



Regulating oil and gas facility stormwater discharge: An assessment of surface impoundments, spills, and permit compliance



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ABSTRACT

Contaminated stormwater runoff from oil and gas (O & G) operations can pose a significant threat to surface waters. The purpose of this study is to examine the extent of this threat and identify more specific permitting requirements to protect surface waters. To better understand the extent of the threat, this paper identified and characterized the use of waste surface impoundments at O & G facilities as well as the threat level from O & G spills in California. To assess the efficacy of the current federal and California state-permitting regime, the paper evaluated stormwater permit compliance in two California counties. It also reviewed selected spill cases and associated Spill Prevention, Control and Countermeasure Plans and Stormwater Pollution Prevention Plans to identify the adequacy of current industry practices.

The analysis showed that contaminated stormwater from O & G facilities can be better regulated. The U.S. Environmental Protection Agency does not require O & G facilities to file for an Industrial Stormwater General Permit even though many O & G industry practices have the potential to contaminate stormwater runoff from the site. When O & G facilities discharge a Reportable Quantity of a hazardous chemical or violate a water quality standard, they are required to enroll in the National Pollutant Discharge Elimination System permit program. Spills, although not a direct indication of stormwater runoff, can highlight polluted runoff discharges that should have been regulated. Medium and large spills that reached waterways were such a risk for which operators did not file for a permit. In California new filing requirements for the oil and gas industry require all facilities that discharge stormwater that has come into contact with any overburden, raw material, or intermediate products located on the site, to file for an Industrial Stormwater General Permit. As this study showed, there has been an increase in enrollment since the enactment of the new requirements. Having all facilities enroll in the general permit program, as done in California, would require minimum monitoring and maintenance that could help prevent spills. A further step to ensure better protocol is to require specific pollution control practices in addition to the current general permit requirements. Such permitting regimes not only can be implemented on the US federal level but also internationally.

1. Introduction

O & G exploration and development is a large global industry, and it is likely to expand in the near future due to technological advances and the increased cost-effectiveness of unconventional oil stimulation techniques. With increased activity, there are a variety of ways in which pollutants can get into our waterways, especially if the activity goes unregulated: stormwater transports debris, chemicals, sediment and other pollutants that may adversely impact wildlife, cause algae blooms and increase flooding. Due to an exemption, stormwater runoff from oil and gas drilling sites is not regulated under the National Pollutant Discharge Elimination System (NPDES).

There are many O & G field operations that can contribute to

contamination of stormwater. They include but are not limited to drilling and production equipment and other machinery, raw materials, waste products and by-products, O & G treatment units, finished products, storage areas, fuels and lubricants, and waste treatment areas (US EPA, 2006). For more details on the activities, pollutant sources, and pollutants that are commonly found at O & G extraction facilities see the supplementary section.

Construction activity is a major source of pollutant discharge, both from sediment and also the equipment and materials used. O & G construction sites have the potential to produce as much sediment as other types of construction sites (McBroom et al., 2012; Williams et al., 2008). Well drilling, well stimulations, and well production are all sources of increased total suspended solids (TSS), total dissolved solids

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(TDS), and pollutants including oil and grease as well as a large variety of hazardous chemicals listed as chemicals requiring reporting under the Clean Water Act (US EPA, 2006).

Vehicles and equipment on site are another source of TSS, TDS, oil and grease, and pH alterations. Oil fields with more wells are greater threats to stormwater pollution. Well density is positively correlated with in-stream turbidity measurements (Entrekin et al., 2011) and increased TSS concentrations (Olmstead et al., 2013).

Another source of contamination are surface impoundments that are often used to store a variety of potentially toxic, as well as non-hazardous liquid and solid wastes associated with O & G development. Although no studies have looked at the impact of stormwater runoff from surface impoundments, the chemicals may leach into groundwater; contaminate soils and vegetation; or overflow from the sides of the impoundment—either during a rain event, or due to inadequate storage—and pollute soil and surface waters.

The purpose of this study is to identify the extent that O & G exploration and production operations threaten surface water and identify more specific permitting requirements to eliminate the exposure of O & G operations to stormwater runoff and/or to control pollutants in discharges to protect surface waters. To determine if a significant threat exists—which if it does exist, the US EPA Regional Administrator may designate additional stormwater discharges as requiring NPDES permits—this paper identified and characterized the use of waste surface impoundments at O & G facilities and highlighted risks from spill reports, quantifying the occurrence rate of medium and large sized spills as well as whether they came in contact with waterways.

To identify more specific permitting requirements the paper identified areas of improvement in the current federal and California state regulatory framework for managing direct and indirect discharges from O & G development. To do so the paper reviewed Industrial Stormwater General Permit compliance and current unconventional oil stimulation stormwater permit compliance given the increase in this practice in two California Counties. It also reviewed selected spill cases and associated Stormwater Pollution Prevention Plans (SWPPP) and Spill Prevention, Control and Countermeasure (SPCC) plans to identify adequacy of current industry practices.

1.1. Oil and gas exploration and production stormwater regulations

The Clean Water Act regulates the treatment and discharge of wastewater into surface waters of the United States. It sets national standards for industrial wastewater discharges to surface waters – which is known as direct discharge – and municipal sewage treatment plants (also known as publicly owned treatment works or POTWs) – which is known as indirect discharge – based on the performance of treatment and control technologies.

Direct discharges are subject to the National Pollutant Discharge Elimination System (NPDES) permit program. The permit contains limits on what can be discharged, monitoring and reporting requirements, and other provisions to ensure that the discharge does not hurt water quality or people's health. There are two basic types of NPDES permits issued: an individual permit and a general permit. An individual permit is tailored to an individual facility, and a general permit to a group of similar dischargers. In certain cases there are more sector/industry specific permits/requirements, such as the Washington States boatyard permit (Boatyard General Permit) or California Regional Water Quality Control Board Santa Ana Region's sector-specific general permit for storm water runoff associated with industrial activities from scrap metal recycling facilities (SWRCB, 2012).

Stormwater runoff is a direct discharge. Requirements for the Industrial Stormwater General Permit include development of a written Stormwater Pollution Prevention Plan (SWPPP), implementation of control measures, and submittal of a request for permit coverage, usually referred to as the Notice of Intent or NOI. The SWPPP is a written assessment of potential sources of pollutants in stormwater

runoff and measures that will be implemented at the facility to minimize the discharge of these pollutants in runoff from the site. These measures include site-specific best management practices (BMPs), maintenance plans, inspections, employee training, and reporting. The procedures detailed in the SWPPP must be implemented by the facility and updated as necessary, with a copy of the SWPPP kept on-site. The Industrial Stormwater General Permit also requires collection of visual, analytical, and/or compliance monitoring data to determine the effectiveness of implemented BMPs (US EPA, 2009).

Direct discharges from O & G sites are subject to the NPDES permit program, with the exception of coal bed methane. There can be no discharge of water pollutants from any source associated with production, field exploration, drilling, well completion, or well treatment, except for wastewater that is of good enough quality for use in agricultural and wildlife propagation.

Stormwater runoff at O & G sites, however, is exempted from the NPDES program unless a facility has a discharge of Reportable Quantity (RQ) or contributes to a violation of a water quality standard (40 CFR 122.26(a)(2)). This includes discharges that cause a film or sheen, or a discoloration of the water surface or adjoining shorelines, or causes a sludge or emulsion to be deposited beneath the water surface or upon adjoining shorelines. Reportable Quantity is a determined limit for specific hazardous chemicals pursuant to section 311 of The Clean Water Act.

Proving a discharge of RQ or noting a violation of a water quality standard will not happen if proper monitoring equipment and requirements are not in place. Such monitoring happens when a facility is enrolled in the NPDES program.

The stormwater discharge exemption impedes our ability to prevent contamination of waterways. However there is Residual Designation Authority in the CWA that allows for regulating an activity that may adversely impact surface waters. A delegated state such as California also has this authority. It states that, “the EPA Regional Administrator may designate additional stormwater discharges as requiring NPDES permits where he determines that the discharge, or category of discharges within a geographic area, contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States (40 CFR 122.26).”

Also part of the CWA, the US EPA requires certain oil drilling facilities to prepare and implement Spill Prevention, Control and Countermeasure (SPCC) plans to prevent discharge of oil into navigable waters or adjoining shorelines. Facilities that must prepare and implement SPCC plans include: non-transportation related facilities; facilities that have an aggregate above ground storage capacity over 1320 gallons or a buried storage capacity over 42,000 gallons; and facilities that have a reasonable expectation of discharging into or upon navigable waters or adjoining shorelines (40 CFR 122).

The SPCC plan and the NPDES permit program are intended to capture potential sources of pollutants that may contaminate surface water. However, often the suggested protocol and measures taken are too general for them to be effective for the specific industry. With no industry specific permits there is no guidance as to where and how representative and effective monitoring should take place, what industry specific constituents should be monitored, or which BMPs serve that industry's needs. With no industry specific recommendations, it is left up to operators to implement or not implement measures. If appropriate monitoring is not happening it is not capturing any violations.

The limitations of Federal regulations, summarized above, are counteracted to some extent by CA regulations that require all O & G facilities that discharge stormwater contaminated by contact with, or that has come into contact with any overburden, raw material, intermediate products located on the site of such operations, to file for an Industrial Stormwater General Permit, effective July 2015 (SWRCB, 2014). O & G exploration and production facilities that drain to waterways must now submit an application to be covered by the General Permit or file a No Exposure Certification. A No Exposure Certification

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