

Clean Water Act Regulation of Oil and Gas Wastewater Discharges

*A Call for Improved Oversight
and Transparency*

January 2020



CLEAN WATER ACTION | CLEAN WATER FUND

About this Report

This report was written by Delia Mayor.

Delia Mayor worked with Clean Water Action/Clean Water Fund to research and write this report as part of the 2019 Environmental Fellows Program (EFP), a partnership between the Environmental Grantmakers Association and the University of Michigan School for Environment and Sustainability. For more information on EFP, please visit <https://efp.seas.umich.edu>

This project was supervised by Andrew Grinberg, with additional support from Lynn Thorp, Clean Water Action/Clean Water Fund.

Thank you to the following external reviewers:

Nichole Saunders, Environmental Defense Fund
Dominic DiGiulio, Physicians, Scientists, and Engineers for Healthy Energy
Briana Mordick, Natural Resources Defense Council



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Appendix of permit inventory available at www.cleanwater.org/producedwaterELG

Executive Summary

The United States has become the top producer of oil and gas in the world as domestic oil and gas production has doubled since 2010, resulting in increased industrial water use and increased production of wastewater. As the industry attempts to manage this wastestream, it is advocating for regulatory changes under the Clean Water Act to facilitate increased surface discharge. U.S. Environmental Protection Agency (EPA) officials and state agencies are exploring the possibility of expanding reuse of produced water outside of the industry and making more direct discharges to surface waters possible, especially in arid parts of the country that may be experiencing water shortages.

The Clean Water Act's National Pollutant Discharge Elimination System (NPDES) requires a permit for industrial pollution discharges to waters of the U.S. EPA has established effluent guidelines to apply to different industrial discharges, including for oil and gas extraction. These guidelines, or the absence thereof, impact how produced water discharges to waters of the U.S. are regulated.

The report provides an overview of Clean Water Act regulations governing onshore produced water discharge, evaluates several aspects of its oversight, and makes recommendations for both EPA and state regulators to improve protection of water resources and increase transparency. It

focuses on direct discharges to waters of the U.S., and to a lesser extent addresses indirect discharges to municipal sewage plants, also known as Publicly Owned Treatment Works (POTWs) and discharges to Centralized Waste Treatment (CWT) facilities. Several problems in the existing regulations, and the current understanding of produced water quality, highlight the need to strengthen protections.

By conducting a systematic search for active NPDES permits across the nation, this report reviews the public availability and transparency of permits, and examines where direct discharges to surface waters are occurring. The search yielded information about which states issue permits and where EPA retains permitting authority, availability of permit documentation, and an inventory of existing permits. The search found active direct discharge permits in 7 states, however some uncertainty remains due to data and permit accessibility issues. Public availability and transparency of permits varies widely across states, creating considerable challenges for accessing data and information on permitted activities.

This report finds that Clean Water Act regulations are inadequate to ensure protection of public health and the environment from onshore produced water discharges.

Key Recommendations

1. EPA should first improve its understanding of the chemical characteristics of produced water by establishing regulations to improve transparency and reporting of chemical use in the industry, and by working to improve analytical methods and toxicity measures of chemicals found in produced water.
2. EPA should revise effluent guidelines for oil and gas extraction, for both direct discharges to surface waters, and discharges to publicly owned treatment works (POTWs) and centralized waste treatment facilities (CWTs).
3. EPA and states with oil and gas NPDES primacy should improve permitting oversight, transparency and data management to make permits available and more easily understood to the public.

Introduction

Production of oil and gas in the United States has more than doubled since 2010. Advances in drilling technologies, including horizontal drilling, hydraulic fracturing (fracking), and enhanced recovery, have allowed oil and gas companies to access hydrocarbons previously inaccessible or not economically viable, increasing production in areas like the Permian basin located across Texas and New Mexico.¹ According to the International Energy Agency, the U.S. is not only an oil and gas producer for national consumption, but is also projected to become the second largest exporter of oil and gas in the world after Saudi Arabia.² With increased exploration and production activities, production of wastewater has also increased, creating challenges for oil and gas producers who must manage and dispose of this wastestream.³

This report: (1) Summarizes current regulatory frameworks for produced water surface discharges from onshore oil and gas exploration and production activities. (2) Conducts a systematic search of state and EPA issued NPDES permits for oil and gas produced water discharges to surface water. (3) Assesses the level of availability of permitting information accessible to the public either through a website or by request. (4) Provides recommendations for how EPA and states can improve oversight of produced water discharges to increase transparency and better protect water resources.

Produced Water: What Is It and What's In It?

Oil and gas exploration and production activities generate industrial wastes, of which produced water is one of the most abundant. For the purposes of this report, produced water broadly refers to the fluids that come to the surface from an oil and gas well. Produced water contains both fluids that are naturally present in oil and gas-bearing geologic formations, and fluids injected into the well for maintenance and/or production

activities such as hydraulic fracturing, acidizing, or enhanced recovery. Formation fluids contain naturally occurring constituents including salts, toxic chemicals such as benzene, metals, and radioactive materials, including NORM (naturally occurring radioactive material) and TENORM (technologically enhanced naturally occurring radioactive material).⁴ Chemical additives used in production and maintenance, such as those present in fracking fluids, may be present as well. Produced water quality varies across geographies and formations.

The U.S. Environmental Protection Agency has documented impacts from produced water in multiple studies. According to EPA's study on Centralized Waste Treatment (CWT) facilities, evidence exists that levels of total dissolved solids (TDS), chloride, bromide, metals, and radioactive materials such as Radium and TENORM found downstream from treatment plants exceed the thresholds recommended to assure the health of aquatic ecosystems and human health.⁵ This study noted that even when produced water is treated before being discharged, measurable impacts have been documented.⁶ EPA's 2016 study on *Impacts from Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States*, concluded that inadequate treatment of produced water from fracking operations was a potential threat to drinking water sources.⁷

A growing body of independent research and state regulatory proceedings indicate water quality problems can arise from produced water discharge and reuse. In one study, researchers found increased levels of chlorides and bromides downstream of produced water discharges in Pennsylvania.⁸ In California, the discharge of produced water into open pits has contaminated groundwater, resulting in new enforcement and regulatory activities.⁹

Several sources have documented that per- and polyfluoroalkyl substances (PFAS) may be used in

enhanced oil recovery operations.¹⁰ According to a Stockholm Convention report, “PFOS derivatives may be used as surfactants in the oil and mining industry to enhance oil or gas recovery in wells.”¹¹ Several materials disseminated by EPA include reference to use in the oil and gas industry.¹² However, lack of transparency and reporting requirements for enhanced recovery and other operations prevent the public and/or regulators from obtaining data about the presence and quantity of these contaminants in produced water discharges.

According to EPA, one of the most cited concerns among environmental and public health organizations, academia, and government associations, is the lack of data about existing

constituents in produced water.¹³ Due to produced water constituent variability, chemical-use trade secret claims, inadequate reporting requirements — especially for the use of chemical additives in routine well maintenance and production activities, and a lack of robust analytical methods, there is significant uncertainty around the chemical composition of produced water and its safety for humans and the environment.¹⁴

In light of evidence that produced water discharges may be unsafe for public health and the environment, it is paramount to understand where these discharges occur and whether current regulations sufficiently protect public health and the environment.

Disposal Methods and Regulations

Current methods to dispose of produced water include: disposal into underground injection wells; reuse within the oil and gas field for hydraulic fracturing or enhanced recovery (EOR); disposal into open percolation and evaporation pits; treatment through Centralized Waste Treatment

(CWT) facilities or Publicly Owned Treatment Works (POTWs); and discharge or reuse outside of the oil and gas industry for irrigation of crops and other purposes.¹⁵ [Table 1](#) summarizes methods of disposal and the laws and regulations that govern each method.

Produced Water Methods of Disposal and Laws or Regulations Governing Them	
Underground injection disposal well	Federal Safe Drinking Water Act — Underground Injection Control (UIC) Class II program
Underground injection for enhanced recovery (EOR)	Federal Safe Drinking Water Act — Underground Injection Control (UIC) Class II program
Disposal in on-site evaporation or percolation pits/ponds/impoundments	No federal regulation — State regulation only
Recycled and reused within the oil and gas field for drilling and hydraulic fracturing	No federal regulation — State oversight varies
Reuse outside the oil and gas industry for agricultural use or wildlife propagation — if discharged to a Water of the U.S. (WOTUS)	Clean Water Act, 40 CFR part 435, subcategory E
Reuse outside the oil and gas industry for agricultural use or wildlife propagation — if transported and reused without discharging to WOTUS	No federal regulation — State regulation only
Treated at a Centralized Waste Treatment facility (CWT)	Clean Water Act, 40 CFR part 437 (produced water treated at a CWT can also be subject to oil and gas ELGs, 40 CFR part 435, in some instances)
Discharge to surface waters of the U.S.	Clean Water Act, 40 CFR part 435

Table 1. Methods of produced water discharge and corresponding governing laws and regulations.

The oil and gas industry has proposed relaxing the already limited existing standards to dispose of wastewater in order to support the current industry boom, claiming that the limited availability of some disposal options and high costs of

transportation are a burden.¹⁶ Additionally, as the use of water by the industry increases,¹⁷ loosening regulations for reuse of wastewater outside of the industry is being framed as a solution to water shortages.

Clean Water Act Regulation of Produced Water Discharges

Congress passed the **Clean Water Act** (CWA, 33 U.S.C. §1251) in 1972 to “restore and maintain the chemical, physical and biological integrity of the Nation’s waters.”¹⁸ To regulate discharges from point sources, the National Pollutant Discharge Elimination System (NPDES, 40 CFR part 122), created under the CWA, provides guidelines and standards to protect and restore water quality of waters of the United States (WOTUS).¹⁹ Under the **National Pollutant Discharge Elimination System**, a permit is required to discharge pollutants to waters of the United States.

Who Issues NPDES Permits?

As a federal program, EPA has authority over NPDES permits. However, like many programs,²⁰ EPA may delegate regulatory primacy to states, tribes, and territories to issue and administer programs. Federal regulation 40 CFR part 123 outlines the primacy delegation process, which consists of (1) the state, tribe or territory submitting the required documentation, (2) conducting a public review, comment period, and a public hearing, and (3) EPA making a determination. If approved, a state, tribe or territory can assume authority for the program or for a specific program component (e.g. NPDES permits for oil and gas industry). When a state is authorized, EPA retains authority on tribal lands (unless the tribe requests and is granted primacy), and could retain authority for components such as federal facilities.²¹ Primacy states may rename their programs to reflect their authority,* but since the name change is not consistent, the acronym

“NPDES” is used throughout this report regardless of the issuing authority or state specific program name.

According to EPA’s website, “EPA issues all National Pollutant Discharge Elimination System (NPDES) water quality permits in Idaho, Massachusetts, New Hampshire, New Mexico, the District of Columbia, U.S. territories, and on federal and tribal lands. Other states have been delegated by EPA to issue their own permits.”²² However, delegation of authority does not apply to oil and gas permits in Oklahoma²³ and Texas, for which EPA retains authority to issue permits, while the states are currently engaged in applying for authority. Texas begun the application process to obtain authority to issue and administer permits for produced water per House Bill (HB) 2771, which requires the Texas Commission on Environmental Quality to submit a request by September 1, 2021.²⁴ In its 2017 report, the Oklahoma Produced Water Working Group recommended that Oklahoma seek NPDES delegation for produced water discharges, indicating that State Senate and House bills were introduced to request NPDES delegation from EPA.²⁵

Effluent Limitations and Standards for Oil and Gas Extraction

NPDES programs regulate multiple industries and discharges. Permit writers, generally staff in state agencies or EPA regional offices responsible

*For example, New York’s program is titled “New York State Pollution Discharge Elimination System” (NYSNPDES)

for Clean Water Act implementation, incorporate federal guidelines based on current available technologies that are considered financially achievable, as well as state water quality standards. This report focuses on **industrial wastewater pollution from onshore oil and gas extraction discharged to surface water**. This report does not focus on other point sources of pollution such as mining, other discharges from the oil and gas industry, such as discharges of stormwater, from pipelines, or to groundwater, but some regulations that govern these are discussed to provide an understanding of the broader regulatory context.

This section explores guidelines and standards applicable to oil and gas extraction discharges to surface water as specified in 40 CFR part 435, 437 and 122.44(d) of the Clean Water Act, to explain the intricacies of the regulations and highlight problematic areas.

There are two components to NPDES permit requirements for the oil and gas industry. First, technology-based effluent limitations, or TBELs, set standards that guarantee a minimum level of protection based on current technologies deemed financially achievable for discharging industries. In addition to TBELs, permit writers must consider the water quality standards of receiving bodies of water set by states, and develop water quality based effluent limitations or WQBELs, as more stringent limits may need to be incorporated into the permit requirements to reach quality measures for those water bodies. When technology based guidelines are not provided, the permit writer must use Best Professional Judgment (BPJ) to set pollution limits. Permitted facilities must report compliance with set limits by submitting periodic Discharge Monitoring Reports (DMRs) to the permitting authority.²⁶

1. Technology-based Effluent Limitations (TBELs)

TBELs (40 CFR part 125.3(a)) set limits of minimum protection based on the most effective available technology that is economically achievable for each regulated industry.²⁷ Effluent Limitation Guidelines (ELG) are standards developed by EPA to regulate the discharge of liquid waste from specific industries based on current technologies that provide the best reductions in pollution, and are economically reasonable for industries to adopt. Effluent limitations are a component of an NPDES permit that set pollution limits for receiving bodies of water. ELG standards for the oil and gas industry differ depending on certain parameters.²⁸

First, effluent guidelines for oil and gas extraction differ according to six subcategories (A through H of CFR 40 part 435) of discharge. Some subcategories depend on the location of production and exploration activities. For example subcategory A, C, and D categorize facilities located offshore, onshore, and coastal respectively. Others are based on the level of hydrocarbon production, such as subcategory F, or Stripper subcategory, which applies to low-producing oil wells. Definitions for each category and descriptions of key differences of standards for each category are summarized in [Table 2](#), obtained from EPA's *Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001*.²⁹ Some exemptions for specific subcategories are explored later in this report.

Second, standards may differ according to levels of control for specific classes of pollutants. Pollutants are classified as (1) *priority pollutants*, which are frequently and abundantly found during testing and have approved EPA detection methods; (2) *conventional pollutants*, which include “biochemical



Figure 1. Specific area of focus for this report.

Subparts of 40 CFR Part 435 and their Applicability Limitations			
Subpart	Title	Applicability	Description
A	Offshore Subcategory	Facilities located in waters that are seaward of the inner boundary of the territorial seas as defined in 502(g) of the CWA.	Subpart A contains BPT, BAT, BCT and NSPS regulations. For some wastestreams in certain locations, numeric limits apply; for other wastestreams in certain locations, the rule requires zero discharge.
C	Onshore Subcategory	Facilities located landward of the inner boundary of the territorial seas as defined in 40 CFR 125.1(gg) and which are not included within subparts D, E, or F.	BPT regulations require zero discharge of produced water for direct dischargers. PSES and PSNS require zero discharge for unconventional oil and gas extraction facilities.
D	Coastal Subcategory	Facilities located in or on a water of the United States landward of the inner boundary of the territorial seas (40 CFR 435.40(a), or as defined at 40 CFR 435.40(b)(1).	Zero discharge as BAT for the coastal subcategory (except for Cook Inlet) and zero discharge pretreatment standards.
E	Agricultural and Wildlife Water Use Subcategory	Onshore facilities located in the continental United States and west of the 98th meridian for which the produced water has a use in agriculture or wildlife propagation when discharged into navigable waters.	Subpart E requires no discharge of wastewater pollutants into navigable waters from any source other than produced water. Produced water discharges have a daily maximum limitation of 35 mg/L for oil and grease by the application of the BPT, and must be “of good enough quality” for wildlife or agricultural use.
F	Stripper Subcategory	Onshore facilities which produce 10 barrels per well per calendar day or less of crude oil and which are operating at the maximum feasible rate of production and in accordance with recognized conservation practices.	This subcategory has no ELG-based limitations. Technology-based limitations are developed on a case-by-case basis or in a state-wide general permit.
H	Coalbed Methane Subcategory	Facilities engaged on extraction of Coalbed Methane.	This subcategory has no ELG-based limitations. Technology-based limitations are developed on a case-by-case basis in an individual or state-wide general permit.

Note: Subpart B is reserved. Subpart G requirements prevent moving effluent produced in one subcategory to another subcategory for disposal under less stringent requirements.

Table 2. Subcategories of 40 CFR part 435. Source: EPA’s Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001.

oxygen demand, total suspended solids, fecal coliform, pH and oil and grease”; and (3) *nonconventional pollutants*, all other pollutants not included in the prior categories.³⁰

Third, ELGs apply to both new and existing discharges.

Finally, different programs are employed to set guidelines for **direct discharges**, or wastewater discharged to surface water bodies, and **indirect discharges**, or wastewater that is discharged to Publicly Owned Treatment Works (POTWs). These two programs (NPDES permit program and NPDES pretreatment program) are further explored in the next section.

Direct Discharges (discharges to waters of the US)

Direct discharges from point sources to waters of the United States are regulated by the NPDES permit program. The pollution control guidelines of this program can be based on (1) best practicable control technology currently available (BPT), (2) best conventional pollutant control technology (BCT), (3) best available technology economically achievable (BAT), and (4) new source performance standards (NSPS), depending on which subcategory the discharge is regulated by. Onshore pollution control guidelines are based on best practicable control technology (BPT) only.



Indirect Discharges

Indirect discharges occur when produced water is transported from the production site to a publicly owned treatment works or POTW, treated, and then discharged into a receiving water body. Wastewater from oil and gas extraction point sources to POTWs is regulated by the NPDES pretreatment program. Because many POTWs are designed to process municipal waste, but not industrial waste, treating produced water in these facilities may interfere with POTW operations or pass through the POTW insufficiently treated.³¹ To address these potential problems, general pretreatment regulations found in 40 CFR part 403, require the establishment of pretreatment programs to avoid these potential complications as POTWs receive non domestic waste. Agencies responsible for permitting, administrative, and enforcement tasks are municipalities that have been authorized by a state and EPA. Produced water discharges to POTWs pose specific problems due to the nature of the waste. EPA's *Study of Oil and Gas Extraction Wastewater Management* included the input of POTW associations, which expressed that, in general, POTW operators would prefer to not accept produced water, as treatment technologies are not

capable of treating contaminants of concern such as TDS and chloride.³² Discharges to POTWs mostly occur in Pennsylvania, Ohio, and West Virginia, according to EPA.³³ Due to these inadequate technologies, produced water is sometimes treated at a Centralized Waste Treatment (CWT) facility designed to treat industrial waste before it is transported to a POTW. Pollution control guidelines in this program include (1) pretreatment standards for existing sources (PSES) and (2) pretreatment standards for new sources (PSNS).

Pretreatment Standards for Unconventional and Conventional Oil and Gas

EPA finalized a rule in June 2016 prohibiting the discharge of wastewater from onshore unconventional oil and gas (UOG) extraction facilities to publicly owned treatment works (POTWs).³⁴ EPA defines unconventional oil and gas in 40 CFR 435.33(a)(2)(i) as "crude oil and natural gas produced by a well drilled into a shale and/or tight formation (including, but not limited to, shale gas, shale oil, tight gas, and tight oil)." EPA states POTWs are not designed to treat constituents present in this effluent, and accepting it could damage POTWs and discharge untreated wastewater. However,

there are currently no pretreatment standards for produced water from conventional oil and gas extraction sources.³⁵ Lack of effluent guidelines for conventional sources of oil and gas is problematic, as a study by EPA on the effects of hydraulic fracturing on drinking water showed no significant difference between produced water from conventional sources and unconventional sources, and many of the same constituents of concern are found in both. EPA also found that “produced water generated from unconventional reservoirs is reported to be similar to produced water from conventional reservoirs in terms of TDS, pH, alkalinity, oil and grease, TOC, and other organics and inorganics.”³⁶

Table 3 summarizes the different levels of control applicable to all subcategories of CFR 40 part 435 according to type of sites and pollutants regulated for both direct and indirect discharges.

Zero Discharge of Pollutants Standard

Clean Water Act section 40 CFR part 435.32 prohibits the direct discharge of wastewater to surface water from oil and gas facilities located onshore in most cases.

For **direct discharges**, the standard prohibits the direct discharge of pollutants from oil and gas extraction facilities located onshore into waters of the U.S. (WOTUS). However, there are several exceptions to this rule.

1. Subcategory E of 40 CFR part 435, or Agricultural and Wildlife Water Use Subcategory, allows onshore facilities located in the continental United States and west of the 98th meridian, where more arid conditions exist (refer to *Figure 2*), to discharge produced water to surface waters. Under this exception produced water must provide a beneficial use for agriculture, livestock watering, or wildlife propagation when discharged into navigable waters, and

Summary of CWA Technology Levels of Control						
Types of Sites Regulated	BPT Best practicable technology	BCT Best conventional pollutant control technology	BAT Best available technology economically achievable	NSPS New source performance standards	PSES Pretreatment standards for existing sources	PSNS Pretreatment standards for new sources
Existing Direct Dischargers	X	X	X			
New Direct Dischargers				X		
Existing Indirect Dischargers					X	
New Indirect Dischargers						X
Pollutants Regulated	BCT	BCT	BAT	NSPS	PSES	PSNS
Conventional Pollutants	X	X		X		
Nonconventional Pollutants	X		X	X	X	X
Toxic (Priority) Pollutants	X		X	X	X	X

*Table 3. Levels of control applied to different classes and types of pollutants. Source: EPA Office of Water NPDES Permit Writers’ Manual Chp. 5 pg 15.*³⁷

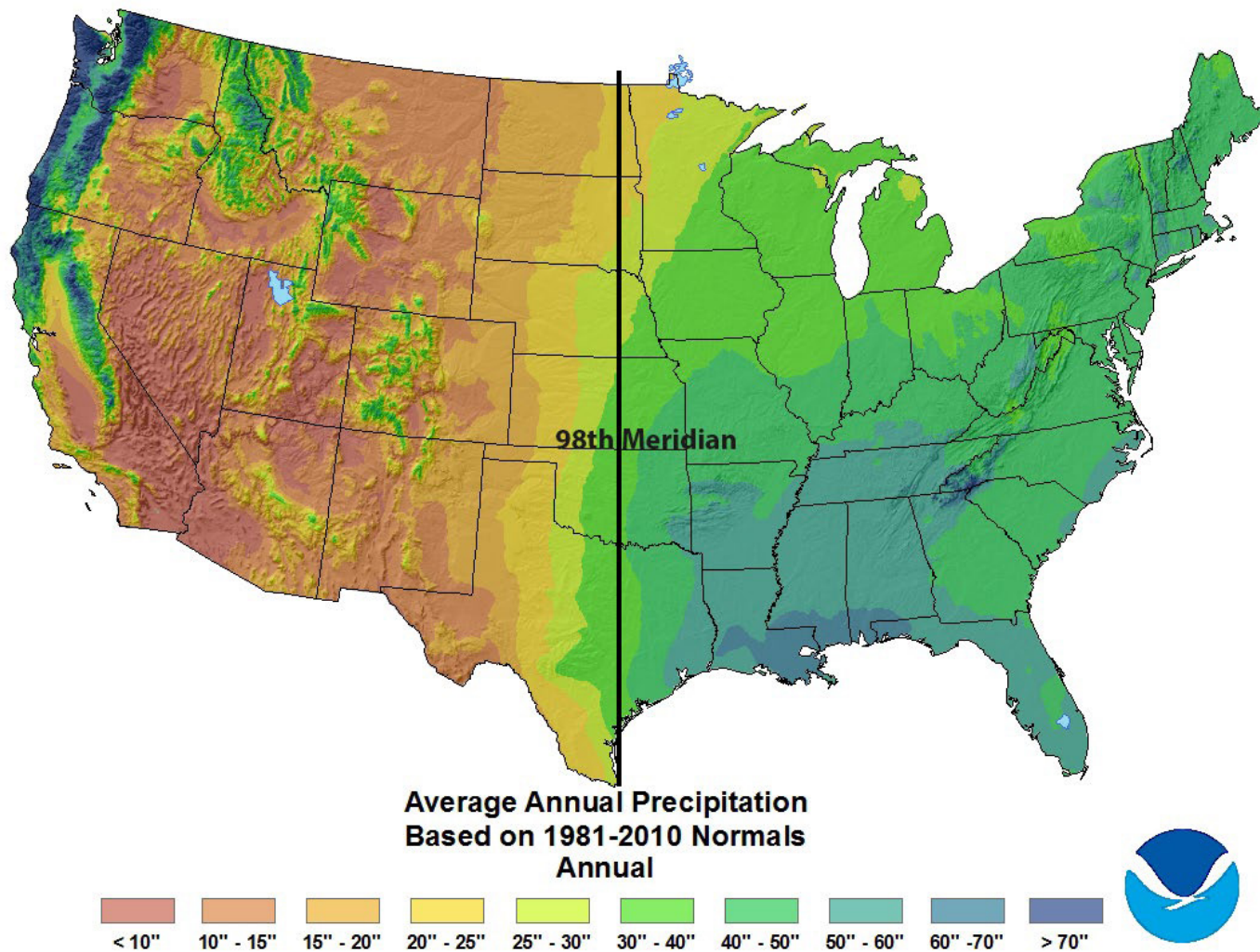


Figure 2. Map Showing 98th Meridian and Annual Precipitation Source: Modified from National Oceanographic and Atmospheric Administration <https://www.ncdc.noaa.gov/climateatlas>

adhere to a daily maximum limitation of 35 mg/L for oil and grease by the application of the best practicable control technology or BPT.³⁸ This practice takes place primarily in Wyoming, though other states have explored the use of produced water for these purposes. New Mexico, the third largest oil producing state, signed a Memorandum of Understanding with EPA in July 2018, and published a draft paper identifying possible reuse methods of produced water in the state.³⁹ Oklahoma’s Produced Water Working Group published a report on *Produced Water Reuse and Recycling* in 2017, exploring possibilities of reuse as part of Oklahoma’s Water for 2060 initiative.⁴⁰ Colorado engaged stakeholders in a dialogue about potential reuse of

produced water in 2014, which resulted in a report detailing potential opportunities and constraints for some of these uses.⁴¹ California is currently utilizing produced water for agricultural purposes, but without directly discharging produced water to waters of the United States.⁴² This form of reuse is therefore outside the scope of this report.

2. Subcategory F of 40 CFR part 435, or stripper subcategory, states that wells that produce 10 barrels of crude oil a day or less, considered low production wells, are exempt from the zero discharge standard and do not have ELG standards. Technology based standards are instead established on a case by case basis utilizing best professional judge-

ment (BPJ), or as part of a general permit. Stripper wells accounted for 11% of U.S. natural gas and 10% of U.S. oil production in 2015 according to the U.S. Energy Information Administration.⁴³ This raises questions about how much produced water is discharged from stripper wells to waters of the United States, and the impacts on water quality, health, and ecosystems. More information about the difficulty of assessing how many active permits exist for this subcategory can be found in section *Produced Water Discharge Permits: Systematic Search and Availability Analysis* later in this report.

3. Subcategory H of 40 CFR part 435, or coalbed methane subcategory, does not have effluent limitation guidelines and is exempt from the zero discharge standard. Similarly to subpart F, technology based standards are established on a case by case basis utilizing best professional judgement (BPJ) and incorporated into an individual or general permit. In 2010, EPA considered developing effluent guidelines for this category and published a report detailing available technologies. However, EPA deemed these technologies were not economically achievable and ruled against establishing effluent guidelines.⁴⁴

Centralized Waste Treatment Facilities

Centralized Waste Treatment facilities (CWTs) are industrial waste processing facilities that receive waste from a variety of industrial activities to be treated, discharged, or reused. CWTs are governed by effluent guidelines found in 40 CFR part 437 and accept both wastes to be treated for discharge to WOTUS (direct discharge) as well as waste to be further treated at a POTW (indirect discharge).

A CWT can be a stand alone facility receiving waste from off-site industries, or it can be located in a facility with a primary purpose other than waste treatment. To be defined as a CWT, according to 40 CFR §437.2, a treatment facility has to receive waste from outside the boundaries of that industrial facility (off-site).^{*} For example, an industrial

facility could house a waste treatment facility and treat wastes generated on-site, but it would not be considered a CWT unless it also receives wastes from outside that facility or off-site.⁴⁵

Because a CWT can treat waste generated on-site and off-site, there are specific guidelines that determine if the waste is regulated by 40 CFR part 437 or ELGs applicable to the source of the waste. First, if the off-site waste being treated is subject to the same ELGs as the on-site waste (40 CFR part 437.1), the industry ELGs apply. In the case of oil and gas, that would mean that if both on-site and off-site wastes are subject to 40 CFR part 435, then CWT ELGs would not apply. Second, CWT ELGs would not apply if the off-site waste is compatible with the on-site waste, which is defined as “the off-site wastes are of similar nature and the treatment of such wastes are compatible with the treatment of non-CWT wastes generated and treated at the CWT.” Third, CWT ELGs do not apply to waste generated off-site and transported via conduit if the waste does not commingle with other wastes treated at the CWT (40 CFR part 437.1). In summary, there are a number of factors that dictate whether produced water treated at a CWT is governed by 40 CFR part 437 or the industry guidelines in part 435.

Applicability of CWT ELGs to wastes treated at CWTs has important implications for several reasons.(1) CWTs ELGs are not subject to the zero discharge of pollutant standards of 40 CFR part 435 subpart C. Therefore, if oil and gas wastewater is treated at CWTs and it is subject to CWT ELGs, then the treated waste could be discharged to surface waters east and west of the 98th meridian. (2) According to EPA's *Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes EPA-821-R-18-004*, “the current ELGs at 40 CFR part 437 do not contain limitations for many of the pollutants commonly found in oil and gas extraction wastes” leaving it to the permit writer to use best professional judgement (BPJ) to develop technology based effluent limits for

^{*}EPA defines off-site as “outside the boundaries of a facility” (40 CFR 437.2(n))

constituents such as radionuclides.⁴⁶ Additionally, the CWT study states that “EPA approved analytical methods do not exist for many constituents found in oil and gas extraction wastes”.⁴⁷ The implications are that oil and gas waste being discharged by CWT facilities subject to 40 CFR part 437 may result in harmful public health and environmental impacts. Discharges from CWTs mainly occur in Pennsylvania, Ohio, and West Virginia, according to EPA.⁴⁸

2. Water Quality-Based Effluent Limitations (WQBELs)⁴⁹

The Clean Water Act establishes a process by which permit writers can enact more stringent standards for water bodies where TBELs are not sufficient to meet water quality standards. Water quality standards are set by states through a process delineated in regulation 40 CFR part 131 and approved by EPA to be consistent with the CWA.⁵⁰ According to chapter 6 of EPA’s NPDES Permit Writers’ Manual “If, after technology-based

limits are applied, the permit writer projects that a point source discharger may exceed an applicable criterion, a WQBEL must be imposed. EPA regulations at 40 CFR §122.44(d) require that all effluents be characterized by the permitting authority to determine the need for WQBELs in the permit.”⁵¹ Additional standards can include setting total maximum daily loads (TMDLs) which determine the maximum amount of a pollutant that can be discharged to a water body without surpassing the quality standards or effluent limits based on water quality standards and appropriate wasteload allocations. The process followed by the permit writer, as well as the data used to make determinations need to be clearly documented in the permit fact sheet.⁵²

In summary, produced water is regulated by technology based and water quality based guidelines and standards that are incorporated into NPDES permits. [Figure 3](#) below provides a summary of the regulations governing the oil and gas extraction industry.

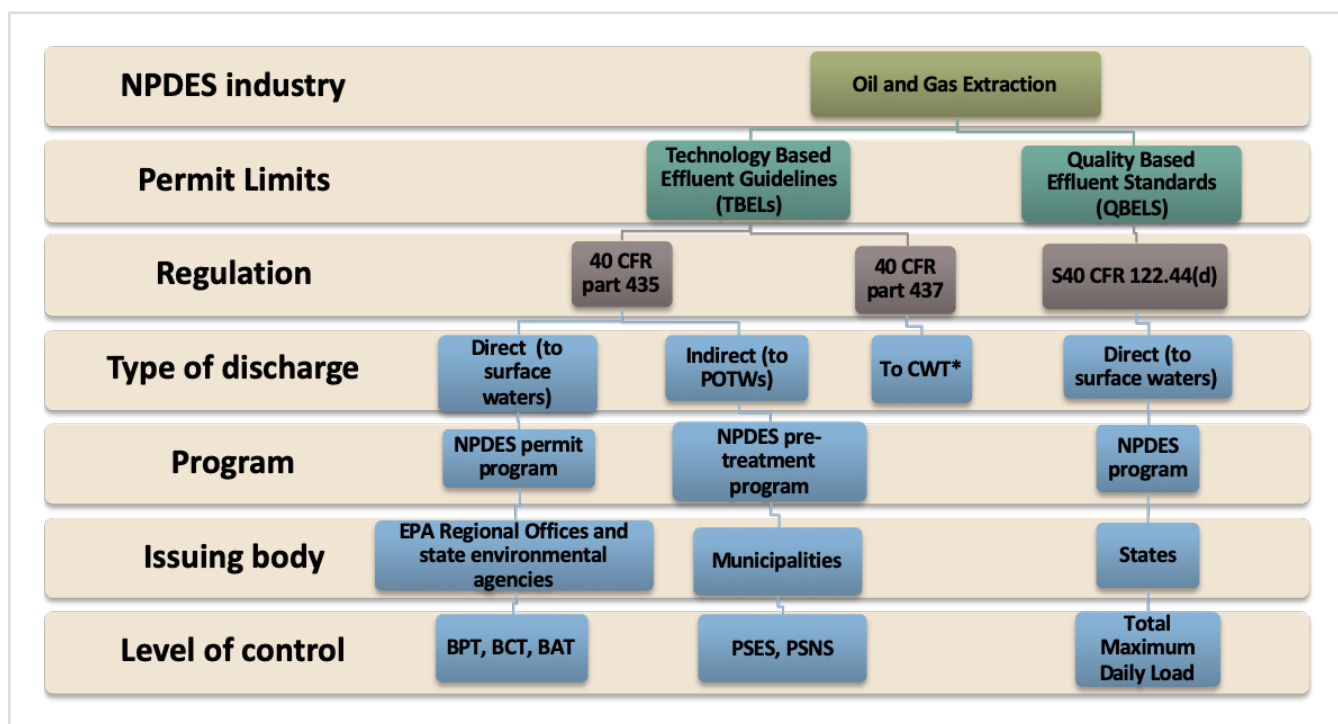


Figure 3. Matrix of guidelines governing oil and gas extraction wastewater discharges to surface water.

*For additional details on components of 40 CFR part 437, please refer to EPA’s Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes EPA-821-R-18-004.

Produced Water Discharge Permits: Systematic Search and Availability Analysis

A search for existing discharges governed by oil and gas effluent guidelines (40 CFR part 435) was undertaken to better understand to what extent and where discharges are occurring, as well as the availability and transparency of permits. Concerned members of the public, researchers and advocates should be able to search for and easily find permits to discharge produced water in any given state. This search revealed serious deficiencies in how states make these permits available to the public.

Methodology

A systematic exploratory search was conducted to assess how accessible active permits for oil and gas extraction wastewater discharge to surface water regulated under 40 CFR part 435 were to the general public, as well as to find where onshore produced water discharge to surface water was occurring. The steps followed included:

1. Visiting EPA's *Find an NPDES permit* website.⁵³
2. Selecting each state in alphabetical order.
3. Searching for oil and gas active wastewater

discharge to surface waters permits if listed on the EPA website.

4. For states with primacy to issue permits: accessing the website of the state's environmental agency provided in EPA's website.
5. Searching for active oil and gas wastewater discharge to surface water permits if available on the agency's website.
6. Contacting the appropriate EPA region or state agency by method specified on the website if permits were unavailable online and requesting the permits.

Considerations for Future Permit Searches

EPA and state agencies are undergoing a transition from paper based to electronic reporting to comply with the NPDES Electronic Reporting Rule (40 CFR part 127). This rule establishes a requirement to transition to electronic reporting to improve efficiency and accuracy in the permitting program and requires that most documentation for the



NPDES program be submitted online through NetDMR, or the Central Data Exchange (CDR) and Ne T.⁵⁴ These changes may affect future availability of documentation as some states may be in the process of adapting their electronic systems. Additional research is needed to inform how this transition will impact the availability of data for the general public in the future. There is also an opportunity to utilize findings of this report as some states had more accessible systems that could serve as best practices for other states still in transition.

Additionally, EPA's website hosts the Enforcement and Compliance History Online (ECHO) tool. This tool presents an alternate method for finding NPDES-permitted facilities, as well as facilities with unresolved violations.⁵⁵ Future studies could utilize this tool to replicate this search and compare results.

Findings

Permits Issued by EPA

Most permits issued and administered by EPA are listed on the agency's website, including "all final (i.e. active) and draft (i.e. proposed) NPDES permits issued by EPA... It includes permits for individual facilities, general permits, and stormwater permits."⁵⁶ The list of permits includes documents for all NPDES categories and industries and can only be organized by location, permit or facility name, permit number, permit status (final or draft), effective date, and expiration date. It is difficult to find and review permits for oil and gas discharges unless a user is looking for a specific permit and has the facility name or permit number. Additionally, permits are not posted for some states with EPA primacy, such as Oklahoma, New Mexico and Texas. It is unclear whether permits are not listed because there are no active permits, or due to other reasons. When contacted about permits for the states of Oklahoma, New Mexico and Texas, EPA Region 6 staff requested that a Freedom of Information Act

(FOIA) request be submitted to obtain permits. Region 6 staff did not indicate whether or not there are existing active permits.

Permits Issued by State Agencies

There is little consistency in how states make oil and gas extraction wastewater discharge to surface water permits available. Many state websites had permits listed or a document search tool, but most did not have the appropriate search filters to isolate permits for produced water discharge and the additional criteria utilized in this search. During the systematic search, it was found that some state agencies utilized the United States Department of Labor's Standard Industrial Classification (SIC) System as a way to categorize permits of differing industries.⁵⁷ This search focused on *Division B, mining, Major Group 13: Oil And Gas Extraction*. When searching for permits employing SIC codes, the following codes were utilized: *1311 Crude Petroleum and Natural Gas, 1321 Natural Gas Liquids, 1381 Drilling Oil and Gas Wells, 1382 Oil and Gas Field Exploration Services, 1389 Oil and Gas Field Services, Not Elsewhere Classified*. Another classification system utilized by some states is the North American Industry Classification System or NAICS, but it was not utilized in this search due to time constraints. NAICS codes in the subsector 211, Oil and Gas Extraction, could be used in future searches.⁵⁸

The systematic search of NPDES permits for oil and gas wastewater discharge to surface waters revealed discrepancies in the availability of permits online, how permits were organized if available, and whether it was possible to filter permits by industry.

Some states did not make NPDES permit information available on their website, and only provided information about permit applications and perhaps included the blank forms needed for the application process. For these states, there was also variability in the ease of finding a contact within the agency to make a request for this information. When contacting state agencies, there were additional differences in the request process,

some of them requiring a written document request in various forms to obtain the permits. Some of these requests were formal petitions equivalent to a Freedom of Information Act request, and did not guarantee that the agency had a process for identifying oil and gas wastewater permits internally. One state agency, Alabama Department of Environmental Management, stated via email that maintaining a list of individual permits is prohibited by the state’s regulation: “*Paragraph 335-1-1-.06(4) of our Department’s regulations reads as follows:Creation of record. Records will not be created by compiling selected items from other documents at the request of a member of the public, nor will records be created to provide the requester with data such as ratios, proportions, percentages, frequency distribution, trends, correlations, or comparisons except as necessary to administer the Act.*” Finally, many states did list general permits but did not make individual permits available.

States that made permit information available online showed variation in how it was organized, searchable, and if the PDF permit documentation was attached. State agencies varied in offering either a list of permits, a spreadsheet, or offering a search tool with multiple filter options. For each of these variations, filter options were also different, with a few offering the possibility to filter by industry utilizing the Standard Industry Classification (SIC) code. The main SIC group for oil and gas production is SIC 13. Subgroups are 1311, 1321, 1381, 1382, and

1389.⁵⁹ Other search criteria that differed across states included filtering for active permits and type of discharge (e.g. wastewater vs. stormwater). The majority of states only provided options to find permits through permit name or number, making it difficult to find permits unless the user is looking for a specific permit and already has this information. Most states included the permit name and number when information was available, but did not specify other information such as which subcategory of 40 CFR part 435 applies to the discharge (e.g. subpart F or stripper subcategory). Generally, as filter options increased, ease of finding the desired permits increased.

Another main difference included whether the PDF of the permit document was attached to the listing of the permit or had to be found elsewhere requiring additional time and effort. **Mississippi and Arkansas have accessible search engines where it is possible to find permits by SIC code and download the documentation in the same online location. These systems are a good example of transparency and could be used as a best practice.**

Availability of Permits

States have been organized according to the level of availability of permits online as shown in [Table 4](#). For the purposes of this report, level of availability has been defined according to whether a permit list was found online (in a list, spreadsheet, or document

Level of Availability	States
Permits are available online and can be sorted by industry	Arkansas, California, Colorado, Indiana, Iowa, Mississippi, Oregon, Pennsylvania.
Permits are or may be available through a search function, but cannot be filtered by industry	Alaska, American Samoa, Connecticut, Florida, Georgia, Guam, Idaho*, Illinois, Louisiana, Maine, Maryland, Massachusetts*, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire*, New Jersey, New York, North Dakota, Northern Mariana Island, Ohio, Puerto Rico, Rhode Island, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.
Permits are not available	Alabama, Arizona, Delaware, Hawaii, Kansas, Kentucky, Minnesota, New Mexico*, North Carolina, Oklahoma*, South Carolina, Texas*, West Virginia.

Table 4. Level of availability of permits in states around the nation. An asterisk (*) indicates states where EPA retains authority.

search tool) and could be sorted by industry or SIC code (green), a permit list was available online, but couldn't be sorted by industry or SIC code (yellow), or permits were not found online (red).

Where Are There Permitted Discharges of Produced Water?

The systematic search found **7 states** that may have onshore oil and gas extraction wastewater discharge permits in effect. It was difficult to assess whether the permits were relevant to the search and some of these permits did not have language that specified if the permit was a wastewater permit for oil and gas extraction or pertained to other oil and gas activities. It is also unclear whether some permits are regulating wastewater or stormwater discharges. Additionally, most permits did not specify which subcategory of 40 CFR part 435 regulated the discharge, making it difficult to identify if permits were for onshore, coastal, offshore discharges or other subcategory. [Table 5](#) below includes a list of states and the number of general and individual permits found. In total, **3 general permits and 668 individual permits** were found during this search.

Mississippi (not included in [Table 5](#)) and New York appeared to have active permits for oil and gas extraction wastewater discharge to surface water, even though they are located east of the 98th Meridian. Due to lack of information in the permit documents, it was difficult to find under which subcategory of 40 CFR part 435 these permits were issued. Additional research could provide more information about the nature of these permits. The permits for the state of NY were obtained from a spreadsheet provided by a state employee through email. After looking for the permit documentation in a folder system provided by the same employee, an email was sent to confirm that these were permits for wastewater discharge and not stormwater discharge. The employee responded stating that it was not part of their program to verify this information and referred back to the information available in the permit documents. An email was also sent to a Mississippi state employee to corroborate they meet the search criteria. An email response stated that the permits found did not meet the criteria (they were therefore removed from [Table 5](#)).

Number of Permits Found		
State	General permits	Individual permits
Alaska	0	2*
Colorado	1	6
Indiana	0	1 (coalbed methane)
Montana	1	0*
New York	0	10
Utah-Navajo Nation	1	0*
Wyoming	0	649
Total	3	668

Table 5. Number of general and individual permits found for oil and gas extraction wastewater discharge to surface water under 40 CFR part 435. An asterisk () denotes there may be additional permits that were not found due to lack of accessibility or transparency.*

Conclusion

As production of oil and gas in the United States has increased, so has the need to manage and dispose of large volumes of produced water. A growing interest from industry and other stakeholders to reuse produced water outside of the oil industry should be accompanied by increased commitment to assure these practices do not happen at the expense of the health of the public and the environment. This report explored current legislation and regulatory frameworks governing oil and gas produced water discharges to surface waters of the United States. Through a review of effluent guidelines and standards for the oil and gas industry, as well as a systematic search of National Pollution Discharge Elimination System permits for oil and gas extraction wastewater discharges, this report reveals that current regulations are allowing discharges of wastewater that may be harmful to human health and the environment. In addition, this search found that EPA regional offices and states have varying methods of making permits available, and it is difficult to obtain information about where oil and gas produced water discharges to surface water are occurring and what specific regulations are governing the discharges.

This report shows that current legislation and regulations are insufficient to ensure protection of water resources. Areas of concern include:

1. There are significant knowledge and data gaps around the constituents present in produced water, as a result of inadequate chemical additive reporting requirements, trade secret claims, lack of analytical methods, and incomplete toxicity profiles.
2. Subcategory E (agricultural and wildlife water use) of 40 CFR part 435 leaves areas west of the 98th meridian unprotected given the lack of evidence that discharges for beneficial purposes are safe for the environment and public health.
3. Subcategories F (stripper well) and H (coalbed methane) of 40 CFR part 435 are not subject to federal effluent guidelines, placing the burden of developing technology based guidelines on a case by case basis on permit writers of the issuing authority.
4. Produced water treated at CWTs can be discharged both west and east of the 98th meridian, but a recent EPA study calls into question the availability of analytic methods to detect pollution in wastewater discharges, and effluent guidelines do not address constituents commonly found in produced water.⁶⁰ Produced water treated at these facilities and discharged according to 40 CFR part 437 cannot be assumed safe and places the health of the public and the environment at risk. Until analytical methods and standards are adequate and can assure safe discharges of produced water from these facilities, 40 CFR part 437 constitutes a loophole for industries discharging east of the 98th meridian.
5. Despite evidence that produced water from unconventional and conventional sources often contain similar constituents of concern, there are no existing pretreatment standards for wastewater from conventional oil and gas extraction activities, placing POTWs at risk of damage to their operations, and putting public health and the environment at risk.
6. Variability in how EPA and states make permits available online or by request, makes it difficult to know where discharges are occurring and to understand the activities and applicable regulations.

Recommendations

EPA should not only be cautious in its response to industry requests to weaken existing regulations to allow for more produced water discharge, but should strengthen current regulations of produced water discharge under the Clean Water Act. Specific recommendations for EPA include:

EPA should improve its understanding about chemical characteristics of produced water by promulgating regulations to:

- Improve chemical additive transparency by limiting trade secret claims and requiring disclosure of chemicals used in routine well activities and enhanced recovery.
- Limit the use of chemical additives which lack established analytical methods and/or have incomplete toxicity profiles.

EPA should take the following steps to revise effluent guidelines for oil and gas extraction:

- Review and update the effluent guidelines for oil and gas extraction in 40 CFR part 435, in order to fully identify possible pathways of chemical exposure that could harm the environment and public health, including:
 - Eliminate subcategory E (agricultural and wildlife water use subcategory) by expanding the zero discharge standard to all areas west of the 98th meridian until appropriate analytical methods and standards are developed that can assure discharges are safe for humans and the environment.
 - Update effluent guidelines for subcategory F (stripper well subcategory).
 - Update effluent guidelines for subcategory H (coalbed methane subcategory).⁶¹

EPA should also update effluent guidelines in the following ways:

- Establish zero discharge pretreatment standards for discharges to POTWs for conventional oil and gas wastewater.
- Review and update CWT effluent guidelines in 40 CFR part 437 to address risks and deficiencies, such as those identified in EPA's CWT study.

Specific recommendations for EPA and states with oil and gas NPDES primacy to improve permitting oversight and transparency:

- Review, evaluate and update state water quality standards to ensure protection of water resources from produced water discharges.
- Make NPDES permits documentation available and easily searchable online and by request. Increased transparency would allow the public to know where discharges are occurring. Specific steps include:
 - Consider following Mississippi and Arkansas (or similar) model for making permits and other documentation available and searchable online.
 - Include federal regulation, including subcategory, in the permit and the search filters of the online search tool. This change would allow a member of the public to search, for example,

how many permits from coalbed methane extraction facilities for wastewater discharges to surface water are active in their state.

- Create a national inventory of oil and gas discharges to surface waters that includes links to permits and information on regulatory activities such as enforcement and monitoring.

Future Research Needs

Researching this issue led to the identification of several next steps for future research on this topic. They include:

- Evaluating state and tribal primacy applications and agreements with EPA for delegating oil and gas NPDES authority.
- Reviewing state water quality standards that relate to produced water discharges.
- A more in depth review of CWT regulations and updates needed to protect water resources.
- A review of individual permits, including enforcement activities, monitoring data and volumes of permitted discharges
- Definitions of wildlife use for Subcategory E, especially in Wyoming where this subcategory is most commonly applied.



Notes

- 1 International Energy Agency (2019). Oil 2019, Analysis and Forecasts to 2024. <https://www.iea.org/oil2019/>
- 2 International Energy Agency (2019). Oil 2019, Analysis and Forecasts to 2024. <https://www.iea.org/oil2019/>
- 3 Kondash, Andrew J, Nancy E. Lauer, Avner Vengosh. (Aug 2018) "The intensification of the water footprint of hydraulic fracturing". Science Advances.: EAAR5982. <http://advances.sciencemag.org/content/4/8/eaar5982>
- 4 EPA, Office of Water (2019). Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pg.5.
- 5 EPA (2018). Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes EPA-821-R-18-004. S.9; pg 6
- 6 EPA (2018). Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes EPA-821-R-18-004 https://www.epa.gov/sites/production/files/2018-05/documents/cwt-study_may-2018.pdf
- 7 EPA(2016). Hydraulic Fracturing For Oil And Gas: Impacts From The Hydraulic Fracturing Water Cycle On Drinking Water Resources In The United States (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/236F.
- 8 Warner, Nathaniel & A Christie, Sidney & B Jackson, Robert & Vengosh, Avner. Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania, Environmental Science & Technology. (Oct 2013).
- 9 Cal. Reg'l Water Quality Control B.d Central Valley Region, Cease and Desist Order R5-2019-0045 for Valley Water Management Company McKittrick 1 & 1-3 Facility Kern County, adopted June 6, 2019, https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/kern/r5-2019-0045.pdf.
- 10 Karydas, A. (1990). U.S. Patent No. 4,921,619. Washington, DC: U.S. Patent and Trademark Office. <https://patentimages.storage.googleapis.com/0c/a2/eb/4091ebf58f32c6/US4921619.pdf>
- 11 Jensen, Allan. (2010). Draft guidance document on alternatives to perfluorooctane sulfonate and its derivatives. 10.13140/RG.2.1.4628.6489. https://www.researchgate.net/publication/299238731_Draft_guidance_document_on_alternatives_to_perfluorooctane_sulfonate_and_its_derivatives/citation/download
- 12 U.S. EIntl. Prot. Agency (2018). Basic Information on PFAS. <https://www.epa.gov/pfas/basic-information-pfas>
- 13 EPA, Office of Water. (2019) Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001
- 14 Oetjen, K., Giddings, C. G., McLaughlin, M., Nell, M., Blotvogel, J., Helbling, D. E., ... & Higgins, C. P. (2017). Emerging analytical methods for the characterization and quantification of organic contaminants in flowback and produced water. Trends in Environmental Analytical Chemistry, 15, 12-23.
- 15 EPA, Office of Water. (2019) Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pgs 7-9.
- 16 Comments on EPA's May, 2019 Draft Report on the "Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act" [EPA-821-R19-001] <https://www.axpc.org/wp-content/uploads/2019/07/07-01-19-API-AXPC-IPAA-DEPA-Wastewater-Study-Comment-Package-for-EPA.pdf>
- 17 Kondash, A. J., Lauer, N. E., & Vengosh, A. (2018). The intensification of the water footprint of hydraulic fracturing. Science advances, 4(8), eaar5982. https://advances.sciencemag.org/content/4/8/eaar5982?utm_source=TrendMD&utm_medium=cpc&utm_campaign=TrendMD_1&stream=top-stories
- 18 Environmental Protection Agency (2019). Summary of the Clean Water Act. <https://www.epa.gov/laws-regulations/summary-clean-water-act>
- 19 EPA (2019) National Pollutant Discharge Elimination System (NPDES). <https://www.epa.gov/npdes/about-npdes#overview>
- 20 EPA (2019). NPDES State Program Information. <https://www.epa.gov/npdes/npdes-state-program-information>
- 21 EPA (2019). NPDES State Program Information. <https://www.epa.gov/npdes/npdes-state-program-information>
- 22 EPA (2019). NPDES permits around the nation. <https://www.epa.gov/npdes-permits>
- 23 GWPC (2015). Produced Water Reuse in Oklahoma: Regulatory Considerations and References. Pg 4. <http://www.gwpc.org/sites/default/files/Oklahoma-Produced-Water-Project-Summary-Report.pdf>
- 24 TCEQ (2019). TCEQ's activities and schedule for implementing House Bill 2771, 86th Legislature 2019, relating to delegation of wastewater permits for oil and gas facilities. <https://www.tceq.texas.gov/permitting/wastewater/housebill-2771#Notice%20of%20Upcoming%20HB%202771%20Stakeholder%20Meeting>
- 25 Produced Water Working Group. (2017). Oklahoma Water for 2060: Produced Water Reuse and Recycling. <https://www.owrb.ok.gov/2060/PWWG/pwwgfinalreport.pdf>
- 26 EPA (2018). Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes EPA-821-R-18-004, pg.9. https://www.epa.gov/sites/production/files/2018-05/documents/cwt-study_may-2018.pdf
- 27 EPA (2019). Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pgs 9-14.
- 28 EPA (2019). Learn about effluent guidelines. <https://www.epa.gov/eg/learn-about-effluent-guidelines>
- 29 EPA, Office of Water (2019). Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pg 12.
- 30 EPA (2019) Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pgs 9-12.
- 31 EPA, (2017). National Pretreatment Program. <https://www.epa.gov/npdes/national-pretreatment-program>
- 32 EPA, Office of Water (2019). Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pg 29
- 33 EPA (2019). Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pg 2.
- 34 EPA (2016). Pretreatment Standards for the Oil and Gas Extraction Point Source Category https://www.epa.gov/sites/production/files/2016-06/documents/uog-final-rule_fact-sheet_06-14-2016.pdf
- 35 EPA (2016). Pretreatment Standards for the Oil and Gas Extraction Point Source Category. https://www.epa.gov/sites/production/files/2016-06/documents/uog-final-rule_fact-sheet_06-14-2016.pdf
- 36 U.S. Environmental Protection Agency, Office of Research and Development, Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States, (Washington, D.C., December 2016), 7-16, www.epa.gov/hfstudy.
- 37 U.S. Environmental Protection Agency (2010). NPDES Permit Writers' Manual. Chp.5, pg. 15. https://www.epa.gov/sites/production/files/2015-09/documents/pwm_2010.pdf

Notes *continued*

- 38 EPA (2019). Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pg 12
- 39 State of New Mexico and the U.S. Environmental Protection Agency (2018). Oil and Natural Gas Produced Water Governance in the State of New Mexico—Draft White Paper. <http://www.emnrd.state.nm.us/wastewater/documents/Oil%20and%20Gas%20Produced%20Water%20Governance%20in%20the%20State%20of%20New%20Mexico%20Draft%20White%20Paper.pdf>
- 40 Produced Water Working Group. (2017). Oklahoma Water for 2060: Produced Water Reuse and Recycling. <https://www.owrb.ok.gov/2060/PWWG/pwwgfinalreport.pdf>
- 41 CDR Associates, for the Colorado Energy Office & Colorado Mesa University Water Center (2014). Produced Water Beneficial Use Dialogue: Opportunities and Challenges for Re-Use of Produced Water on Colorado’s Western Slope.
- 42 California Water Boards (2019). Frequently Asked Questions about Recycled Oilfield Water for Crop Irrigation. https://www.waterboards.ca.gov/centralvalley/water_issues/oil_fields/food_safety/data/fact_sheet/of_foodsafety_fact_sheet.pdf
- 43 U.S. Energy Information Administration (2018). U.S. Oil and Natural Gas Wells by Production Rate. <https://www.eia.gov/petroleum/wells/>
- 44 EPA (2018). Coalbed Methane Extraction Industry. Rulemaking Activities. <https://www.epa.gov/eg/coalbed-methane-extraction-industry>
- 45 EPA (2019). Centralized Waste Treatment Effluent Guidelines, Facilities Covered. <https://www.epa.gov/eg/centralized-waste-treatment-effluent-guidelines>
- 46 EPA (2011). Natural Gas Drilling in the Marcellus Shale NPDES Program Frequently Asked Questions. pg.11 https://www3.epa.gov/npdes/pubs/hydrofracturing_faq.pdf
- 47 EPA (2018) Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes EPA-821-R-18-004 s.1,pg3 https://www.epa.gov/sites/production/files/2018-05/documents/cwt-study_may-2018.pdf
- 48 EPA, Office of Water (2019). Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pg 2
- 49 EPA (2019) Draft Study of Oil and Gas Extraction Wastewater Management Under the Clean Water Act EPA-821-R19-001, pgs 14-15
- 50 Clean Water Act, 40 CFR Part 131. https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40cfr131_main_02.tpl
- 51 EPA Permit Writers Manual Chapter 6 Water Quality-Based Effluent Limits, pg 87 https://www3.epa.gov/npdes/pubs/chapt_06.pdf
- 52 EPA Permit Writers Manual Chapter 6, pg 35 https://www.epa.gov/sites/production/files/2015-09/documents/pwm_chapt_06.pdf
- 53 EPA (2019). NPDES Across the Nation. <https://www.epa.gov/npdes-permits>
- 54 EPA (2019). NPDES eReporting. <https://www.epa.gov/compliance/npdes-ereporting>
- 55 EPA (2019). Enforcement and Compliance History Online. <https://echo.epa.gov/>
- 56 EPA (2019). Illinois NPDES Permits. <https://www.epa.gov/npdes-permits/illinois-mpdes-permits>
- 57 United States Department of Labor (2019). SIC Division Structure. https://www.osha.gov/pls/imis/sic_manual.html
- 58 United States Census Bureau (2019). North American Industry Classification System. <https://www.census.gov/eos/www/naics/>
- 59 US Department of Labor, Occupational Safety and Health Administration. (2019). Major Group 13 Oil and Gas Extraction. https://www.osha.gov/pls/imis/sic_manual.display?id=8&tab=group
- 60 EPA (2018) Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes EPA-821-R-18-004 https://www.epa.gov/sites/production/files/2018-05/documents/cwt-study_may-2018.pdf
- 61 EPA (2014). Final 2012 and Preliminary 2014 Effluent Guidelines Program Plans. Pg 4-2. https://www.epa.gov/sites/production/files/2016-10/documents/final-2012-and-preliminary-2014-effluent-guidelines-program-plans_sept-2014_508.pdf

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