EARTHWORKS

**Docket ID:** EPA-HQ-OA-2015-0245

**Public Comments for the Science Advisory Board Review of EPA's Assessment Report on EPA's Research on the Potential Effects of Hydraulic Fracturing on Drinking Water Resources**

Thank you for the opportunity to submit comments on the Environmental Protection Agency's (EPA) *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources.* (EPA study or report).

Please accept these comments on behalf of Earthworks, a national non-profit organization that protects communities and the environment from the impacts of energy development while seeking sustainable solutions. These comments primarily focus on Chapter 7 of EPA's report dealing with flowback and produced water.

To begin, we believe the unequivocal conclusion from the report is that **hydraulic fracturing contaminates drinking water resources**. For instance, looking narrowly at the pollution pathway of spills from flowback and produced water, EPA identified 225 such spills of which 146 reached environmental receptors (soil, surface water, or groundwater). These spills totaled at least 1.6 million liters (422,000 gallons)[1].

**Background on EPA's regulation of exploration and production wastes from oil and gas extraction**

In 1976, Congress passed the Resource Conservation and Recovery Act[2] (RCRA) in order to respond to the growing problem of municipal and industrial waste. Subtitle C of RCRA specifically tackles hazardous waste- creating a "cradle to grave" regulatory approach for hazardous waste management and disposal. In 1978, EPA released a proposal for hazardous waste management standards that exempted six categories of what EPA deemed "special wastes" in need of further study for their potential effects on public health and the environment[3]. The list of special wastes included oil and gas drilling muds and oil production brines.

Two years later, in 1980, Congress passed amendments to the Solid Waste Disposal Act which broadened EPA's oil and gas waste exemption pending the agency's determination as to whether "drilling fluids, produced waters, and other wastes associated with the exploration, development, and production of crude oil and natural gas warranted regulation under RCRA Subtitle C"[4]. In 1988, EPA issued its Regulatory Determination for Oil, Gas, and Geothermal Exploration, Development and Production Wastes[5]. EPA decided to keep oil and gas wastes exempt from Subtitle C regulation reasoning that compliance would create too great an expense, despite the fact that according to EPA:

"It is clear that some portions of both the large-volume and associated waste would have to be treated as hazardous if the Subtitle C exemption were lifted." [6]

**EPA's Study Reinforces their 1988 Conclusion that Some Oil and Gas Wastes would be Hazardous but for the RCRA Subtitle C Exemption**

The purpose of these comments is to illustrate the subsequent studies (most are part of EPA's report) that confirm EPA's conclusion that flowback and produced water from oil and gas operations would have to be treated as hazardous but for the exemption.

In order for mixtures of wastes (i.e. produced water and flowback) to qualify as RCRA Subtitle C hazardous material, it must exhibit at least one of four characteristics: flammability, corrosivity, ignitability, or toxicity. These comments will primarily address the latter two characteristics.

**Ignitability**

A substance becomes RCRA ignitable when it combusts in a closed-cup at less than 60°C (140°F)[7]. One study of oil wells in California and a few news reports have confirmed that the contents of exploration and production (E&P) wastes can catch fire under those conditions.

In 2002, the California Department of Toxic Substances Control[8] found 11% of oil waste samples tested exceeded flashpoint regulatory thresholds. As early as 2003, federal regulators became aware that E&P wastes do spontaneously combust. In January of that year, a Texas collection pit of E&P waste ignited when hydrocarbon vapors interacted with sediments and water in the pit.[9] In May 2006, a natural gas condensate tank and pit operated by EnCana caught fire and burned for five hours.[10] In April 2010, a wastewater impoundment in Washington County, PA ignited reportedly shooting flames 100 feet in the air.[11]

**Toxicity**

The toxicity characteristic identifies wastes likely to leach dangerous chemicals into ground water. The EPA has developed the Toxicity Characteristic Leaching Procedure (TCLP) to estimate the leaching potential of waste and have codified a series of regulatory thresholds based upon contaminant concentrations to determine which waste mixtures exhibit the characteristic of toxicity.[12]

Barium and benzene are the two most common toxic substances found in produced water and flowback in concentrations above their statutory thresholds. The barium standard is 100 mg/L; the benzene standard is 0.5 mg/L[13]. Evaluating the results of three different studies, EPA generalizes, "elevated levels of…barium (is) characteristic of Marcellus Shale flowback and produced water".[14]

For example, Hayes (2009) analyzed flowback from three West Virginia wells and nine Pennsylvania wells.[15] The study, conducted for the Marcellus Shale Coalition, indicated median barium levels more than five times the statutory threshold.[16]

Alley et al. (2011) aggregated a number of testing results by performing original analyses, studying peer-reviewed literature, public and confidential government and industry sources. For

shale gas formations, the authors found maximum concentrations of barium in produced water and flowback as high as 4,370 mg/L.[17]

Similarly, a Department of Energy study detected barium concentrations up to 352 mg/L in Mississippi and Alabama's Black Warrior Basin.[18]

In the Barnett, Hayes and Severin (2012) calculated average benzene concentrations at .680 mg/L (680 micrograms/L).[19]

Neff (2002) found total BTEX (benzene, toluene, ethylbenzene, and xylene) maximum concentrations at 578 mg/L. [20]

In addition to the science cited by this EPA study, the agency also prepared its *Technical Development Document for Proposed Effluent Limitations Guidelines and Standards for Oil and Gas Extraction* (ELG study) while developing its proposed rule[21] preventing discharge of unconventional oil and gas wastewater to publicly owned treatment works.

The ELG study looked at the concentrations of selected organics and metals in produced water and flowback from Marcellus wells. The tables reveal benzene levels as high as 800 mg/L[22] and barium levels reaching 2000 mg/L.[23] Similarly, EPA found lead levels as high as 8 mg/L[24].

Across all shale formations studied, the ELG study found maximum concentrations of barium as high as 16,000 mg/L, cadmium at 1.2 mg/L, chromium at 260 mg/L, lead at 5.0 mg/L, and mercury at 0.3 mg/L.[25] Each is at or above their respective toxicity concentrations.

**Conclusion**

EPA's acknowledgment that produced water and flowback from Marcellus wells demonstrate elevated levels of barium smacks of understatement. As does their public claim that hydraulic fracturing has not led to systemic and widespread impacts to drinking water resources.

The Marcellus shale spans the largest geographical area of any shale play in the country. The EPA study demonstrates median barium levels for Marcellus flowback and produced water that far exceed RCRA's threshold for toxicity. Furthermore, evidence indicating 146 flowback or produced water spills that have polluted soils, surface, or groundwater, indicate the problem has become both systemic and widespread.

These figures speak for themselves. The Science Advisory Board should conclude that hydraulic fracturing operations not only pollute drinking water resources, but also sometimes do so with hazardous contaminants.

We appreciate EPA's Science Advisory Board's consideration of our comments.

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[1] Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources, Chapter 7 page 33

[2] 42 U.S.C. §6901 et seq. (1976)

[3] 43 Fed. Reg. 58946 (1978)

[4] This amendment of RCRA, named for Senator Lloyd Bentsen, is section §3001(b)(2)(A)) of the Solid Waste Disposal Act
[5] 53 Fed. Reg. 25447 (1988)
[6] 53 Fed. Reg. 25455 (1988)
[7] EPA, Hazardous Waste Identification, Chapter III: RCRA Subtitle C- Managing Hazardous Waste or see 40 CFR 261.21
[8] Claudia Zagrean Nagy, California Dep't of Toxic Substances Control, Oil, Exploration and Production Wastes Initiative (2002) at 36
[9] U.S. Dep't of Labor, Occupational Safety and Health Admin., Potential Flammability Hazard Associated with Bulk Transportation of Oilfield Exploration and Production (E&P) Waste Liquids, SHIB 03-24-2008. It is possible also that this incident might meet the RCRA standard for reactivity.
[10] Earthworks Oil & Gas Accountability Project, Spring/Summer 2006 Report
[11] Janice Crompton, *Residents Reported Gas Odors Before Explosion,* Pittsburg Post-Gazette, Apr. 1, 2010 at B-1
[12] 40 CFR § 261.24
[13] Ibid.
[14] See EPA's Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources at Chapter 7 page 25-26
[15] T. Hayes, "Sampling and Analysis of Water Streams Associated with the Development of Marcellus Shale Gas," *Gas Technology Institute*, report prepared for the Marcellus Shale Coalition, (2009)
[16] Ibid. at page 36 Table 9. See also Appendix D for benzene results.
[17] Ibid. at Chapter 7 page 23 See Table 7-4 or Alley et al. "Chemical and physical characterization of produced waters from conventional and unconventional fossil fuel resources". *Chemosphere* (74-82) (2011) http://hero.epa.gov/index.cfm/reference/details/reference_id/1241172
[18] Ibid. at Appendix E page 14 Table E-5 or Department of Energy, "Water management strategies for improved coalbed methane production in the Black Warrior Basin". (2014) http://hero.epa.gov/index.cfm/reference/details/reference_id/2447897
[19] Ibid. at Appendix E page 25 Table E-9 or Hayes, T; Severin, BF "Evaluation of the aqua-pure mechanical vapor recompression system in the treatment of shale gas flowback water- Barnett and Appalachian shale water management and reuse technologies" (2012). http://hero.epa.gov/index.cfm/reference/details/reference_id/2140380
[20] Ibid. at Chapter 7 page 28 Table 7-5 or Neff, JM "Bioaccumulation in marine organisms: Effect of contaminants from oil well produced water" (1-35) (2002) http://hero.epa.gov/index.cfm/reference/details/reference_id/2215587
[21] 80 Fed. Reg. 18,557 (April 7, 2015)
[22] Technical Development Document for Proposed Effluent Limitations Guidelines and Standards for Oil and Gas Extraction, Table C-15 at page 66
[23] Ibid. Table C-16 page 68
[24] Ibid. The toxicity standard for lead, found at 40 CFR §261.24 is 5 mg/L.
[25] Ibid. Table C-17, page 69. The toxicity standards: cadmium 1.0 mg/L, chromium 5.0 mg/L, lead 5.0 mg/L, and mercury 0.2 mg/L.