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The Science of Fracking and Health April 2018 Webinar

Ashley L. Bolden, MS

*Exploring Endocrine Disrupting Air
Pollutants near Unconventional Oil
and Gas Sites*





HISTORICALLY

- WATER
- DRINKING, GROUND, AND SURFACE WATER CONTAMINATION





CONNECTIONS TO HEALTH EFFECTS

Endocrine disrupting activities of surface water associated with a West Virginia oil and gas industry wastewater disposal site



Christopher D. Kassotis ^a, Luke R. Iwanowicz ^b, Denise M. Akob ^c, Isabelle M. Cozzarelli ^c, Adam C. Mumford ^c, William H. Orem ^d, Susan C. Nagel ^{e,*}

Adverse Reproductive and Developmental Health Outcomes Following Prenatal Exposure to a Hydraulic Fracturing Chemical Mixture in Female C57Bl/6 Mice

Christopher D. Kassotis, John J. Bromfield, Kara C. Klemp, Chun-Xia Meng, Andrew Wolfe, R. Thomas Zoeller, Victoria D. Balise, Chiamaka J. Isiguzo, Donald E. Tillitt, and Susan C. Nagel

Endocrine-Disrupting Activity of Hydraulic Fracturing Chemicals and Adverse Health Outcomes After Prenatal Exposure in Male Mice

Christopher D. Kassotis, Kara C. Klemp, Danh C. Vu, Chung-Ho Lin, Chun-Xia Meng, Cynthia L. Besch-Williford, Lisa Pinatti, R. Thomas Zoeller, Erma Z. Drobnis, Victoria D. Balise, Chiamaka J. Isiguzo, Michelle A. Williams, Donald E. Tillitt, and Susan C. Nagel

Cardio-respirometry disruption in zebrafish (*Danio rerio*) embryos exposed to hydraulic fracturing flowback and produced water[☆]

Erik J. Folkerts ^{a,*}, Tamzin A. Blewett ^a, Yuhe He ^a, Greg G. Goss ^{a,b}

Chemical and toxicological characterizations of hydraulic fracturing flowback and produced water

Yuhe He ^a, Shannon L. Flynn ^b, Erik J. Folkerts ^a, Yifeng Zhang ^c, Dongliang Ruan ^c, Daniel S. Alessi ^b, Jonathan W. Martin ^c, Greg G. Goss ^{a,*}

Effects on Biotransformation, Oxidative Stress, and Endocrine Disruption in Rainbow Trout (*Oncorhynchus mykiss*) Exposed to Hydraulic Fracturing Flowback and Produced Water

Yuhe He, ^{†,‡} Erik J. Folkerts, ^{†,‡} Yifeng Zhang, [‡] Jonathan W. Martin, ^{‡,Ⓞ} Daniel S. Alessi, [§] and Greg G. Goss ^{*,†,Ⓞ}

CONNECTIONS TO HEALTH EFFECTS

- HEADACHE
- FATIGUE
- SKIN IRRITATION
- PRETERM BIRTH
- LOW BIRTH WEIGHT
- CONGENITAL ANOMALIES

OBJECTIVES OF THE STUDY

- IDENTIFY THE MOST COMMONLY DETECTED AIR POLLUTANTS NEAR SITES OF UNCONVENTIONAL OIL AND GAS PRODUCTION
- DETERMINE IF THE AIR POLLUTANTS HAVE ENDOCRINE ACTIVITY

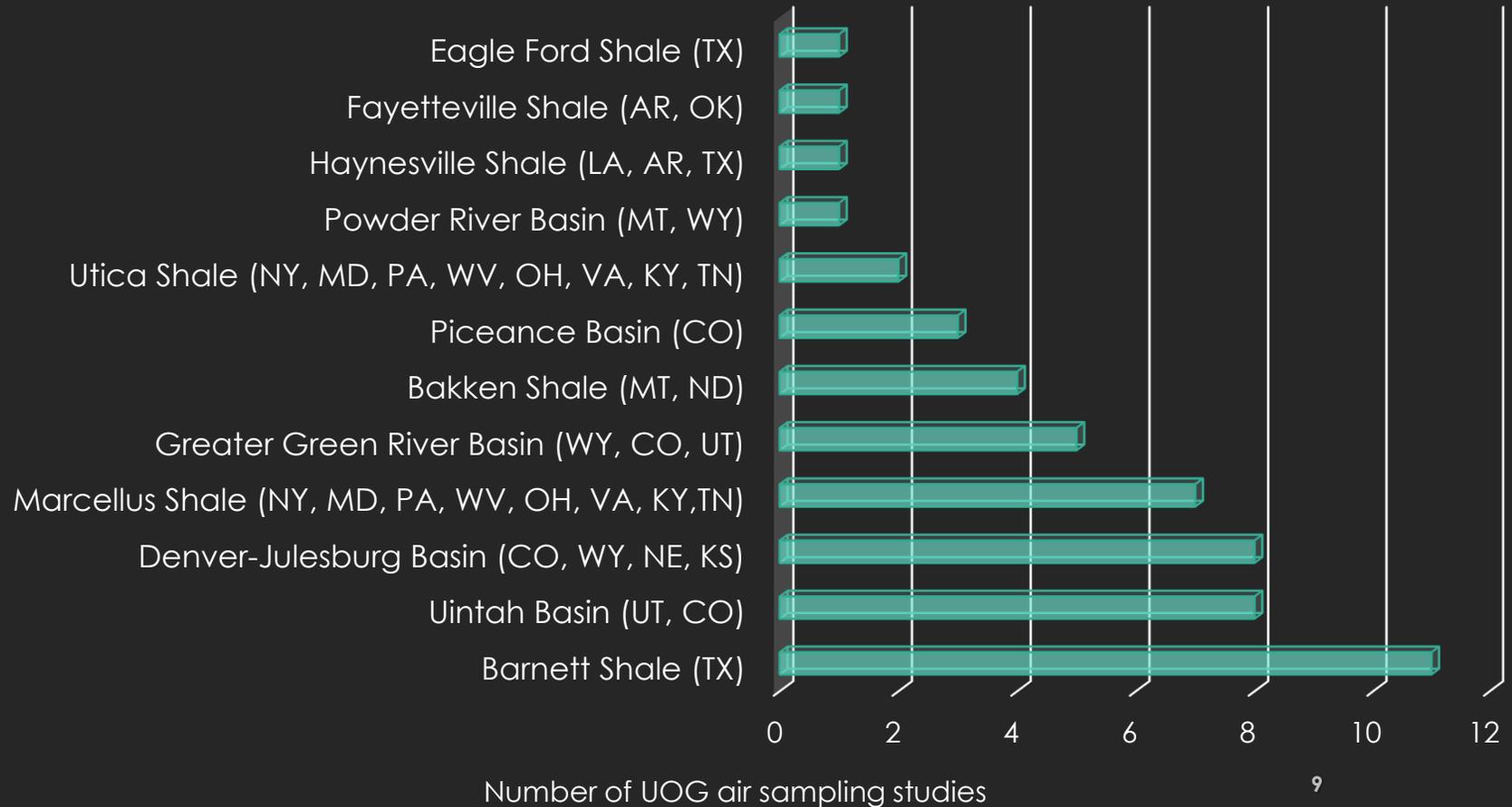
METHODS

IDENTIFY STUDIES THAT MEASURED AIR NEAR UNCONVENTIONAL OIL AND GAS SITES

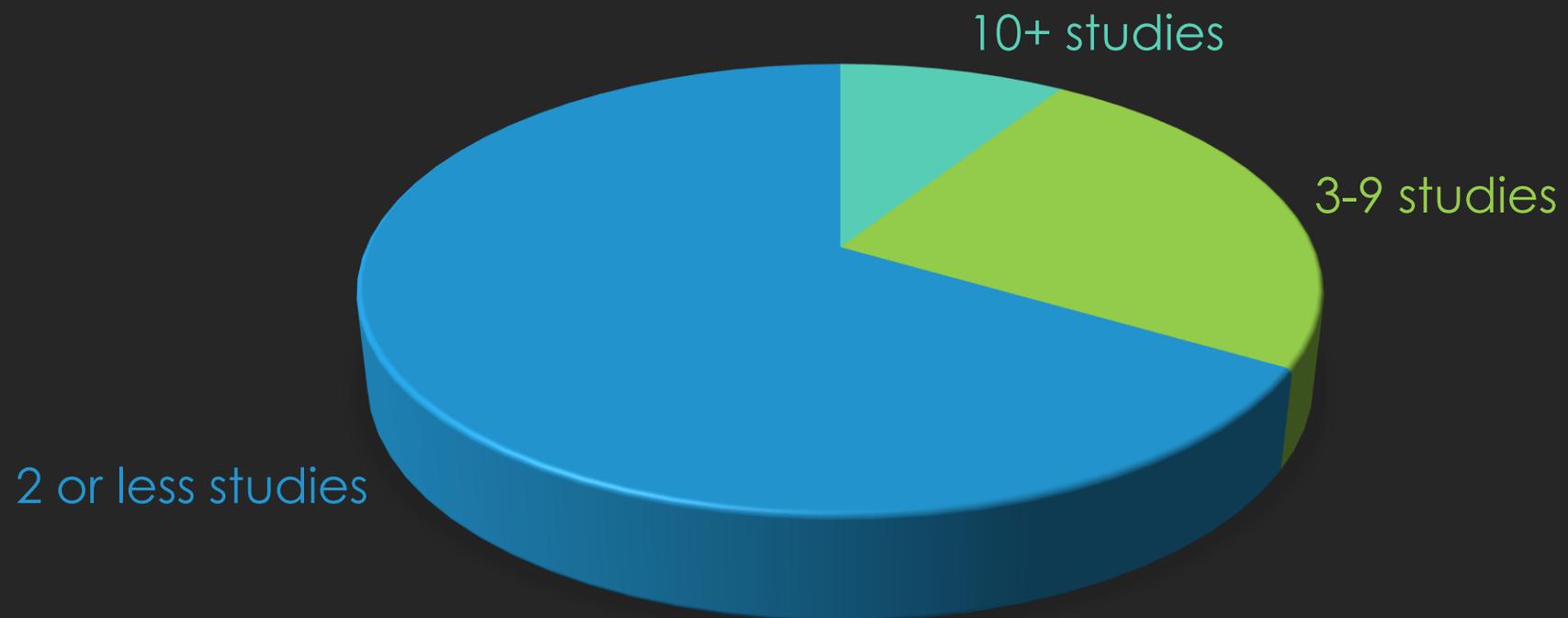
- DEVELOPED SEARCH LOGIC USING KEY TERMS
- PERFORMED ELECTRONIC SEARCHES OF PUBMED AND WEB OF SCIENCE UP TO JUNE 2016
- SCREENED ARTICLES USING DISTILLERSR®
- COMPLETED SUMMARY LEVEL DATA EXTRACTION

RESULTS

- 48 studies measuring air pollutants were identified
- Majority done in Barnett Shale in TX
- No studies completed prior to 2009
- 221 chemicals detected



RESULTS



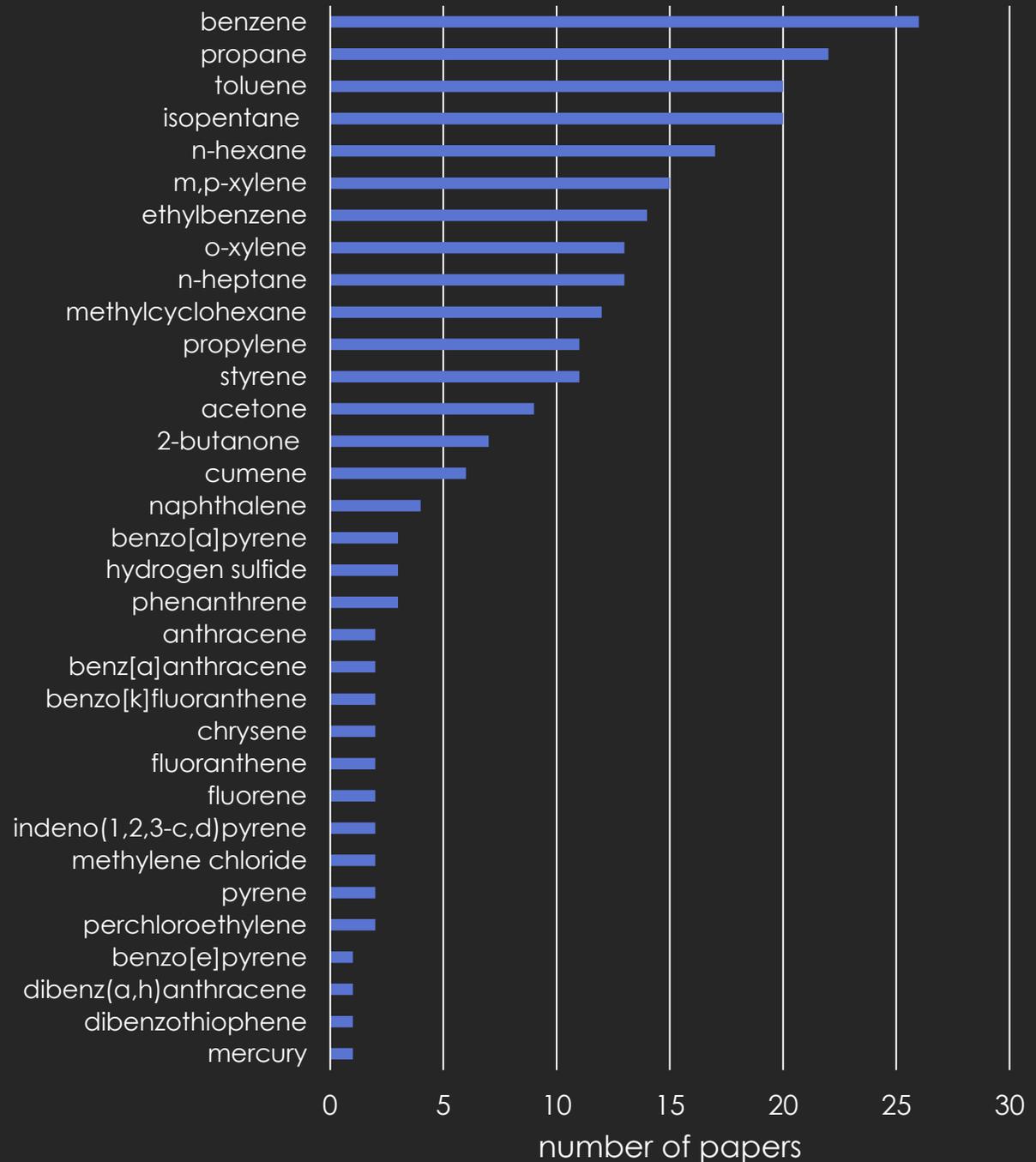
METHODS

DETERMINE ENDOCRINE ACTIVITY OF UOG RELATED AIR POLLUTANTS

- CROSS REFERENCED LIST OF AIR POLLUTANTS WITH THE TEDX LIST OF POTENTIAL EDCs
- DEVELOPED SEARCH LOGIC FOR THE CHEMICALS FOUND IN GREATER THAN 10 AIR STUDIES
- PERFORMED SEARCHES USING PUBMED
- SCREENED USING SWIFT-REVIEW
- REVIEWED RELEVANT ARTICLES FOR ENDOCRINE ACTIVITY

RESULTS

- 26 chemicals listed on TEDX List of Potential EDCs
- 8 additional frequently detected compounds found to be endocrine active



TYPES OF ENDOCRINE ACTIVITY FOUND

	PERCHLOROETHYLENE	MERCURY	DIBENZ[A,H]ANTHRACENE	DIBENZ[A,H]ANTHRACENE	BENZO[E]PYRENE	PYRENE	METHYLENE CHLORIDE	INDENO[1,2,3-C,D]PYRENE	FLUORENE	FLUORANTHENE	CHRYSENE	BENZO[K]FLUORANTHENE	BENZO[A]ANTHRACENE	ANTHRACENE	PHENANTHRENE	NAPHTHALENE	HYDROGEN SULFIDE	BENZO[A]PYRENE	CUMENE	2-BUTANONE	ACETONE	STYRENE	PROPYLENE	N-HEPTANE	METHYLCYCLOHEXANE	O-XYLENE	ETHYLBENZENE	M,P-XYLENE	N-HEXANE	ISOPENTANE	TOLUENE	PROPANE	BENZENE		
Estrogenic			○		○				○	○			○	○	○	○		○	○			○	○			○	○					○	○		
Androgenic			○							○	○		○	○	○	○		○	○			○	○			○	○						○	○	
Thyroidogenic		○														○						○	○												
Progestogenic																○			○							○									
Glucocorticogenic																○						○	○												
Aryl hydrocarbon receptor signaling			○	○	○	○	○	○		○	○	○	○	○		○		○				○	○												
Developmental	○		○						○													○	○			○	○	○						○	○
Reproductive	○													○	○	○	○	○					○		○					○	○	○	○	○	○
Steroidogenesis											○				○	○	○	○				○	○		○			○							
Neurophysiological	○						○													○	○	○													
Other evidence of endocrine activity	○												○										○	○		○		○	○					○	○

CONCLUSIONS

- THERE IS EVIDENCE THAT ENDOCRINE ACTIVE AIR POLLUTANTS ARE ASSOCIATED WITH UNCONVENTIONAL OIL AND GAS EXTRACTION.
- AT THIS TIME WE DO KNOW THAT EXPOSURE TO ENDOCRINE DISRUPTORS DURING DEVELOPMENT MAY RESULT IN ADVERSE HEALTH IMPACTS.
- WE DO NOT KNOW THAT THESE AIR POLLUTANTS ARE THE CAUSE OF THE HEALTH EFFECTS OBSERVED IN HUMAN STUDIES.

FUTURE DIRECTIONS

- COMPLETE STRATEGICALLY TARGETED SYSTEMATIC REVIEWS
- MEASURE A BROADER SET OF AIR POLLUTANTS

IN CLOSING

- THERE IS AN URGENT NEED TO ADDRESS THESE RELEASES NEAR HUMAN AND WILDLIFE POPULATIONS.



THANKS!

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<https://ehjournal.biomedcentral.com/articles/10.1186/s12940-018-0368-z>



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