protection Agency (Training Agreement CT829472), National Health and Environmental Effects Research Laboratory, Experimental Toxicology Division, Immunotoxicology Branch, Research Triangle Park, NC (Advisor: Dr. Robert Luebke). Evaluation of immune function and exploration of immunotoxic mechanisms, including use of knock-out models and molecular techniques, of various xenobiotics (organotins and perfluoroalkyl acids) in rodent models.
June 2004-June 2008.

Postdoctoral Research Associate in Environmental and Ecotoxicology

Developmental Neurobiology and Environmental Toxicology Laboratory, School of Public and Environmental Affairs, Indiana University, in cooperation with the U.S. Fish and Wildlife Service Bloomington Ecological Services Field Office, Bloomington, IN (Advisors: Dr. Diane Henshel and Daniel Sparks). Cardiotoxic effects in wild passerine birds developmentally exposed to PCBs.
September 2003-May 2004.

Research Assistant in Environmental and Ecotoxicology

Developmental Neurobiology and Environmental Toxicology Laboratory, School of Public and Environmental Affairs, Indiana University, Bloomington, IN (Advisor: Dr. Diane Henshel). Toxicological effects of dioxin and polychlorinated biphenyls after developmental exposure in an avian model, wild birds, and wild fish.
August 1995-August 2003.

Field Assistant in Limnology

Lake Lemon Conservancy District, Unionville, IN. Canada goose control, littoral zone revegetation, and monitoring of native and exotic aquatic plant populations.
June 2000-May 2003.

Field Assistant in Ecotoxicology

U.S. Fish and Wildlife Service-Bloomington Ecological Services Field Office, Bloomington, IN. Wild bird and macroinvertebrate population monitoring in a metal-contaminated lake, including assessment of fertile eggs for embryonic abnormalities.
April 1997-October 1997.

Research Associate in Entomology

Landscape Entomology Division, Department of Entomology, Michigan State University, East Lansing, MI. Research and efficacy tests for forest, ornamental and turf entomological studies for the Michigan Department of Agriculture and Turf Foundation.
September 1992-August 1995.

Research Assistant in Entomology

Medical Entomology Division, Department of Entomology, Michigan State University, East Lansing, MI. Assessment of Lyme disease prevalence in deer and dog ticks collected from a Lyme disease endemic area in Michigan.
May 1992-May 1993.

PUBLICATIONS

Primary Research Manuscripts

Jiang Q, Xu X, **DeWitt JC**, Zheng Y. Using chicken embryo as a powerful tool in assessment of developmental cardiotoxicities. Under review by the *Journal of Visualized Experiments*.

McDonough C, Ward C, Hu Q, Vance S, Higgins C, **DeWitt J**. 2020. Immunotoxicity of an electrochemically fluorinated aqueous film-forming foam. *Toxicological Sciences*, 178:104-114.

vonderEmbse A, Hu Q, **DeWitt J**. 2020. Postnatal toxicant exposure in 3xTgAD mice promotes gene x environment-related early alterations to neuroimmune epigenetic profiles. *Neuroimmunology and Neuroinflammation*, 7(online first): DOI: 10.20517/2347-8659.2019.29.

Kotlarz N, McCord J, Collier D, Lea CS, Strynar M, Lindstrom AB, Wilkie AA, Islam JY, Matney K, Tarte P, Polera ME, Burdette K, **DeWitt J**, May K, Smart RC, Knappe DRU, Hoppin JA. 2020. Poorly understood PFAS generated as byproducts of fluorochemical manufacturing are in the blood of children and adults living in Wilmington, North Carolina. *Environmental Health Perspectives*, 128: https://doi.org/10.1289/EHP6837.

McDonough C, Choyke S, Ferguson PL, **DeWitt J**, Higgins C. 2020. Bioaccumulation of novel per- and polyfluoroalkyl substances (PFASs) in mice dosed with an aqueous film-forming foam (AFFF). 2020. *Environmental Science & Technology*. 54:5700-5709.

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Kwiatkowski C, Andrews D, Birnbaum L, Bruton T, **DeWitt J**, Knappe D, Maffini M, Miller M, Pelch K, Reade A, Soehl A, Trier X, Venier M, Wagner C, Wang Z, and Blum A. 2020. The scientific basis for managing PFAS as a chemical class. *Environmental Science & Technology Letters*, 7:532-543.

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Edited Books

DeWitt JC, Rockwell CE, and Bowman CC (eds). 2018. *Immunotoxicity Testing: Methods and Protocols,* Methods in Molecular Biology Series. Springer Science + Business Media, LLC (Invited).

DeWitt JC (ed). 2015. *Toxicological Effects of Perfluoroalkyl and Polyfluoroalkyl Substances*. Springer Science + Business Media, LLC (Invited).

Book Chapters

Meadows JR, **DeWitt JC**, and Rooney AA. 2018. Ecoimmunotoxicology – An overview. In: *Comprehensive Toxicology* (McQueen CA, ed) 3rd edition. Elsevier Ltd., Oxford.

DeWitt JC and Keil DE. 2017. Current issues in developmental immunotoxicity. In: *Immunopathology in Toxicology and Drug Development* (Parker GA, ed). Springer International Publishing, Switzerland.

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Dietert RR, **DeWitt JC**, and Luebke RW. 2012. Reducing the prevalence of immune-based chronic disease. In: *Immunotoxicity, Immune Dysfunction, and Chronic Diseases* (Dietert RR and Luebke RW, eds), Molecular and Integrative Toxicology, Springer Science + Business Media, LLC. pp 419-440.

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DeWitt JC and Dietert RR. 2012. Postnatal immune dysfunction and its impact on growth parameters. In: *Handbook of Growth and Growth Monitoring in Health and Disease* (Preedy VR, ed), Springer, New York, NY. pp 741-755.

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Dietert RR and **DeWitt J**. 2010. Developmental immunotoxicity (DIT): The why, where and how of DIT testing. In: *Immunotoxicity Testing: Methods and Protocols* (Dietert RR, ed), Methods in Molecular Biology. Humana Press, Inc., Totowa, NJ. 598:17-25.

Luebke RW, Beamer CA, Bowman C, **DeWitt JC**, Gowdy K, Johnson VJ, Shepherd DM, and Germolec DR. 2009. Immunotoxicology (developmental immunotoxicology section). In: *General and Applied Toxicology*, 3rd Edition (Marrs T, Ballantyne B, Syversen T, eds.), John Wiley & Sons, Ltd., Chichester, UK, pp 1561-1583.

Other Scholarly Contributions

Portier CJ et al. (90+ co-authors). 2016. Differences in the carcinogenic evaluation of glyphosate between the International Agency for Research on Cancer (IARC) and the European Food Safety Authority (EFSA). *Journal of Epidemiology and Community Health*. 70:741-745.

DeWitt JC and Luebke RW. 2014. Immunological Aging. *Online Reference Database Biomedical Science*.

Benbrahim-Tallaa L, Lauby-Secretan B, Loomis D, Guyton KZ, Grosse Y, El Ghissassi F, Bouvard V, Guha N, Mattock H, and Straif K *on behalf of the International Agency for Research on Cancer Monograph Working Group* (**DeWitt JC**, Mechanisms Subgroup Member). 2014. Carcinogenicity of perfluorooctanoic acid, tetrafluoroethylene, dichloromethane, 1,2-dichloropropane, and 1,3-propane sultone. *The Lancet Oncology*. 15:924-925.

IARC. 2014 Perfluoro-octanoic acid, Tetrafluoroethylene, Dichloromethane, 1,2-Dichloropropane, and 1,3-Propane sultone. *IARC Monogr Eval Carcinog Risks Hum* (**DeWitt JC**, Mechanisms Subgroup Member). *Monograph 110*.

DeWitt JC and Dietert RR. 2011. Response to "Theoretical aspects of autism: Causes - a review" by Ratajczak, HV (*Journal of Immunotoxicology* 8:68-79, 2011). *Journal of Immunotoxicology.* 8:195-197.

Non-Refereed Articles

DeWitt JC, Brown P, Carignan C, Kasper S, Schaider L, Osimo C, Fitzstevens M. Op-ed: PFAS chemicals – the other immune system threat. *Environmental Health News.* July 6, 2020.

"Toxicant induced brain asymmetry: More than just a bird-brained scheme?" Learned Discourses, *SETAC Globe*, Jan/Feb 2001 (invited).

RESEARCH FUNDING

North Carolina Policy Collaboratory 1 year

Per- and Polyfluoroalky Substances (PFAS) in North Carolina: Descriptive Toxicological Needs

Role on project: Principle Investigator
Status: Award notification August 2020. Direct costs: $83,446

Center for Human Health and the Environment at North Carolina State University 1 year
Uncovering PFOA-Induced Metabolic Changes and their Association with B-cell Metabolic Function
Role on project: Principle Investigator of Record (Mentor to Postdoctoral Scholar, Dr. Tracey Woodlief, who wrote and received award)
Status: Award notification April 2020. Direct costs: $25,000

Brody Brothers Endowment Foundation 1 year
Do Per- and Polyfluoroalkyl Substances found in the Cape Fear River of North Carolina Pose a Risk to the Immune System?
Role on project: Principal Investigator
Status: Award notification December 2019. Direct costs: $32,000

National Institute of Environmental Health Sciences Superfund Research Program (P42) via subcontract from North Carolina State University 5 years
Center for Environmental and Health Effects of PFAS. BMRP2: Uncovering the Mechanisms of PFAS-Induced Immunotoxicity: An Important Public Health endpoint
Role on project: Co-Principal Investigator (C. Mattingly and D. Knappe, PIs, NCSU)
Status: Award notification December 2019. Direct costs to ECU: $684,005

Department of Defense 3 years
New Approaches for the Treatment of Neuroinflammatory and Behavioral Consequences of Exposure to Gulf War Illness Chemicals
Role on project: Principal Investigator
Status: Award notification March 2019. Direct costs: $699,564.

United States Environmental Protection Agency via subcontract from Oregon State University 3 years
System Toxicological Approaches to Define and Predict Toxicity of Per- and Polyfluoroalkyl Substances
Role on project: Co-Principal Investigator (R. Tanguay, PI, OSU)
Status: Award notification September 2018. Direct costs to ECU: $465,000.

North Carolina Policy Collaboratory 2 years
Per- and Polyfluoroalkyl Substance Testing (PFAST) Network: Effects of novel PFASs on immune function
Role on project: Co-Principal Investigator and Team Co-Lead (with R. Fry, UNC-CH)
Status: Award notification September 2018. Direct costs to ECU: $168,068.

North Carolina Policy Collaboratory 6 months
Emerging contaminants in North Carolina, including PFASs, 1,4-dioxiane, and bromide, in air and water
Role on project: Co- Principal Investigator
Status: Award notification July 2018. Direct costs to ECU: $12,000.

National Institutes of Health/National Institute of Environmental Health Sciences via subcontract with North Carolina State University 2 years

Assessing Impact of Drinking Water Exposure to GenX in the Cape Fear River Basin
Role on project: Co-Investigator (J. Hoppin, NCSU, PI)
Status: Award notification November 2017. Direct costs to ECU: $20,000

Brody Brothers Endowment Foundation 1 year
Immunomodulatory Effects of Aqueous Film Forming Foam (AFFF): An Effective Fire Suppressant or a Persistent Environmental Contaminant with Unknown Health Consequences?
Role on project: Principal Investigator
Status: Award notification November 2016. Direct costs: $20,000

Center for Human Health and Environment at NCSU Pilot Project Program 1 year
Discovery of Biomarkers of Effect following Environmentally-Relevant Exposure to Pharmaceutical Pollutants
Role on project: Co-Principal Investigator (E. Hvastkovs and K. McCoy, ECU, co-PIs)
Status: Award notification August 2015. Direct costs: $25,000

Brody School of Medicine Internal Seed/Bridge Grant Program 1 year
Post-translational Modifications to Potassium Channels in Alzheimer's Disease: Triggers of Onset and Progression?
Role on project: Co-Principal Investigator (R. Schwalbe, ECU, co-PI)
Status: Award notification August 2015. Direct costs: $25,000

The Harriet and John Wooten Laboratory for Alzheimer's and 1 year
Neurodegenerative Disease Research
Microglia as a Target of Environment x Gene Interactions Part II: Digging into the Biochemistry of Alzheimer's Disease
Role on project: Principal Investigator (R. Schwalbe, ECU, co-PI)
Status: Award notification November 2014. Direct costs: $12,000

Interdisciplinary Research Collaboration Award (East Carolina University) 6 months
Pharmaceutical and Personal Care Product Contaminants in Fresh Water
Role on Project: Corresponding Faculty PI
Status: Award notification August 2014. Direct costs: $23,000

Alzheimer's North Carolina 1 year
A Multidisciplinary Approach to Fight Senior Dementia
Role on Project: Co-Investigator (Q. Lu, ECU, PI)
Status: Award notification February 2014. Direct costs: $50,000

East-West Research Collaboration Award (East Carolina University) 6 months
Pharmaceutical and Personal Care Product Contaminants in Fresh Water
Role on Project: Corresponding Faculty PI
Status: Award notification December 2013. Direct costs: $23,000

The Harriet and John Wooten Laboratory for Alzheimer's and 1 year
Neurodegenerative Disease Research
Microglia as a Target of Environment x Gene Interactions: Exacerbation of Alzheimer's Pathology by Early-life Exposure to Lead
Role on project: Principal Investigator
Status: Award notification April 2013. Direct costs: $12,000

Bureau of Land Management via subcontract from University of Nevada-LV 3 years
Nellis Dunes Recreation Area Dust Exposure and Human Health Risk Assessment
Role on project: Co-Principal Investigator (B. Buck, UNLV, PI)
Status: Award notification March 2011. Direct costs to ECU: $105,699

Department of Defense 1 year
Immunopathogenesis in autism: Regulatory T cells and autoimmunity in neurodevelopment
Role on project: Principal Investigator
Status: Award notification December 2009. Direct costs: $75,000

School of Public and Environmental Affairs, Indiana University. Ph.D. Student Travel Award and Graduate Student Organization Travel Award. 2001. Funded amount: $500.00
Ohio Valley Chapter of the Society of Environmental Toxicology and Chemistry. Student Travel Grant. 1997, 1998, 2001. Funded amounts: $300.00 each year

EDITORIAL BOARDS/AD HOC MANUSCRIPT REVIEWER

Editorial Board Member, *Journal of Immunotoxicology*. 2010-
Editorial Board Member, *Journal of Toxicology and Environmental Health Part A.* 2013-
Associate Editor, *Toxicology and Applied Pharmacology*. 2016-
Series co-Editor (with Sarah Blossom), *Molecular and Integrative Toxicology*. 2016-
Editorial Board Member, *Environmental Health Perspectives*. 2017-
Editorial Board Member, *NeuroToxicology*. 2018-
Editorial Board Member, *PLoS One*. 2018-
Editorial Board Member, *Reproductive Toxicology*, 2019-

Ad Hoc Reviewer:

Advances in Physiology Education
Archives of Environmental Contamination & Toxicology
Archives of Toxicology
Chemical Research in Toxicology
Chemosphere
Drug and Chemical Toxicology
Environmental Health Perspectives
Environment International
Environmental Research
Environmental Science & Pollution Research
Environmental Science & Technology
Epidemiology
Food and Chemical Toxicology
GENE
Human & Experimental Toxicology
International Aquatic Research
International Immunopharmacology
Journal of Environmental Immunology & Toxicology
International Journal of Tropical Biology
Journal of Immunotoxicology
Journal of Toxicology & Environmental Health
NeuroToxicology
Pharmacological Research
PLoS One
Regulatory Toxicology & Pharmacology
Reproductive Toxicology
Science of the Total Environment
Southeastern Naturalist
Toxicology & Applied Pharmacology
Toxicology Letters
Toxicology Reports
Toxicological Sciences

GRANT REVIEWER & REVIEW PANEL CHAIR

National Institute of Environmental Health Sciences, 2020, 2021
University of North Carolina at Chapel Hill pilot funding programs, 2020
Wisconsin SeaGrant, 2019
Hudson River Foundation, 2019

Department of Defense Congressionally Directed Medical Research Programs, Review Panel Chair, 2018, 2019, 2020
CORIS, Consorzio per la Ricerca Sanitaria, 2018
Department of Defense Congressionally Directed Medical Research Programs, 2013-2020
Graduate Women in Science Graduate Fellowships, 2011, 2014-2018
CDC-NIOSH, 2010, 2013, 2016

EXTERNAL REVIEWER

California Environmental Protection Agency (product), 2019, 2020
US Environmental Protection Agency (product), 2019
ATSDR, 2017-2021 (manuscripts and Toxicological Profile)
New York State Department of Public Health, 2017 (Cancer incidence investigation: Village of Hoosick Falls, Rensselaer County, New York)

ORAL PRESENTATIONS (Invited)

"From Pollutants to People: How Studying PFAS has given my Laboratory Research Deeper Meaning." *NC Water Resources Research Institute Annual Conference*. Virtual Talk. 2021.

"PFAS Exposure and COVID-19." *The PA Multi-site Health Study Information Session.* Virtual Talk. 2021.

"An Overview of the Health Effects of PFAS." *Toxic Free NC and Climate Action NC Educational Event.* Virtual Talk. 2021.

"Unregulated and Emerging Contaminants in North Carolina Waters: Focus on PPCPs and PFAS." *Sierra Club Cypress Group.* Virtual Talk (with Dr. Sid Mitra). 2021.

"PFAS Immunotoxicity." *Environmental Working Group Press Briefing*. Virtual Talk. 2020.

"Forever Chemicals." *Tell me about it Tuesdays, Sound Rivers Science Series.* Virtual Talk. 2020.

"Why Uncovering Immunotoxicological Impacts of Understudied PFAS are Public Health Protective." *PharmTox Seminar, Michigan State University*, Virtual Seminar. 2020.

"Let's not Forget about the T in the PBMT of PFAS: An Overview of what we know about PFAS Toxicity." *EHSC 8030 Environmental Health Science, College of Public Health, University of Georgia*, Virtual Seminar. 2020.

"What can Science tell us about Potential Health Effects of PFAS found in NC: Why Understanding Effects of PFAS on the Immune System is Important." *PFAST Network Webinar*. 2020.

"PFAS 101: A 10-minute Primer on Per- and Polyfluoroalkyl Substances." *NAS Virtual Workshop on Federal Government Human Health PFAS Research.* 2020.

"Immune Investigations of some of the Understudied PFAS found in the Cape Fear River." *NC Coastal Federation Emerging Contaminants in North Carolina Waters*, Virtual Seminar. 2020.

"Immunotoxicological Evaluation of Understudied Per- and Polyfluoroalkyl Substances found in North Carolina." *WVU Microbiology & Women in Biomedical Science Seminar,* Virtual Seminar. 2020.

"PFAS: Why Immune Effects are Relevant Points of Departure for these Multisystem Toxicants." *M-LEEaD Virtual Mini-Symposium on Per- and Polyfluoroalkyl Substances (PFAS): Exposure, Toxicity, and Policy at the University of Michigan*, Virtual Seminar. 2020.

"Why Uncovering Immunotoxic Outcomes of PFAS can be a Health Protective Strategy." *Department of Environmental Medicine, NIEHS Environmental Health Sciences Center Seminar Series, University of Rochester*, Virtual Seminar. 2020.

"From Inert to Adverse: What we've learned about PFAS Toxicity in the Past Two Decades." *VME4906 Intro to Water Analysis, University of Florida Gainesville*, Virtual Lecture. 2020.

"Immunotoxicity of PFAS: Functional Toxicological Outcomes to Support Decision-Making." *Air & Waste Management Association, The Science of PFAS, Chemistry, Health and Multimedia Measurements,* Virtual Conference. 2020.

"(Eco)toxicology of PFAS: A few Highlights." *Europe's PFAS Problem: Situation Briefings by Independent Experts, European Environmental Bureau,* Virtual Webinar. 2020.

"What are PFAS and why should you care about them?" *Climate Action NC*, Virtual Public Meeting. 2020.

"Mechanisms of Toxicity for Per- and Polyfluoroalkyl Substances: Are we there yet?" *Chemical Exposures and Impact on Health, ACS Fall 2020 Virtual Meeting & Expo,* Virtual Meeting. 2020.

"Biomarkers of Immunotoxicity and Applicability to PFAS and other Environmental Toxicants," *Predicting Human Health Effects from Environmental Exposures: Applying Translatable and Accessible Biomarkers of Effect – A NAS Workshop, National Academies of Science,* Virtual Workshop. 2020.

"Developmental Immunotoxicology." *Society for Birth Defects Research and Prevention Annual Meeting,* Virtual Meeting. 2020.

"Bringing Scientific Evidence to Meet Local Policy Challenges," Session Panelist, *American Association of the Advancement of Science Annual Meeting*, Seattle, WA. 2020.

"Approaches to Understand Health Risks of Understudied PFAS." *Environmental Health Collaborative 2019 Summit on "PFAS: Integrating Science and Solutions in NC."* Durham, NC. 2019.

"An Overview of how PFAS are Toxic with the Immune System as a Specific Example." *Michigan Society of Toxicology Fall 2019 Meeting on "PFAS Exposure and Toxicology in Michigan and Beyond."* Ann Arbor, MI. 2019

"Addressing Public Health Concerns about PFAS: Focus on Immunotoxicology." *Purdue University, Chemical Exposure Research Area, Center for the Environment and School of Health Sciences Seminar Series.* Lafayette, IN. 2019.

"Immunotoxicological Findings of PFAS: Consistency of Effects between Humans and Rodent Models." *SETAC North America Focused Topic Meting: Environmental Risk Assessment of PFAS.* Durham, NC. 2019.

"Per- and Polyfluoroalkyl Substances (PFAS): A Lifecycle Perspective." *The Toxicology Forum Summer Meeting*. Alexandria, VA. 2019.

"What can PFAS do to our Health?" *North Carolina Museum of Natural Sciences Science Café: "Toxic Chemicals and Human Health*." Raleigh, NC. 2019.

"Immunotoxicological Findings of PFAS: Consistency of Effects between Rodent Models and Humans." *2019 Per- and Polyfluoroalkyl Substances: Second National Conference*. Northeastern University. Boston, MA. 2019.

"PFAS Testing Network: Team #5: Other Applied R&D." *What's in our Water? A Public Forum on Emerging Contaminants*. NC Coastal Federation. Wilmington, NC. 2019.

"Per- and Polyfluoroalkyl Substances are Immunotoxic: What does this mean for Public Health Protection?" *Environmental and Molecular Toxicology Seminar Series*, Oregon State University. Corvallis, OR. 2019.

"An Overview of what we know about PFAS Toxicology." *PFAS and Other Emerging Contaminants Conference*. American Council of Engineering Companies of North Carolina and Groundwater Professionals of North Carolina. Raleigh, NC. 2019.

"Developmental Immunotoxicology." *American College of Toxicology and Teratology Society Practical Reproductive and Developmental Toxicology*. Gaithersburg, MD. 2019.

"PFAS Toxicity." *North Carolina Waterworks Operators Association Lab Technology Day*. Raleigh, NC. 2019.

"PFAS and Health: What we've learned in the Past Two Years." *Center for Human Health and the Environment Third Annual Symposium*. North Carolina State University, Raleigh, NC. 2019.

"Three Reasons that Per- and Polyfluoroalkyl Substances do not belong in our Bodies." *University of North Carolina Wilmington Department of Chemistry and Biochemistry Seminar*, Wilmington, NC. 2019.

"PFAS Exposure: What are the Health Implications?" *Cape Fear Public Utility Authority Board Workshop*, Wilmington, NC. 2018.

"Impact of Early-Life Environmental Factors on the Developing Immune system." *PPTOX VI*, Faroe Islands. 2018.

"Health Effects of GenX: What do we know and what do we need to know to Protect Public Health?" *45th Annual Meeting of the Cape Fear River Assembly*, Wilmington, NC. 2018.

"How do we know Whether a Chemical is Toxic?" *Osher Lifelong Learning Institute Sea & Coffee Series*, University of North Carolina at Wilmington, Wilmington, NC. 2018.

"PFASs, AFFFs, PFAAs: An Alphabet Soup of Emerging Aquatic Contaminants with Immunotoxic Potential." *NCSU Toxicology Program Seminar Series*, North Carolina State University, Raleigh, NC. 2018.

"How Per- and Polyfluoroalkyl Substances (PFASs), as EDCs, can Fool the Developing Brain's Immune System." *EDC-NC Annual Meeting*. RTP, NC. 2018.

"Research Challenges Associated with PFASs: Ubiquitous Multisystem Toxicants." *The Toxicology Forum Winter Meeting*. Washington DC. 2018.

"Environmental Triggers of Underlying Neuroimmune Susceptibilities: Critical Events in Development." *Webinar*, Autism Research Institute. 2018.

"Are Replacements for the Legacy PFASs Indisputably Safe Alternatives?" *Webinar*, Toxic-Free Future. 2018.

"Per and Polyfluoroalkyl Substances: Complex Chemicals that Challenge Policies for Environmental Health Protection and Risk Communication." *Brown Bag Lunch*, RTI International, RTP, NC. 2018.

"From Legacies to Alternatives: What we know and what we need to know about the Toxicity of Per- and Polyfluoroalkyl Substances." *Weekly Seminar*, NC Department of Health and Human Services, Raleigh, NC. 2017.

"The Never-Ending Story of Per- and Polyfluoroalkyl Substances: Immunotoxicity from Legacies to Alternatives." *Mid Atlantic Society of Toxicology Annual Meeting*, Edison, NJ. 2017.

"A Potential Never-Ending Story of Chemical Water Pollution in LMICs: Proliferation of Legacy and Replacement PFASs." *International Society of Exposure Science*, Research Triangle Park, NC. 2017.

"The Science behind GenX." *Water Wednesday*, Clean Cape Fear, Wilmington, NC. 2017.

"Is it Possible to Untangle Underlying Developmental Susceptibilities from Exogenous Triggers in ASD?" *Autism Think Tank*, Autism Research Institute, Dallas-Fort Worth, TX. 2017.

"Urgent Research Needs for Better Understanding the Toxicity of PFASs." *Northeast Superfund Research Program Meeting*, Northeastern University, Boston, MA. 2017.

"Emerging Toxicological Knowledge and Data Gaps for "Novel" PFASs." *Public Workshop on Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) in Carpets, Rugs, Indoor Upholstered Furniture, and Their Care and Treatment Products*, Safer Consumer Products Program, Department of Toxic Substances Control, California Environmental Protection Agency, Sacramento, CA. 2017.

"Pharmaceuticals and Personal Care Products as Emerging Pollutants in Coastal Waters (with Dr. Siddhartha Mitra). *Science on the Sound Symposium*, Coastal Studies Institute, Wanchese, NC. 2017.

"Emerging Aquatic Contaminants and Health: Finding Solutions with Transdisciplinary Teams." Coastal Health Initiative, East Carolina University, Greenville, NC. 2016.

"Water Pollution: Is seeing believing?" *Love a Sea Turtle Second Annual Environmental Symposium*, River Park North, Greenville, NC. 2016.

"Developmental Immunotoxicology." *Middle Atlantic Reproduction and Teratology Association*, Covance Research Products, Inc., Denver, PA. 2015.

"A Little Bit of this and a Little Bit of that…How do we Understand Risks of Agents in just a Drop of Water?" *Love a Sea Turtle First Annual Environmental Symposium*, River Park North, Greenville, NC. 2015.

"Updates on Alzheimer's Disease Research in the DeWitt Lab at East Carolina University" (with Annalise vonderEmbse). *Senior Services Community Health Program*, Vidant Medical Center, Greenville, NC. 2015.

"Immunomodulatory Effects of Perfluoroalkyl Substances in Rodents and Humans." *Immunotoxicology in Food and Ingredient Safety Assessment: Approaches and Case Studies, SOT FDA Colloquia on Emerging Toxicological Science Challenges in Food and Ingredient Safety*, Washington, DC. 2015.

"Updates on Alzheimer's Disease Research in the DeWitt Lab at East Carolina University" (with Annalise vonderEmbse). *Alzheimer's Professional Partnership-Greenville*, Greenville, NC. 2015.

"From Sink to Sea: Evaluating Health Impacts of Pills and Perfumes after we Wash them away" (with Krista McCoy). *FaculTea Seminar*, East Carolina University, Greenville NC. 2014.

"Better Living through Chemistry: A Tale of Two Toxicants." *Department of Chemistry Seminar*, East Carolina University, Greenville, NC. 2014.

"The Nuts and Bolts of Interdisciplinary Toxicological Research" (with Christie Sayes). *Western Carolina University Department of Biology Spring Seminar Series*. Cullowhee, NC. 2014.

"Alzheimer's Disease and Neurodegenerative Disorders Research at East Carolina University" (with Annalise vonderEmbse). *Alzheimer's Professional Partnership-Goldsboro*, Goldsboro, NC. 2015.

"Endocrine Disruption of the Neuro-immune Interface." *The Collaborative on Health and the Environment Partnership Call* (Teleseminar). 2014
"Contaminated Drinking Water: A Case Study of Perfluorinated Compounds." *Coastal Water Resources Center*, East Carolina University, Greenville, NC. 2013.

"Villains and Heroes in the Battle for Clean Water" (with Siddhartha Mitra and Anthony Cannon). *STEM at Starlight*, Greenville, NC. 2013.

"The Nuts and Bolts of Alzheimer's Disease Research at East Carolina University." *Senior Services Community Health Program*, Vidant Medical Center, Greenville, NC. 2013.

"Alzheimer's Disease and Neurodegenerative Disorders Research at East Carolina University." *Alzheimer's Professional Partnership-Greenville*, Greenville, NC. 2013.

"A Neuroimmune Investigation of an Endocrine-Disrupting Compound". *Department of Biology Seminar*, East Carolina University, Greenville, NC. 2013.

"A Neuroimmune Investigation of an Endocrine-Disrupting Compound: How Bisphenol A may Disrupt Learning and Memory through Immunomodulation." *Endocrine Disrupting Chemicals Forum*, Research Triangle Park, NC. 2013.

"Undecafluoro-2-methyl-3-oxahexanoic Acid Versus Perfluorooctanoic Acid: Is Polyfluorination a Less Immunotoxic Option than Perfluorination?" *Department of Environmental and Molecular Toxicology Seminar*, North Carolina State University, Raleigh, NC. 2013.

"Early Life Triggers of Developmental Immunotoxicity." *Society for Toxicologic Pathology*, Annual Meeting, Denver, CO. 2011.

"Is the Pathway to Autism Paved with Environmental Chemicals?" *Department of Comparative Medicine seminar*. East Carolina University, Greenville, NC. 2011.

"PPAR Involvement in PFAA Immunotoxicity." *U.S. EPA PFAA Days III Workshop*, U.S. Environmental Protection Agency, Research Triangle Park, NC. 2010.

"Are Environmental Contaminants (Developmental) Immunotoxicants? A Case Study of a Fluorinated Compound." *Department of Microbiology and Immunology Seminar*, East Carolina University, Greenville, NC. 2010.

"Developmental Immunotoxicity of PFOA, an Emerging Contaminant." *Department of Biology Seminar*, East Carolina University, Greenville, NC. 2009.

"The Immunotoxicity of Perfluorooctanoic Acid (PFOA)." *Department of Physiology Seminar*, Brody School of Medicine, East Carolina University, Greenville, NC. 2008.

"Immunotoxic Potentials of PFOA." *U.S. EPA PFAA Days II Workshop*, U.S. Environmental Protection Agency, Research Triangle Park, NC. 2008.

"Chasing Down the Mechanism of Perfluorooctanoic Acid-Induced Immunomodulation: Knock-outs and Adrenalectomies." *National Health and Environmental Effects Research Laboratory Work in Progress*, U.S. Environmental Protection Agency, Research Triangle Park, NC. 2007.

"Wildlife Immunotoxicology." Immunotoxicology course. College of Veterinary Medicine, North Carolina State University. 2006.

"Immunotoxicity of Individual Organotin Compounds in Sprague-Dawley Rats." *Society for Risk Analysis* 25th Annual Meeting, Orlando, FL. 2005.

"Immune Function in Rats Exposed to Organotins as Adults or During Development." *National Health and Environmental Effects Research Laboratory Work in Progress*, U.S. Environmental Protection Agency, Research Triangle Park, NC. 2005.

"Brain Asymmetry in Domestic Hatchling Chickens Developmentally Exposed to TCDD: A Histological Examination." *Society of Environmental Toxicology and Chemistry* 24th Annual Meeting, Austin, TX. 2003.

"Service Learning and Scientific Research." Indiana University Community Outreach and Partnerships in Service-Learning Workshop, Indiana University, Bloomington, IN. 2004.

"Toxic Effects of Mercury." Clean Air Indiana Speak out on the Clear Skies Initiative, Indiana University, Bloomington, IN. 2003.

"Environmental Health Concerns for Toxics in Indiana Superfund Sites." Indiana Public Interest Research Group (INPIRG) Teach-In on Indiana Superfund Issues, Indiana University, Bloomington, IN. 2002.

"Introduction to Environmental Toxicology." Techniques in Environmental Science and Environmental and People courses. School of Public and Environmental Affairs, Indiana University-Bloomington. 2000, 2001, 2003.

"Bioaccumulation and Biomagnification of Environmental Chemicals in Colonial Fish-eating Waterbirds." Introduction to Environmental Sciences course. School of Public and Environmental Affairs, Indiana University-Bloomington. 2000 and 2001.

"Women in the Sciences: Abolishing Gender Apartheid." IU Skills for Leadership Conference, Office of Women's Affairs, Indiana University, Bloomington, IN. 1999.

ORAL PRESENTATIONS

"Developing an Understanding of the Effects of PFAS on the Immature Immune System." *Symposium on Developmental toxicity of per- and polyfluoroalkyl substances (PFAS): Current in vivo approaches and application to human health risk assessment, Society of Toxicology Annual Meeting*, Virtual Meeting. 2020.

"Immunotoxicity Evaluation as a Tool for Protecting Public and Environmental Health from PFAS." *Society of Environmental Toxicology and Chemistry* 40th Annual Meeting, Toronto, Ontario. 2019.

"Immunotoxicological Findings of an Aqueous Film-Forming Foam Formulation." *Society of Environmental Toxicology and Chemistry annual meeting*, Sacramento, CA. 2018.

"Perspectives from the AAMC Mid-Career Women Faculty Professional Development Seminar "MIDWIMS"). *Brody Women Faculty Committee*. Greenville, NC. 2017.

"Immunopathogenesis in Autism: Regulatory T Cells and Markers of Autoimmunity in Mice Developmentally Exposed to Perflurooctanoic Acid (PFOA). *27th Annual NeuroToxicology Conference*, Annual Meeting, Durham, NC. 2011.

"PFOA-induced Immunomodulation in mice: An Overview." *Society of Toxicology* 48th Annual Meeting, Baltimore, MD. 2009.

"Pathways of PFOA-mediated Immunosuppression." *Society of Toxicology* 48th Annual Meeting, Baltimore, MD. 2009.

"Dose-response of Perfluorooctanoic Acid-Induced Immunomodulation in Adult C57BL/6 Mice." *Society of Toxicology* 46th Annual Meeting, Charlotte, NC. 2007.

"Immune Function in Rats Developmentally Exposed to Dibutyltin Dichloride." *Society of Toxicology* 45th Annual Meeting, San Diego, CA. 2006.
"Neurotoxic Effects in Avian Species: Implications for Human and Ecological Health." School of Public and Environmental Affairs *2nd Annual Young Researchers Conference*, Indiana University, Bloomington, IN. 2002.

"TCDD-Induced Brain Asymmetry and Behavior: What do Individual Chicks Have to Say?" *Ohio Valley Chapter of the Society of Environmental Toxicology and Chemistry*, Hueston Woods State Park, College Corner, OH. 2000.

"Behavioral and Morphological Changes in Domestic Chicks Exposed to TCDD or PCB-126 at Embryonic Day 0 or Embryonic Day 4." *Ohio Valley Chapter of the Society of Environmental Toxicology and Chemistry*, Indiana University, Bloomington, IN. 1997.

"Behavioral Changes in Domestic Hatchling Chicks Exposed to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) *in ovo*." *Conference on Chlorine in the Environment*, Massachusetts Institute of Technology, Boston, MA. 1996.

"Behavioral Assessment of Hatchling Chicks Exposed to TCDD *in ovo*: Preliminary Results." *Great Lakes Bioeffects Workgroup*. Wright State University, Dayton, OH and *Ohio Valley Chapter of the Society of Environmental Toxicology and Chemistry*, Eastern Kentucky University, Richmond, KY. 1996.

CONTINUING EDUCATION COURSES

Mid-Career Women Faculty Leadership Development Seminar
Stress as a Confounding Factor in Toxicology Studies
Rodent Pathology (Immunopathology)
Basic Embryology and Developmental Toxicology
Grants 101: Professional Grant Writing Workshop
Immunology for Toxicologists
Risk Communication for the General Public
Estrogen Mimics in Health and Disease
Methods for Assessment of Neurotoxicity

PROFESSIONAL ORGANIZATIONS

2019-present	The Toxicology Forum
2017-2018	International Society of Exposure Science
2009-Present	Carolinas Society of Environmental Toxicology and Chemistry
2005-Present	Society of Toxicology (SOT)
2005-Present	North Carolina Chapter of the Society of Toxicology
1997-Present	Society of Environmental Toxicology and Chemistry (SETAC)
1996-2004	Ohio Valley Chapter of the Society of Environmental Toxicology and Chemistry
1996-2004	Great Lakes Bioeffects Workgroup

AWARDS AND HONORS

- *Engagement and Outreach Scholars Academy Scholar*, East Carolina University, Office of Community Engagement and Research. 2019-2020.
- *The Faculty Mentor Award*, East Carolina University Honors College. 2017.
- *Outstanding Young Investigator Award*, Immunotoxicology Specialty Section, Society of Toxicology. 2013.
- *Outstanding Teaching Award*, School of Public and Environmental Affairs, Indiana University. 1999 and 2002.
- *Future Faculty Teaching Fellowship*, Preparing Future Faculty program, Indiana University. 2002.

- *Marian Vinegar Award*, Outstanding Student Presentation at the annual meeting, Ohio Valley Chapter of the Society of Environmental Toxicology and Chemistry. 2000.
- *Outstanding Educational Volunteer*, Monroe County Humane Association, Bloomington, IN. 2000.
- *Outstanding Student Poster Award*, Society of Environmental Toxicology and Chemistry 19th Annual Meeting (3rd place). 1998.
- *Teaching Excellence Recognition Award*, School of Public and Environmental Affairs, Indiana University. 1998.

PROFESSIONAL PRACTICE

North Carolina Secretaries Science Advisory Board Member, NC Department of Environmental Quality (DEQ) and NC Department of Health and Human Services (DHHS). 2019-present.

- Charged with advising the DEQ and DHHS on toxicological effects of contaminants and levels of control necessary for protection of human health and the environment.

North Carolina Cancer Advisory Research Panel Member, NC Policy Collaboratory. 2019-2020.

- Charged by the NC General Assembly with recommending strategies for assessing cancer incidence and mortality rates with respect to temporal and spatial patterns within NC.

Tennessee PFAS External Advisory Group Member, Tennessee Departments of Environment and Conservation and Health. 2019-present.

- Charged with informing the state of Tennessee about PFAS, including compound characteristics, identification, sampling and measurement, remediation, etc.

U.S. House of Representatives Congressional Testimony. 2019, 2021.

- Committee on Energy and Commerce, *Subcommittee on Environment and Climate Change*, "Protecting Americans at Risk of PFAS Contamination and Exposure." May 15, 2019.
- Committee on Oversight and Reform, *Subcommittee on Environment*, "The Devil they Knew – PFAS Contamination and the Need for Corporate Accountability." July 24, 2019.
- Committee on Appropriations, *Subcommittee on Military Construction, Veterans Affairs, and Related Agencies,* "Remediation and Impact of PFAS." March 24, 2021.

Michigan Science Advisory Workgroup Member, Michigan PFAS Action Response Team (MPART). 2019.

- Charged with advising the state of Michigan on Maximum Contaminant Level recommendations for PFAS.

PFAS Testing Network Executive Advisory Committee Member and Team 5 Co-Lead, NC Policy Collaboratory. 2018-present.

- Responsible for advising the Network on addressing occurrence and effects of PFAS in drinking water resources in the state of NC.
- Responsible for co-leading Team 5 (with Dr. Rebecca Fry from University of North Carolina at Chapel Hill) charged with addressing "other research opportunities" for understanding PFAS in NC.

Workshop Participant, Sustainability consequences of chemical exposures: connecting environment, health, and economic assessments. Organized by the European Environmental Agency, Copenhagen, Denmark. June 2018.

- Panelist representing the toxicological sciences.

Global PFAS Science Panel Member. Established from the co-authors of the Zurich Statement (Ritscher et al., 2018). 2017-present.

- Group of academic and government scientists dedicated to fostering development of high-quality scientific research, stewarding information exchange, and coordinating advancement of science and policy to address the class of per- and polyfluoroalkyl substances (PFASs) as a global concern.

Plaintiff Expert Witness, various organizations, to provide toxicological expertise regarding per- and polyfluoroalkyl substances (PFAS).

- Natural Resource Damage Assessment (NRDA) claim by the state of Minnesota against a major corporate entity. November 2016-February 2018. Claim for $5 billion; settled for $850 million. Third largest NRDA claim in U.S. history. Deposed but did not testify.
- Involved in several other ongoing cases.

Pro-bono Consultation, various environmental protection and advocacy organizations, 2015-present.

- Provide scientific interpretation and opinion regarding toxicity of per- and polyfluoroalkyl substances to individual community members as well as organizations.
- Organizations include *California Environmental Protection Agency, Cape Fear Public Utility Authority, Center for Environmental Health, Green Science Policy Institute, Massachusetts Toxic Use Reduction Program, Silent Spring Institute, and Toxic Free Future.*

Workshop Participant, Is the European Food Safety Authority (EFSA) standard for bisphenol A sufficiently protective of the immune system and should the Dutch government consider a different standard? Organized by representatives of RIVM (National Institute for Public Health and the Environment), Amsterdam, The Netherlands. September 2015.

- Provided immunotoxicological guidance for regulatory consideration of bisphenol A (BPA).

Consultant, CZR Incorporated, Wilmington, NC. May-July, 2014-2019.

- Provided toxicological interpretation of stream water quality monitoring data for heavy metals.

Technical Advisor, Office of Health Assessment and Translation (OHAT), National Toxicology Program, National Institute of Environmental Health Sciences. March 2013. March 2015. April 2016.

- Evaluated OHAT protocol for evaluation of PFOS-PFOA immunotoxicity.

External Peer Reviewer, U.S. Environmental Protection Agency, External peer review of EPA's Draft Health Effects Documents for Perfluorooctanoic acid (PFOA) and Perfluorooctane Sulfonate (PFOS). 2014.

- Scientific peer reviewer of the health effects documents. Nominated and selected.

Working Group Member, International Agency for Research on Cancer (IARC), IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 110: Perfluorooctanoic acid, Tetrafluoroethylene, Dichloromethane, 1,2-Dichloropropane, and 1,3-Propane sultone. 2014.

- Member of Mechanistic and Other Relevant Data Working Group for perfluorooctanoic acid and tetrafluoroethylene. Invited.

Consultant, Constella Group, LLC, Durham, NC. October 2004-December 2005.

- Summarized immunotoxicology of atrazine for the National Toxicology Program's Report on Carcinogens.

Consultant, Henshel EnviroComm, Bloomington, IN. June 1999-May 2004.
- Representative of the Restoration Advisory Board for Jefferson Proving Ground (Department of Defense) through the Technical Assistance for Public Participation program.
- Interpreted risk assessment documents associated with base clean-up for the general public.

Consultant, Dinosaur Inc., Bloomington, IN. June 2000-September 2000.
- Summarized the potential health and environmental effects of land-applied paper mill sludge.

Consultant, Integrated Pest Management in Schools and Childcare Centers, School of Public and Environmental Affairs Information Clearinghouse, Bloomington, IN. April 2000-September 2000.
- Summarized the potential health effects of pesticides commonly used in schools and childcare centers.

Co-Director, *Summer Program for Exploration of Complex Issues in Environmental Science for Teachers (SPECIES-Teachers)* and *Environmental Education 99*, School of Public and Environmental Affairs, Indiana University, Bloomington, IN. Summer 1999 and 2001.
- Directed hands-on environmental science summer field workshop for Indiana teachers.

Consultant, Brownstown Elementary Fourth Grade, Brownstown, IN. September 1999-May 2000.
- Served as environmental science expert during weekly videoconferences in a "students as environmental scientists" program.

Associate Director, *Research Experience for High School Students*, College of Arts and Sciences, Indiana University, Bloomington, IN. February 1999-October 1999.
- Mentored high school students participating in research in university laboratories, provided weekly counseling, and oversaw development of final research reports and presentations.

Co-Director, *Environment 98* and *Environment 99*, School of Public and Environmental Affairs, Indiana University, Bloomington, IN. Summer 1998 and 1999.
- Directed hands-on environmental science summer field workshop for Indiana students.

Chemical Safety Assistant, Office of Radiation, Chemical and Biological Safety, Michigan State University, East Lansing, MI. August 1993-June 1995.
- Developed Michigan State University's Chemical Hygiene Plan, performed university-wide laboratory safety inspections, and trained new science employees in chemical and laboratory safety.

TEACHING EXPERIENCE

Instructor, East Carolina University

- Pandemic Crisis Management. Third year medical students (small group facilitator). 2020.
- Practical Problems in Biometry. Graduate (course director). 2010-2020 (co-director 2021).
- General Toxicology. Graduate (course co-director). 2009-present.
- Advanced Toxicology. Graduate (course co-director). 2016-present.

- Medical Pharmacology. Graduate physician assistant students (topical: endocrine pharmacology, toxicology). 2010-2018.
- Medical Pharmacology. Second year medical students (topical: endocrine pharmacology, toxicology). 2012-present.
- Pharmacology Mini-Course. First and second year dental students (topical: toxicology, management of poisoned patients, endocrine pharmacology, pharmacokinetics I & II; variable and shared among other instructors). 2012-present.
- Foundations of Medicine/Problem Based Learning Mini-Course. First and second year medical students (small group facilitator). 2011-2013.
- Foundations of Medicine/PirateMD. First and second year medical students (small group facilitator). 2013-2019.

Instructor, Indiana University

- Analytical Problem Solving (statistics). Undergraduate, honors, 2 semesters.
- Environment and People. Undergraduate (co-instructor), 1 semester.
- Introduction to Statistical Techniques. Undergraduate, 1 semester.
- Introduction to Environmental Sciences. Undergraduate, 1 semester.
- Environmental Risk Analysis. Graduate, 1 semester.
- Outdoor Environmental Awareness (Public land management). Undergraduate recruitment course, 6 semesters.
- Introduction to Risk Assessment and Risk Communication. Undergraduate, 1 semester.
- Environmental Toxicology. Combined undergraduate/graduate, 1 semester.
- Techniques in Environmental Science (field/lab techniques). Undergraduate, 3 semesters.

Teaching Assistant/Coordinator, Indiana University

- Aquatic Habitat Analysis (field techniques). Combined undergraduate/graduate, 3 semesters.
- Terrestrial Habitat Analysis (field techniques). Combined undergraduate/graduate, 3 semesters.
- Environmental Toxicology. Undergraduate and graduate, 3 semesters.
- Teaching Assistant and Undergraduate Teaching Intern Training Workshop. Combined undergraduate and graduate, 6 sessions.

Laboratory Mentor, East Carolina University

High school students

- Abigail Yoon and Andrew Gallagher, Medical Honors Program (high school laboratory research). Project: Body and liver weight changes in rodents exposed to a binary PFAS mixture (virtual). 2020-2021.
- Javier Limon and John Mallett, Medical Honors Program (high school laboratory research). Project: Liver lipid accumulation in livers from rodents exposed to PFAS. 2019-2020.
- Catherine Wondra and Anushka Nandy, Summer Ventures Program (high school laboratory research). Project: Liver lipid accumulation in livers from rodents exposed to PFAS. 2019.
- Alex Beaver and Margarita Anayiotou, Summer Ventures Program (high school laboratory research). Project: Neuroinflammation in a rodent model of Gulf War Illness. 2018.
- Allison Gallagher and Sophie Villani, Medical Honors Program (high school laboratory research). Project Developmental effects of pharmaceutical pollutants in an avian model. 2017-2018.
- Sunnie Li and Alex Reulbach, Summer Ventures Program (high school laboratory research). Project: Neuroinflammation in a rodent model of Gulf War Illness. 2017.
- Matthew Clayton, high school laboratory research for the NC Science Fair. Project: Developmental effects of pharmaceutical pollutants in an avian model. 2016.

- Virginia Billings, Summer Ventures Program (high school laboratory research). Project: Developmental effects of pharmaceutical pollutants in an avian model. 2016.
- Jaein Yoon, Medical Honors Program (high school laboratory research). Project: Developmental effects of pharmaceutical pollutants in an avian model. 2015-2016.
- Chevonne Parker, Summer Ventures Program (high school laboratory research). Project: Neuronal T-cell infiltration following developmental trichloroethylene exposure. 2015.
- Catherine Taylor and Jessi Zhou, Medical Honors Program (high school laboratory research). Project: Microglial responses in an Alzheimer's mouse model developmentally exposed to lead. 2014-2015.
- Janelle Neal, Summer Ventures Program (high school laboratory research). Project: Microglial responses following inhalation exposure to natural dusts. 2014.
- Brian Alloway, Medical Honors Program (high school laboratory research). Project: Peroxisome proliferation in livers of C57BL/6 mice exposed to undecafluoro-2-methyl-oxahexanoic acid (U2M3-OHxA) gavage. 2013-2014.
- Kortney Wager, Summer Ventures Program (high school laboratory research). Project: Developmental effects of BPA on immune responses. 2013.
- Brian Ennis and Jonathan Reed, Medical Honors Program (high school laboratory research). Project: Teratogenicity of PFOS in early chicken embryos. 2012-2013.
- Willa Chen, Summer Ventures Program (high school laboratory research). Project: Developmental effects of PFOA in primary cardiomyocyte cultures from chickens. 2012.
- Elizabeth Fox and Samantha Rouse, Medical Honors Program (high school laboratory research). Project: Teratogenicity of PFOS in early chicken embryos. 2011-2012.
- Pranavi Sanka, Summer Ventures Program (high school laboratory research). Project: Developmental effects of PFOS: T cell infiltration into mouse brains. 2011.
- Erin Morris and Andrew Wood, Medical Honors Program (high school laboratory research). Project: Developmental effects of PFOA on T cell infiltration and myelin basic protein levels in mouse brains. 2010-2011.
- Jillian Loftis, Summer Ventures Program (high school laboratory research). Project: Developmental effects of PFOA on glycogen deposition in a chicken model. 2010.
- Clarissa Morrissey, Medical Honors Program (high school laboratory research). Project: Teratogenicity of PFOA in early chicken embryos. 2009-2010.
- Taylor Brundage, Summer Ventures Program (high school laboratory research). Project: Developmental teratogenic effects of PFOA in a chicken model. 2009.
- Ian Bryan, Medical Honors Program (high school laboratory research). Project: Developmental effects of PFOA on liver glucocorticoid receptor levels, and pancreatic alpha and beta cells in a mouse model. 2008-2009.

Undergraduate students

- Elizabeth Suter, Biology (undergraduate laboratory research): Cellularity of wing webs of two-week old chickens developmentally treated with fluoxetine. 2020.
- Jasmine Clark, University Studies (undergraduate laboratory research): PFAS as air pollutants. 2019-.
- Jeffery Ayala, and Mark Ibrahim, Program in Neuroscience (undergraduate laboratory research): Microglial morphology in a rodent model of Alzheimer's disease. 2018-.
- Payton Anders, Jeffery Ayala, and Mark Ibrahim, Program in Neuroscience (undergraduate laboratory research): Microglial morphology in a rodent model of Alzheimer's disease. 2018.
- Alexis Liberatore, Program in Neuroscience (undergraduate laboratory research): Glucocorticoid receptor expression in avian brains following developmental exposure to pharmaceutical pollutants. 2018-2019.

- Kathleen Ferris, Biology (undergraduate laboratory research): Peroxisome proliferation in livers of rodents exposed to aqueous film forming foam. 2018-2019.
- Robert Strickland, General Studies/Program in Neuroscience (undergraduate laboratory research). Project: Neuroinflamamtion in a rodent model of Gulf War Illness. 2017.
- Chastity Ward, Summer Biomedical Research Program (undergraduate laboratory research). Project: Immunotoxic effects of AFFF in a rodent model. 2017.
- Christopher Hamby, Mutidisciplinary Studies Program in Neuroscience (undergraduate laboratory research/senior thesis advisor). Project: Microglial morphology in a rodent model of Gulf War Illness. 2016-2017.
- Ishmael Gomez, Summer Biomedical Research Program (undergraduate laboratory research). Project: DAP12 microglial signaling in a rodent model of Alzheimer's disease. 2016.
- Brianna Davidson, Multidisciplinary Studies Program in Neuroscience (undergraduate laboratory research). Project: Synaptic degeneration in a rodent model of Alzheimer's disease. 2016.
- Samuel Vance, Mutidisciplinary Studies Program in Neuroscience (undergraduate laboratory research/senior thesis advisor). Project: Project: Post-translational modifications and Alzheimer's pathology. 2015-2017.
- Waeya Lin, Summer Biomedical Research Program (undergraduate laboratory research). Project: Exacerbation of Alzheimer's pathology by prenatal exposure to lead; Dystrophic microglia. 2015.
- Giovana Fernanda Cosi Bento, Brazil Scientific Mobility Program (undergraduate laboratory research). Project: Exacerbation of Alzheimer's pathology by prenatal exposure to lead; Synaptosomes. 2015.
- Zoe Hinton, Mutidisciplinary Studies Program in Neuroscience (undergraduate laboratory research/senior thesis advisor). Project I: Exacerbation of Alzheimer's pathology by prenatal exposure to lead; Synaptosomes. 2015. Project II: Microglial morphology in a rodent model of Gulf War Illness. 2016-2017.
- Andrew Wood, Biology (undergraduate honors thesis advisor). Project: Exacerbation of Alzheimer's pathology by prenatal exposure to lead; Measurement of amyloid beta. 2014-2015.
- Dakota Johnson, Biology (undergraduate honors thesis advisor). Project: Exacerbation of Alzheimer's pathology by early-life exposure to lead; Measurement of amyloid beta. 2013-2014.
- Sydney Henry, Summer Biomedical Research Program (undergraduate laboratory research). Project: Neurotoxic effects of dust collected from the Nellis Dunes Recreation Area. 2014.
- Andrew Wood, Biology undergraduate student. Project: Developmental effects of BPA on serum IL-4 and IgG. 2013.
- Dominique Baldwin, Biology undergraduate student. Project: Neurotoxic effects of dust collected from the Nellis Dunes Recreation Area. 2013.
- Megan Biller, Summer Biomedical Research Program (undergraduate laboratory research). Project: Microglia in Alzheimer's-prone triple transgenic mice. 2013.
- Blake Rushing, Summer Biomedical Research Program (undergraduate laboratory research). Project: Blood distribution, urinary excretion, and T cell-dependent immunotoxicity of undecafluoro-2-methyl-oxahexanoic acid (U2M3-OHxA) in C57BL/6 mice exposed via gavage. 2012.
- Alvin-Ming-Yun Tsang, Psychology (undergraduate honors thesis advisor). Project: Developmental effects of nanoparticles in a rodent model. 2011-2012.
- Nick Creech, Summer Biomedical Research Program (undergraduate laboratory research). Project: Immunological effects of PFOA on a T-cell independent antigen (DNP-Ficcol) in an adult mouse model. 2010-2011.
- Hatel Patel, Biochemistry undergraduate student. Project 1: Developmental effects of PFOA on liver peroxisomes proliferation in a chicken model. Project 2: Effects of PFOA on myelin basic protein levels in the brains of developmentally-exposed mice. 2009.

- Ian Bryan, Biology and Chemistry undergraduate student. Project: Developmental effects of PFOA and PROS in a chicken model, including early embryo teratogenesis and hatchling glycogen levels. 2009-2012.

Master's students
- Erica Stewart, Biomedical Sciences Master's Student. Project: Developmental immunotoxicological effects of PFAS. 2020-.
- Emma Tobin, Biomedical Sciences Master's Student. Project: Immunotoxicological effects of PFAS of emerging concern in the Cape Fear River. 2019-.
- Samuel Vance, Biomedical Sciences Master's Student. Project: Immunotoxicological effects of PFMOAA, a contaminant of emerging concern in the Cape Fear River. 2018-2019.
- Carmen Davis, Environmental Health Master's Student. Project: Developmental effects of Triclosan in an avian model. 2015-2016.
- Cory Boles, Biomedical Sciences Master's Student. Project: Exacerbation of Alzheimer's pathology by early-life exposure to lead. 2013-2015.
- Annalise vonderEmbse, Biomedical Sciences Master's Student. Project: Exacerbation of Alzheimer's pathology by early-life exposure to lead; Effects on microglia. 2012-2014.

Doctoral students
- Krystal Taylor, Pharmacology and Toxicology Ph.D. Student. Project: Mechanisms of B-cell directed immunotoxicity of PFAS. 2020-.
- Jacqueline Meadows, Pharmacology and Toxicology Ph.D. Student. Project: Developmental effects of pharmaceutical pollutants in an avian model. 2015-2019.
- Annalise vonderEmbse, Pharmacology and Toxicology Ph.D. Student. Project: Exacerbation of Alzheimer's pathology by early-life exposure to lead; Effects on microglia. 2014-2017. Currently a postdoctoral trainee with Dr. Pam Lein at the University of California-Davis.
- Jason Franklin, Pharmacology and Toxicology Ph.D. Student. Project: Developmental neuroimmunotoxicity of bisphenol a in a rodent model. 2010-2014. Currently a postdoctoral trainee in neurotoxicology at the U.S. Environmental Protection Agency.
- Qixiao Jiang. Pharmacology and Toxicology Ph.D. Student. Project: Developmental cardiotoxicity of perfluorinated compounds in an avian model. 2009-2013. Currently an assistant professor at Qingdo University.

Medical students
- Amie McPherson and Danesh Ghiassi, Medical students. Project: Isolation and stimulation of regulatory T cells from spleens of PFOA-exposed mice. 2009.

Postdoctoral Scholars
- Dr. Tracey Woodlief. Project: Immunotoxicological mechanisms of PFAS. 2019-2020.

Research Instructor
- Dr. Tracey Woodlief. 2021-.

Advisory, East Carolina University

- Rebecca Nickle, Microbiology and Immunology Master's Student (Thesis committee; Advisor: Mark Mannie). 2020-.
- Christopher Norton, Microbiology and Immunology Master's Student (Thesis committee; Advisor: Isabelle Lemasson). 2019-2020.

- Heidi Knecht and Danielle Carter, Public Health Ph.D. Students (Dissertation committee; Advisor: Stephanie Richards). 2018-2020.
- Megan Rhyne, Environmental Health and Health Education & Promotion Master's Student (Thesis committee; Advisor: Stephanie Richards). 2018.
- Dariel Hopersberger, Microbiology and Immunology Ph.D. Student (Dissertation committee; Advisor: Marty Roop). 2018-
- Alexandra Hayes, Microbiology and Immunology Master's Student (Thesis committee; Advisor: Rachel Roper). 2018-2019.
- Kayla DeOca, Microbiology and Immunology Ph.D. Student (Dissertation committee; Advisor: Mark Mannie). 2018-
- Henry Raab, Coastal Resource Management Ph.D. Student (Dissertation committee; Advisor: Joe Luczkovich). 2017-2020.
- Ariel Myers, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Rukiyah Van Dross). 2017-
- Khoa Do, Biomedical Sciences Master's Student (Thesis committee; Advisor: Hu Huang). 2016-2017.
- John Atkinson, Biology Master's Student (Thesis committee; Advisor: David Rudell). 2015-2016.
- Blake Rushing, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Mustafa Selim). 2015-2018.
- Ahmed Aldhafiri, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Ken Soderstrom). 2014-2019.
- Jason Hoggard, Biomedical Sciences Master's Student (Thesis committee; Advisor: Lance Bridges). 2014-2015.
- Matthew Edwards, Biology Master's Student (Thesis committee; Advisor: Krista McCoy). 2014-2015.
- Bevin Blake, Biology Master's Student (Thesis committee; Advisor: Krista McCoy). 2013-2015.
- Anastasia Weeks, Microbiology and Immunology Master's Student (Thesis committee; Advisor: Mark Mannie). 2013-2017.
- Samar Rezq, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Abdel Abdel-Rahman). 2013-2016.
- Partha Nagchowdhuri, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Brian McMillen). 2013-2018.
- Suelen Demor, Biology Ph.D. Student (Dissertation committee; Advisor: David Chalcraft). 2013-2017.
- Tessa Holland, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Ken Soderstrom). 2013-2019.
- Samantha Sellers, Anatomy and Cell Biology Ph.D. Student (Dissertation committee). 2013.
- Alvin Ming-Yun Tsang, Psychology Undergraduate Student (Honors Thesis Advisor). 2011-2012.
- Abdullah Aldossari, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Jared Brown). 2011-2018.
- Michael Smith, Biology Master's Student (Thesis committee; Advisor: Xiaoping Pan). 2010-2011.
- Pranita Katwa, Pharmacology and Toxicology Ph.D. Student (Dissertation committee; Advisor: Jared Brown). 2009-2012.

PROFESSIONAL SERVICE

Scientific Community

- Co-Chair, Timing is Everything: Developmental Exposure Alters the Path of Immune Cell Maturation and Function continuing education course. 2020 Annual Meeting, Society of Toxicology, Virtual.
- Society of Toxicology Faculty United for Toxicology Undergraduate Recruitment and Education (FUTURE) Committee. 2019-present.
- Past-President, Society of Toxicology Immunotoxicology Specialty Section. 2019-2020.
- Chair, Program Planning Committee, The Toxicology Forum 45th Annual Summer Meeting (2019), Alexandria, VA.
- Co-Chair, Advanced Immunotoxicity Testing continuing education course. 2019 Annual Meeting, Society of Toxicology, Baltimore, MD.
- President, Society of Toxicology Immunotoxicology Specialty Section. 2018-2019.
- Co-Chair, Introduction to Immunotoxicity Testing continuing education course. 2018 Annual Meeting, Society of Toxicology, San Antonio, TX.
- Society of Toxicology Career Resource and Development Committee. 2018-2019.
- Society of Toxicology Specialty Section Collaboration and Communication Group. 2017-2019.
- Vice-President, Society of Toxicology Immunotoxicology Specialty Section. 2017-2018.
- Program Planning Committee, Volunteers Sub-committee, 2017 Annual Meeting, Society of Environmental Toxicology and Chemistry. 2016-2017.
- Vice-President Elect, Society of Toxicology Immunotoxicology Specialty Section. 2016-2017.
- Program Committee, Society of Toxicology Immunotoxicology Specialty Section. 2015-2016.
- Moderator for Toxicology, Epidemiology, and Human Health session, FLUOROS 2015 meeting, Golden, CO. 2015.
- Program Planning Committee, 2015 Annual Meeting, Society of Environmental Toxicology and Chemistry. 2014-2015.
- Senior Councilor, Immunotoxicology Specialty Section Society of Toxicology. 2014-2015.
- Past-President, North Carolina Society of Toxicology. 2014-2015.
- Junior Councilor, Immunotoxicology Specialty Section Society of Toxicology. 2013-2014.
- President, North Carolina Society of Toxicology. 2013-2014.
- Research Funding Committee, Society of Toxicology. 2012-2014.
- Vice President, North Carolina Society of Toxicology. 2012-2013.
- Vice President-Elect, North Carolina Society of Toxicology. 2011-2012.
- Program Committee, Society of Toxicology Immunotoxicology Specialty Section. 2010-2011.
- Councilor, North Carolina Society of Toxicology. 2009-2011.
- Workshop co-chair and organizer, "Is Modulation of the Immune System by Perfluoroalkyl Acids a Human Health Concern?" Society of Toxicology Annual Meeting, Baltimore, MD. 2009.
- Symposium co-chair and organizer, "Immune Biomarkers in Alternative Species: Implications for Risk Assessment," Society of Toxicology Annual Meeting, Charlotte, NC. 2007.
- Platform session co-chair, "Immunotoxicology: Immune Modulation and Cell Specific Responses," Society of Toxicology Annual Meeting, Charlotte, NC. 2007.
- Postdoctoral Representative and Program Committee member, Immunotoxicology Specialty Section of the Society of Toxicology. 2005-2007.
- Mentor, Association of Women in Science Program (WISP) Mentoring Project, Office of Women's Affairs, Indiana University, Bloomington, IN. 2000-2002.
- Student Board Member, Ohio Valley Chapter of Environmental Toxicology and Chemistry. 2000-2001.

Workplace Community

- BSOM Promotion and Tenure Committee, 2020-present.
- Department of Comparative Medicine Promotion and Tenure Committee Chair, 2020-present.

- Department Pharmacology & Toxicology Personnel Committee Chair, 2019-present
- Faculty Research Advisory Committee, Division of Research, Economic Development and Engagement, 2019-present.
- Vice-Chair, Institutional Animal Care and Use Committee, 2019-present.
- BSOM Research Committee, 2019-present.
- Diversity and Equity Leadership Program, Division of Research, Economic Development and Engagement, 2019.
- My IDP Mentor, ECU Postdoctoral Training Program, Division of Research, Economic Development and Engagement, 2019.
- LCME Steering Committee and Co-Chair of Academic Environment Sub-Committee, Brody School of Medicine, 2018-2019.
- Department of Comparative Medicine Promotion and Tenure Committee, 2017-present.
- Coastal Strategic Planning Committee, 2016-2017.
- BSOM Promotion and Tenure Committee, 2015-2018.
- Secretary/Treasurer, Brody Women Faculty Committee, 2015-2017.
- Planning committee for the joint PhD program in Integrated Coastal and Marine Sciences, 2015-2017.
- School of Dental Medicine Admissions Committee, 2014-2018.
- BSOM Sustainability Committee, 2014-2016.
- Committee member, BSOM Research Committee, 2014-2015.
- Five-Year Review Committee for Dean Paul Cunningham, Dean of the Brody School of Medicine (appointed by the Vice Chancellor for Health Sciences). 2014.
- Institutional Animal Use and Care Committee. 2013-present.
- M1 Curriculum Committee, Brody School of Medicine, East Carolina University. 2013-2016.
- Master Educator Committee, Brody School of Medicine, East Carolina University. 2012-2016.
- Chair, Brody Women Faculty Committee. 2012-2013.
- Brody Vision, Innovation, Achievement (VIA) group. 2011-2015.
- Undergraduate Research and Creative Activity Biomedical Sciences Grant Review Committee. 2011-2018.
- Chair-elect, Brody Women Faculty Committee. 2011-2012.
- Coastal Maritime Council, East Carolina University. 2010-present.
- Five-Year Review Committee for Dr. David Taylor, Chair of the Department of Pharmacology and Toxicology (appointed by the Dean of the School of Medicine). 2010.
- Shared Resources Committee, Brody School of Medicine, East Carolina University. 2008-2012.
- Faculty of the Interdisciplinary Doctoral Program in Biological Sciences, East Carolina University. 2009-present.
- Brody Women Faculty Committee, East Carolina University. 2008-present.
- Graduate Faculty, Division of Research and Graduate Studies, East Carolina University. 2008-present.
- Vice-President and at-large member, EPA RTP Networking and Leadership Training Organization, USEPA. 2004-2008.
- Organizing Committee, 2007 NIEHS Biomedical Career Fair. 2006-2007.
- Vice-chair, Environmental Science program representative, Association of SPEA Ph.D. Students, School of Public and Environmental Affairs, Indiana University. 2001-2002.
- Environmental Science program representative, Dean's Student Advisory Committee, School of Public and Environmental Affairs, Indiana University. 1997-2002.

Other

- Science Olympiad (regional) Event C-Coordinator, "Potions and Poisons." 2018, 2019.

- Science Event Co-Coordinator, “ADdMe to Tox Town,” Girl Scouts TechnoQuest Event. 2017.
- Science Event Co-Coordinator, “Biometry in Action,” Brody Girl’s STEM Day. 2016.
- Science Event Coordinator, “The Water Cycle,” Youth Ocean Conservation Summit. 2016.
- STEM volunteer, various events, Love a Sea Turtle, NC Estuarium Sound Rivers. 2015-present.
- Science Event Coordinator, “Marshmallow Genetics” and “DNA Necklaces,” ECU Girl’s STEM Day. 2014-2016.
- Scientific Expert, Alzheimer’s North Carolina fundraising walk, Washington, NC. 2014-2016.
- Über Judge, Blue Heron Bowl, Regional Competition for the National Ocean Sciences Bowl. 2012.
- Judge, North Carolina Region 1 Science and Engineering Fair. 2010. 2011.
- North Carolina Estuarium Docent. 2009-present.

AMIGOS BRAVOS' EXHIBIT 9

DIRECT TESTIMONY OF JAMIE C. DeWITT, PH.D., DABT

1. My name is Jamie C. DeWitt and I am an Associate Professor in the Department of Pharmacology and Toxicology of the Brody School of Medicine at East Carolina University (ECU) in Greenville, North Carolina. In this position I manage a research laboratory that conducts toxicological research on the effects of environmental contaminants on the immune system, including the effects of per- and polyfluoroalkyl substances (PFAS). In this position I also teach graduate, medical, and dental students and participate on committees to support my profession and the business of the university.

2. This testimony supports the following opinions:

   i. That perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), perfluorobutane sulfonate (PFBS), fluorotelomer sulphonic acid 8:2 (8:2 FTS), N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA), N-methylperfluorooctane sulfonamidoacetic acid (NMeFOSAA), and perfluorooctanesulfonamide (PFOSA or FOSA) should be treated as "toxic pollutants" for purposes of New Mexico surface water regulations at 20.6.4.7.T(2) NMAC;

   ii. That New Mexico Environment Department's (NMED) proposed definition of "contaminants of emerging concern" (CECs) at 20.6.4.7.C(4) NMAC should include PFAS (not already considered to be "toxic pollutants" by NMED) as examples of CECs;

   iii. That NMED should have the authority to require dischargers to establish a baseline for and monitor CECs in federal permits.

3. In addition to relying upon my professional experience and expertise in forming the opinions expressed below, I reviewed the documents cited at the end of this testimony.

PROFESSIONAL BACKGROUND AND QUALIFICATIONS

4. I received Bachelor of Science degrees in Biology and Environmental Science from Michigan State University and Doctor of Philosophy degrees in Environmental Science and Neural Science from Indiana University-Bloomington. I completed postdoctoral training in Environmental and Ecotoxicology at Indiana University-Bloomington and in Immunotoxicology at the National Health and Environmental Effects Research Laboratory at the United States Environmental Protection Agency (U.S. EPA) through a cooperative training agreement with the University of North Carolina at Chapel Hill. During my postdoctoral training at Indiana University, I evaluated the developmental cardiotoxicity of polychlorinated biphenyls and dioxins in wild passerine birds for a project funded by the United States Fish and Wildlife Service. At the U.S. EPA, I evaluated the immunotoxicity of organotin compounds used in polyvinylchloride pipes and of PFOA as an emerging contaminant in drinking water supplies.

5. In 2008 I joined the faculty of the Department of Pharmacology and Toxicology at the Brody School of Medicine of ECU as a tenure-track Assistant Professor. In 2015 I was promoted to Associate Professor. I also am an Adjunct Associate Professor in the Department of Biological Sciences at North Carolina University (2018-present) and became a Diplomate of the American Board of Toxicology in 2017.

6. My graduate teaching activities include co-instruction in general and advanced toxicology as well as biomedical statistics. My lectures to medical, dental, and physician assistant students have focused on endocrine pharmacology. I deliver general toxicology lectures to medical and dental students, and additional lectures to dental students on management of poisoned patients, toxicodynamics (processes by which exogenous agents produce effects in the body), and toxicokinetics (distribution of exogenous agents in the body, which includes absorption, distribution, metabolism, and excretion).

7. In addition to classroom teaching, I teach and mentor students in my laboratory. I have hosted 34 high school students and 26 undergraduate students through various programs since coming to ECU. I have mentored three masters and four doctoral students through completion of their degrees and am currently mentoring one doctoral student, two masters students, and one research faculty.

8. I am actively engaged in professional, university, and community service activities. Of particular relevance to the topic of PFAS, I helped to write or reviewed documents from the U.S. EPA, the International Agency for Research on Cancer (IARC) of the World Health Organization, the U.S. National Toxicology Program (U.S. NTP), the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). I was part of a steering committee to organize a workshop in 2017 entitled "International Workshop Supporting the Dialogue Between Science and Policy on Per- and Polyfluoroalkyl Substances (PFAS)" and am part of a group known as the Global PFAS Science Panel that grew out of this workshop. I was one of the members of the Science Advisory Workgroup to the Michigan PFAS Action Response Team. I recently was appointed as a member of the North Carolina Secretaries Science Advisory Board, which is charged with advising the North Carolina Departments of Environmental Quality and Health and Human Services with toxicological effects of contaminants and levels of control necessary for protection of human health and the environment. I was a member of the North Carolina Cancer Advisory Research Panel, charged by the North Carolina General Assembly to recommend strategies for assessing cancer incidence and mortality rates within the state. I also am a member of the Tennessee PFAS External Advisory Group to the Departments of Environment and Conservation and Health, charged with informing the state about PFAS. In 2019 I testified about PFAS toxicity before two subcommittees of the U.S. House of Representatives and in 2021 I testified before a third House subcommittee.

9. Overall, I have co-authored 16 primary research articles related to PFAS toxicity (first or senior author of 10). These manuscripts include assessments of immunotoxicity, developmental immunotoxicity, developmental neurotoxicity, developmental cardiotoxicity, dosimetric anchoring, and epidemiological associations. I have co-authored 14 review articles/commentaries on PFAS toxicity and use, two book chapters related to PFAS immunotoxicity, and edited one of the first comprehensive texts on the toxicity of PFAS.

My other publications concern toxicological effects of environmental contaminants, including their impact on human diseases. Overall, I have co-authored nearly 80 scientific publications.

10. Based on my education and experience, I am qualified to discuss the toxicity of the three PFAS listed in the New Mexico ground water regulations as toxic pollutants -- perfluorooctanoic acid (PFOA, CAS# 335-67-1), perfluorooctane sulfonate (PFOS, CAS# 1763-23-1), and perfluorohexane sulfonic acid (PFHxS, CAS# 335-46-4) -- and why these three PFAS should be classified as "toxic pollutants" for purposes of New Mexico surface water regulations and why additional PFAS beyond these three should be considered "toxic pollutants," including PFNA (CAS# 375-95-1), PFBS (CAS# 375-73-5), 8:2 FTS (CAS# 39108-34-4), NEtFOSAA (CAS# 2991-50-6), NMeFOSAA (2355-31-9), and PFOSA (or FOSA, CAS# 754-91-6).

11. My curriculum vitae is Amigos Bravos' Exhibit 8.

SUBJECT MATTER BACKGROUND

12. PFAS are a class of substances that can be organized into various sub-classes (Figure 1) and are, in the vast majority of cases, either non-degradable or degrade to terminal products that are still PFAS (Cousins et al., 2020). PFAS are chemically and thermally stable and have properties that make them commercially useful in numerous applications, including processing aids for fluoropolymer manufacture, stain, grease, and water-resistant coatings, and aqueous film forming foams used in fire suppression activities (Glüge et al., 2020). A consequence of their extensive use and resistance to degradation is their persistence in the environment and when combined with the potential for many PFAS to bioaccumulate, or to move into living organisms from the environment, they are now detectable in tissues and blood of wildlife and humans. The U.S. National Health and Nutrition Examination Survey conducted by the Centers for Disease Control and Prevention has reported detectable concentrations of a subset of PFAS in the serum of 97% of surveyed individuals (Hu et al., 2016), indicating widespread human exposures.

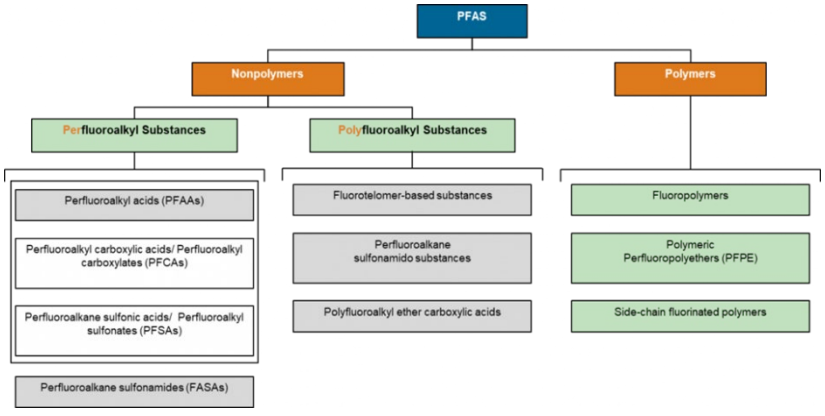

Figure 1. The general classification of PFAS as outlined by the Interstate Technology Regulatory Council (ITRC, 2020).

13. Current estimates by the U.S. EPA put the total number of chemicals classified as PFAS at nearly 10,000 individual substances (U.S. EPA, 2021a). PFAS vary by the number of carbons or chain-length, functional groups present (e.g., carboxylic acid, sulfonic acid, hexanoic acid), and other physicochemical characteristics (ITRC, 2020). Not all of these substances are produced for industrial or consumer uses; some are breakdown products of "precursor compounds" (Houtz et al., 2013), but nonetheless contribute to environmental concentrations and to human exposures.

14. The U.S. EPA defines long-chain PFAS as subsets of perfluoroalkyl acids (PFAAS), including perfluoroalkyl carboxylic acids (PFCAs) with eight or more carbons, which includes PFOA and PFNA, as well as perfluoroalkane sulfonates (PFSAs) with six or more carbons, which includes PFOS and PFHxS (U.S. EPA, 2009). The bulk of toxicological research efforts concerning PFAS has focused on PFOA and PFOS and other long-chain PFAAs such as PFHxS, presumably because they were widely produced and prevalently used. These substances were produced for decades within the U.S. for the fluoropolymer and telomere industry. PFOS manufactured within the U.S. was voluntarily discontinued by the 3M Company in 2002 (U.S. EPA, 2009) and PFOA and other long-chain PFCAs were phased out between 2006 and 2015 by eight major U.S. manufacturers through the 2010/15 PFOA Stewardship Program (U.S. EPA, 2021b). However, these substances may still be present in previously produced and imported items (U.S. EPA, 2021b). Additionally, PFOA and PFOS may result from the breakdown of other PFAS, generally termed as "precursor compounds" (Houtz et al., 2013) and sinks of PFOA, PFOS, and other long chain PFAAs such as PFHxS exist in the environment and contribute to ongoing exposures to living organisms, including humans. One precursor compound that breaks down to PFOA is 8:2 FTS and three precursor compounds that break down to PFOS are NEtFOSAA, NMeFOSAA, and PFOSA/FOSA.

15. In 2006 the U.S. EPA launched the 2010/2015 PFOA Stewardship Program to phase out PFOA and higher homologues (i.e., PFCAs with nine or more carbons such as PFNA) as well as PFAS that could degrade to PFOA (such as 8:2 FTS) due to several concerns associated with these PFAS, including their environmental persistence, widespread presence in the environment and in the blood of people in the U.S., their long residence time (half-life) in people, and developmental and other adverse health effects reported in studies of experimental animals (U.S. EPA, 2021b). The U.S. EPA invited eight major PFAS manufacturers to join the Stewardship Program and commit to working toward elimination of PFOA and higher homologues as well as PFAS that could degrade to PFOA by 2015 due to recognition that PFOA is persistent in the environment, has been detected in human blood, and that animal studies indicate effects of concern (U.S. EPA, 2006).

15. Alternative compounds, such as PFBS, currently are being produced to replace PFOA, PFOS, and other long-chain PFAS that have been phased out of production. Many of these PFAS fall under the Toxic Substances Control Act (TSCA) and the U.S. EPA reviews these under the New Chemicals Program (U.S. EPA, 2019). However, not all PFAS are likely to be subject to TSCA guidelines because some are byproducts of production that may find their way into the environment or are environmental transformation products of precursor compounds. These alternative PFAS and PFAS as byproducts are detectable in the environment, including surface water (Hopkins et al., 2018).

16. Although alternative and byproduct PFAS also likely are persistent in the environment and are believed by some to be less toxic to wildlife and humans, they appear to be highly mobile in soil and water (U.S. EPA, 2019). This mobility in soil and water means that short-chain PFAS can move to points distant from points of release. Emerging publications from studies of these short-chain PFAS indicate that many of these short-chain PFAS elicit toxicities similar to the long-chain compounds.

17. PFAS that have been studied for their toxicity induce a wide variety of adverse health outcomes in experimental animal models. Epidemiological studies, or studies of people that have been exposed to PFAS through their occupations or from environmental sources such as drinking water, link PFAS exposure to similar adverse health outcomes. These toxicological and epidemiological studies indicate that exposure to PFAS poses a hazard to human health.

18. PFAS are synthetic substances that do not occur naturally in the environment, and therefore levels in biological tissues and fluids of humans and other organisms indicate exposure from contaminated water, food, and air, from the use of products that contain PFAS, or from occupational settings. A 2020 report by the Environmental Working Group (EWG, 2020) revealed that the drinking water of 110 million Americans may be contaminated with PFAS. This report highlighted that a major source of PFAS exposure to Americans is via drinking water, which often comes from surface water sources.

19. Drinking water in the U.S. often comes from surface water sources. Community providers deliver drinking water to multiple households and there are multiple types of these facilities across the nation. These facilities draw and treat water before delivering it to households and the source water may come from surface water sources (i.e., lakes and rivers). Surface water can be contaminated by PFAS from a variety of sources, including industrial releases, spills and other accidents, run-off from land-applied biosolids that contain PFAS, release of PFAS-containing wastewater from treatment facilities, and deposition of PFAS in the atmosphere. Living organism can be exposed to PFAS in surface water through ingestion of the water, contact with the water, or immersion in the water.

20. Four organizations, the U.S. EPA, the U.S. NTP, the IARC, and the ATSDR, have completed systematic reviews of toxicity data for PFOA and/or PFOS and additional PFAS (ATSDR included 14 PFAS in its review) and the U.S. EPA just released an updated draft risk assessment for PFBS (U.S. EPA, 2021c). These reviews are thorough evaluations of the body of toxicological evidence concerning PFOA and/or PFOS, or other PFAS and their likelihood of harm to human health following exposure. Each of these assessments is comprehensive of most of the published studies (up to a specified cut-off date determined by the agency sub-committee charged with writing the document) and accumulated knowledge about these PFAS.

21. The U.S. EPA established a lifetime health advisory (HLA) for PFOA and PFOS for protection of public health from ingestion of drinking water contaminated with these PFAS (EPA, 2016a-d). This health protective value is based on the ability of PFOA and PFOS to affect babies as they develop. This value is 70 parts per trillion (ppt).

22. The U.S. NTP evaluated data concerning the ability of PFOA and PFOS to affect the immune system and determined that both compounds are presumed to be immune hazards to humans (U.S. NTP, 2016).

23. The IARC evaluated data concerning links between PFOA exposure and cancer and determined that PFOA is possibly carcinogenic to humans (IARC class 2B) based on evidence of kidney and testicular cancer from epidemiological studies and supportive evidence from experimental animal models (IARC, 2016).

24. The ATSDR evaluated data associated with 14 different PFAS and concluded that the following health outcomes were consistently associated with exposure:
    - Pregnancy-induced hypertension/pre-eclampsia (PFOA, PFOS)
    - Liver damage, as evidenced by increases in serum enzymes and decreases in serum bilirubin levels (PFOA, PFOS, PFHxS)
    - Increases in serum lipids, particularly total cholesterol and low-density lipoprotein (LDL) cholesterol (PFOA, PFOS, perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDeA))
    - Increased risk of thyroid disease (PFOA, PFOS)
    - Decreased antibody response to vaccines (PFOA, PFOS, PFHxS, PFDeA)
    - Increased risk of asthma diagnosis (PFOA)
    - Increased risk of decreased fertility (PFOA, PFOS)
    - Small (<20 g or 0.7 ounces per 1 ng/mL increase in blood perfluoroalkyl level) decreases in birth weight (PFOA, PFOS)

25. The U.S. EPA calculated a chronic reference dose (RfD) for PFBS of 0.0003 mg/kg/day based on its ability to modify levels of thyroid hormones (U.S. EPA, 2021c). The chronic RfD is defined by the U.S. EPA (1993) as an estimate of a daily exposure to the human population that is likely to be without an appreciable risk of deleterious effects during a lifetime.

26. PFOA, PFOS, and PFHxS are "toxic pollutants" under New Mexico ground water regulations at 20.6.2.7.T(2)(s) NMAC. Toxic pollutants under these regulations are agents that have the potential for causing a lifetime risk of more than one cancer per 100,000 exposed persons or unreasonable threats to injure human health, the health of animals or plants that are commonly hatched, bred, cultivated, or protected for use by man for food or economic benefit. 20.6.2.3103.A(2) NMAC. Injuries to health include death, histopathologic change, clinical symptoms of disease, behavioral abnormalities, genetic mutation, physiological malfunctions, or physical deformations in such organisms or their offspring. *Id.*

27. In the State of Colorado, for example, several PFAS are treated as toxic pollutants in surface waters. Section 31.11(1)(a)(iv) of the Colorado Water Quality Control Commission regulations states that "state surface waters shall be free from substances attributable to human-caused point source or nonpoint source discharge in amounts, concentrations or combinations which are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life." In part, the state acted on PFAS because exposure to PFAS is a serious risk to public health (CO WQCC, 2020). Translational levels, or chemical specific values based

on available toxicity data at the federal level, establish the limits for substances that are toxic. Translational levels were developed for five individual PFAS, including PFOA, PFOS, and PFHxS, which are "toxic pollutants" under New Mexico ground water regulations, and two additional PFAS -- PFNA, which is a long-chain PFAS, and PFBS, which is a short-chain PFAS. Translational levels were also applied to four PFAS parent constituents that can degrade to PFOA or PFOS. These parent constituents include NEtFOSAA, NMeFOSAA, PFOSA/FOSA, and 8:2 FTS. The translational levels for PFOA, PFOS, and PFNA are equivalent to the U.S. EPA HLA of 70 ppt, which was based on the potential for PFOA and PFOS to produce adverse health outcomes in developing organisms and on the potential for PFNA to affect developing organisms within the same order of magnitude level of toxicity as PFOA and PFOS (CO WQCC, 2020). The translational level for PFHxS of 700 ppt was based on its potential to induce adverse endocrine effects. The translational level for PFBS of 400,000 ppt was based on its potential to induce adverse effects on the kidney. Translational levels for the four parent constituents, NEtFOSAA, NMeFOSAA, PFOSA/FOSA, and 8:2 FTS, were also equivalent to the U.S. EPA HLA of 70 ppt as these compounds can degrade to PFOA or PFOS. The translational level of 70 ppt applied to PFOA, PFOS, PFNA, and the four parent constituents applies to each PFAS individually as well as to the sum of the seven PFAS (CO WQCC, 2020).

28. Contaminants of emerging concern, or CECs, are defined by the U.S. EPA as "chemicals and other substances that have no regulatory standard, have been recently 'discovered' in natural streams (often because of improved analytical chemistry detection levels), and potentially cause deleterious effects in aquatic life at environmentally relevant concentrations" (U.S. EPA, 2008) and that may have potential significant impact on human health (U.S. EPA, 2019). Chemical classes that have been recognized as CECs include nanoparticles, pharmaceuticals, personal care products, estrogen-like compounds, flame retardants, detergents, and some industrial chemicals (U.S. EPA, 2019). Monitoring of CEC levels in surface waters is an important first step in providing the scientific information necessary to protect human and environmental health (USGS, 2021a). In its PFAS Action Plan Program Update, the U.S. EPA outlines its commitment to take actions to address an "emerging contaminant like PFAS," thus acknowledging that PFAS are CECs.

ASSESSMENT AND OPINIONS

29. I have been asked to offer scientific opinions whether PFOA, PFOS, PFHxS, PFNA, PFBS, NEtFOSAA, NMeFOSAA, PFOSA/FOSA, and 8:2 FTS should be considered "toxic pollutants" for purposes of New Mexico surface water regulations, whether PFAS should be included as an example of CECs in NMED's proposed definition of "contaminants of emerging concern", and whether NMED should have the authority to require dischargers to establish a baseline for and monitor CECs.

30. In my opinion, PFOA, PFOS, and PFHxS, which the New Mexico Water Quality Control Commission has already determined are "toxic pollutants" for purposes of ground water, should be considered "toxic pollutants" for purposes of New Mexico surface water regulations. In addition, PFNA, PFBS, NEtFOSAA, NMeFOSAA, PFOSA/FOSA, and 8:2 FTS should also be considered as "toxic pollutants" for purposes of New Mexico surface

water regulations. Under the surface water regulations, "toxic pollutants" are "those pollutants, or combination of pollutants, including disease-causing agents, that after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will cause death, shortened life spans, disease, adverse behavioral changes, reproductive or physiological impairment or physical deformations in such organisms or their offspring." 20.6.4.7.T(2) NMAC. I base my opinion on accumulated toxicological data for PFOA, PFOS, PFHxS, PFNA, PFBS, NEtFOSAA, NMeFOSAA, PFOSA/FOSA, and 8:2 FTS that have been summarized in documents by the U.S. EPA, the U.S. NTP, the IARC, and the ATSDR, on actions taken by the State of Colorado to limit these PFAS in its surface waters due to their toxicity, and on my own knowledge of and research on toxicological effects of these and other PFAS. The U.S. EPA has determined that PFOA and PFOS have the potential to be toxic to developing organisms. The U.S. NTP has determined that PFOA and PFOS are presumed to be immune hazards to humans. The IARC has determined that PFOA is a possible human carcinogen. The ATSDR has determined that PFOA, PFOS, PFHxS, PFNA, and PFBS have been linked to several toxicities in exposed humans. The U.S. EPA has determined that PFBS has the potential to be toxic to the thyroid gland. The State of Colorado has determined that PFOA, PFOS, PFHxS, PFNA, PFBS, NEtFOSAA, NMeFOSAA, PFOSA/FOSA, and 8:2 FTS should be limited in its surface waters due to their toxicity to humans, animals, plants, or aquatic life and their serious risk to public health.

31. In my opinion, NMED's proposed definition of contaminants of emerging concern should be amended to include the additional PFAS that are not treated as "toxic pollutants" for surface water regulations. NMED's proposed definition of CECs at 20.6.4.C(7) NMAC should therefore be amended to read:

> "Contaminants of emerging concern" or "CECs" refer to water contaminants including, but not limited to, per- and polyfluoroalkyl substances, pharmaceuticals and personal care products that may cause significant ecological or human health effects at low concentrations and are not considered "toxic pollutants" by the department. CECs are generally chemical compounds that, although suspected to potentially have impacts, may not have regulatory standards, and the concentrations to which negative impacts are observed have not been fully studied."

CECs are generally chemical compounds that, although suspected to potentially have impacts, may not have regulatory standards, and the concentrations at which negative impacts are observed have not been fully studied. The inclusion of PFAS as CECs is supported by the U.S. PFAS Action Plan Program Update (U.S. EPA, 2020), which refers to PFAS as "emerging contaminants." In light of the prevalence of PFAS, their persistence in environmental media, and their potential for harm to human health and the environment, it is appropriate to highlight these compounds as examples of CECs in NMED's regulatory definition.

32. In my opinion, NMED should have the authority to require dischargers to establish a baseline for and monitor CECs in federal permits. By definition, CECs are contaminants that may cause significant harm to human or ecological health, even at low concentrations, and require further study. Therefore, NMED should have the authority to study these compounds and add to the science community's body of knowledge by requiring dischargers to establish baseline and monitor and assess. Monitoring and characterization data can further our understanding of the prevalence of these compounds in surface waters, identify levels of PFAS to which humans and other living organisms are exposed, and provide data for development of mitigation and management strategies that can potentially prevent harm to human and ecological health. At the federal level, for example, the U.S. Geological Survey, in conjunction with the U.S. EPA, is conducting a national project looking at and characterizing CECs urban stormwater runoff that is infiltrated into the subsurface or likely to be infiltrated in the future (USGS, 2021b). Therefore, I support adding the following language at 20.6.4.14.F NMAC:

20.6.4.14 SAMPLING AND ANALYSIS

. . .

F. The department may include sampling and monitoring of contaminants of emerging concern as a condition in a federal permit under Section 401 of the federal Clean Water Act.

This ends my direct testimony, which is accurate to the best of my knowledge.

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04/29/21

Date

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