NATURAL RESOURCES DEFENSE COUNCIL

September 10, 2012

Mike Pool
Acting Director
U.S. Department of the Interior, Director (630)
Bureau of Land Management
Mail Stop 2134 LM
1849 C Street, N.W.
Washington, D.C. 20240

Attention: 1004-AE26

Re: Comments on Proposed Rule on Oil and Gas; Well Stimulation, Including Hydraulic Fracturing, on Federal and State Lands

Dear Acting Director Pool:

Please accept these comments on the Bureau of Land Management's proposed rule to regulate hydraulic fracturing on public land, Indian land, and private land overlying federal minerals, published in the Federal Register on May 11, 2012 at 77 Fed. Reg. 27691. These comments are submitted by the Natural Resources Defense Council on behalf of the following organizations: Biodiversity Conservation Alliance, Buckeye Forest Council, Californians for Western Wilderness, Catskill Citizens for Safe Energy, Center for Biological Diversity, Clean Air Task Force, Clean Water Action, Conserving Arkansas's Agricultural Heritage, Earthjustice, Earthworks, EcoFlight, Friends of Blackwater, Heartwood, National Parks Conservation Association, Natural Resources Defense Council, OMB Watch, Ouachita Watch League, Ozark Society, Ozark Water Protection Alliance, Powder River Basin Resource Council, Sierra Club, Southern Environmental Law Center, The Wilderness Society, Upper Green River Alliance, Western Environmental Law Center, Western Organization of Resource Councils, Wild Virginia and Wilderness Workshop. The organizations submitting these comments are described in Section XII.

Respectfully submitted,

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I. INTRODUCTION

An updated and strengthened Bureau of Land Management (BLM) rule to regulate well stimulation, including hydraulic fracturing, is essential. The BLM oversees approximately 700 million subsurface acres of Federal mineral estate and 56 million subsurface acres of Indian mineral estate across forty of the United States. This is an enormous responsibility due to the wide range of environmental and health threats posed by oil and gas development activities, including hydraulic fracturing and other well stimulation techniques. The risks presented by hydraulic fracturing may endanger groundwater, surface water, clean air, human and animal health, soil, fish and wildlife habitat, and recreation opportunities. Risks are associated with site development, well integrity, water and waste management, and air emissions—especially air toxics, ozone-forming pollutants and methane, a highly potent greenhouse gas.

In addition to public lands that belong to all Americans and Indian lands that must be protected, more than 57 million acres of federal minerals lie beneath private lands and many communities are adjacent or above federal minerals leased by the BLM. Millions of people live, work, and go to school near or even above these resources and are counting on the federal government to protect their health and safety, as well as their public and private lands, clean air and water from the harmful impacts of this industrial process. Using the BLM's geographic information systems (GIS) data on surface land ownership and mineral estate, it appears that more than 1,200 public schools in Colorado, Montana, North and South Dakota, Utah and Wyoming fall within one mile of split estate lands (private surface ownership and federal minerals with oil and gas), including almost half of all public schools in New Mexico and Wyoming. When lands with federal surface are included, more than 1,400 public schools lie within one mile of potential federal oil and gas leases in these six western states.

The technology used in oil and gas production has evolved rapidly but, unfortunately, regulation has not kept pace. The BLM's current rules are insufficient to protect public health and the environment. Secretary Salazar has recognized this fact, stating that "BLM's current regulations specific to hydraulic fracturing—or stimulation operations—are in many ways outdated; they were written in 1982; and they reflect neither the significant technological advances in hydraulic fracturing nor the tremendous growth in its use that has occurred in the last 30 years."[1]

Improved regulation can greatly reduce the risks presented by oil and gas development by incorporating best practices and technologies that are readily available. Some companies are already using such practices as green completions, wastewater recycling, closed-loop waste management systems, and more, and have found that many of these approaches are economical to adopt. However, rigorous standards and requirements to improve environmental performance need to be set down in regulation to guarantee all operators are employing best practices wherever hydraulic fracturing occurs.

The BLM has an opportunity to lead the country toward a future where the oil and gas production industry develops these resources more responsibly—in ways that reduce threats to public health and the environment and that respect the quality of life in local communities. As the Shale Gas Subcommittee of the Secretary of Energy Advisory Board stated in its final report, if action is not taken to reduce the environmental impact accompanying the very considerable expansion of shale gas production expected across the country, there is a real risk of serious environmental consequences. Many changes are needed for the regulations, procedures, analyses and decisions of the BLM and other federal agencies, such as the Forest Service, to effectively safeguard health and the environment, including clean air, clean water, communities, wildlands, and wildlife habitat, from the harms of oil and gas development. These comments, however, are confined to hydraulic fracturing and stimulation as addressed by the proposed rule, as requested by the BLM.

Given all the growing body of work regarding the risks of hydraulic fracturing, the public expects urgent and meaningful action from your agency. We urge you to adopt the specific changes and additions detailed in our comments below. Thank you for your consideration of these comments.

II. BLM'S LEGAL AUTHORITY TO PROMULGATE RULES RELATED TO HYDRAULIC FRACTURING

Some commenters have argued that the BLM does not have the legal authority to promulgate these rules.[2] However, claims of this nature are unsupported by law. The BLM has clear

[1] Statement of Ken Salazar, Secretary of the Interior, Before the Committee on Natural Resources, United States House of Representatives: The Future of U.S. Oil and Natural Gas Development on Federal Lands and Waters. November 16, 2011.

[2] *See, e.g.*, Comments of the Wyoming County Commissioners Association, (arguing that the BLM lacks the authority to establish rules relating to hydraulic fracturing and that BLM's rules would impermissibly usurp the State of Wyoming's authority over groundwater resources). The specific argument that the BLM has overstepped its authority related to groundwater is clearly misplaced. Commenters argue that "BLM may not act independent of Congress in displacing established state jurisdiction to protect the quality of its groundwater." *Id.* at 2. However, the BLM does not "displace" state jurisdiction when it acts to ensure that activities engaged in on public lands do

authority to regulate oil and gas activity on public and Indian lands and its potential impacts to the environment. The federal government has constitutional authority over federal property,[3] which the Supreme Court has described as "without limitation."[4] The Congress has delegated that expansive authority in this case to the BLM under the Mineral Leasing Act (MLA) and the Federal Land Policy and Management Act (FLPMA).

The MLA and FLPMA both provide statutory authority for the BLM to enact rules related to the management of oil and gas development on public lands. FLPMA requires the BLM to manage the public lands to ensure that neither the productivity of the land nor the environment is permanently impaired.[5] It also directs the Secretary to promulgate regulations in furtherance of this goal.[6] The MLA requires the BLM to make certain lands available for mineral leasing and to regulate oil and gas development and surface-disturbing uses that it permits.[7] The Act provides authority to the BLM to promulgate rules to carry out the Act.[8] These laws provide the BLM with clear congressional authority to promulgate rules related to hydraulic fracturing on public lands. Similar authority exists for Indian lands.[9]

Because the BLM is directed to ensure that neither these lands nor the environment are permanently impaired, the BLM is obligated to regulate well stimulation activities. These regulations should ensure the protection of the environment and human health. Below we outline revisions to the regulations which would ensure that these congressionally-mandated goals are met.

III. WELL STIMULATION SHOULD BE PROHIBITED IN SOME AREAS

Activities associated with well stimulation, including hydraulic fracturing, pose a significant risk of damage to a variety of natural resources. The underground injection of fluids poses a risk of ground water contamination through multiple pathways, including through improperly constructed or maintained wells or through subsurface pathways. (USEPA, 1980) Further, injected fluids, can affect surface resources, because stimulation fluids, chemical additives, and associated equipment are transported to and stored on site, posing a risk for spills or leaks. Case studies of specific instances of resource damage associated with hydraulic fracturing operations are discussed later in these comments. Hydraulic fracturing can also cause air pollution, habitat fragmentation, soil contamination, and expose wildlife to toxic substances.

Accordingly, both well stimulation and the handling of flowback fluids can cause significant environmental damage. Because of these risks, well stimulation must be prohibited in certain

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not contaminate waters within the state. Clearly the BLM can regulate activities on public lands to protect the broader environment without derogating from any authority of the state over its natural resources. It is illogical to suggest that the BLM "usurp[s] the State of Wyoming's right to regulate the quality of its groundwater" by protecting that groundwater from oil and gas development occurring on federal lands within the state.

[3] *See* U.S. Const. art. IV, § 3, cl. 2.

[4] *Kleppe v. New Mexico*, 426 U.S. 529, 539 (1976).

[5] 43 U.S.C. § 1702(c).

[6] 43 U.S.C. § 1740.

[7] *See* 30 U.S.C. §§ 226.

[8] *See* 30 U.S.C. §189.

[9] *See* 25 U.S.C. §§ 396d & 2107.

environmentally sensitive areas. Categories of lands where well stimulation is not permitted should be identified in the final rule, consistent with the BLM's multiple use mandate. The Federal Land Policy and Management Act (FLPMA) defines multiple use, at 43 U.S. C. § 1702(c), to specifically provide for the agency to manage some areas for certain uses and certain resources:

> "**The term "multiple use"** means the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; **making the most judicious use of the land for some or all of these resources or related services** over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; **the use of some land for less than all of the resources**; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and non-renewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output."

Multiple use, therefore, necessarily includes situations where not all uses will be permitted on all acres. *See, e.g., Norton v. Southern Utah Wilderness Alliance*, 542 U.S. 55, 58 (2004) ("Of course not all uses are compatible."); *State of New Mexico v. Bureau of Land Management*, 565 F.3d 583, 710 (10th Cir. 2009) ("Accordingly, BLM's obligation to manage for multiple use does not mean that development *must* be allowed on the Otero Mesa. Development is a *possible* use, which the BLM must weigh against other possible uses-including conservation to protect environmental values, which are best assessed through the NEPA process").

Based on their important natural values and/or the especially high potential of catastrophic damage from well stimulation activities, we recommend that the rule include a commitment to prohibit well stimulation in the following areas on federal and Indian lands:

- Lands identified and/or designated for their important natural, recreational, scenic and cultural resources, along with appropriate buffer zones, including: national monuments; national conservation areas; wilderness; wilderness study areas; recommended wilderness; citizens proposed wilderness; national scenic areas, national recreation areas or other Congressional protection; inventoried and uninventoried roadless areas; national wild, scenic, and recreational rivers, study rivers and segments, and eligible rivers and segments, including river corridors; units of the National Landscape Conservation System; lands with wilderness characteristics; areas of critical environmental concern, including research natural areas and outstanding natural areas; national landmarks; state parks; areas listed on the National Register of Historic Places and traditional cultural properties; national historic and scenic trails, lands managed by the National Park Service, national wildlife refuges,

- Watersheds that are direct sources of local communities' drinking water and watersheds that are significant sources of drinking water for metropolitan areas downstream,
- Critical habitat for sensitive, endangered and threatened species,
- Superfund and other hazardous waste sites,
- Floodplains and special flood hazard areas,
- Locations with high seismic hazard risks, and
- Aquifers with high occurrence of natural fractures and faults that have not been thoroughly mapped.

We also recommend that the rule prohibit well stimulation within one mile of national wildlife refuges, designated wilderness, and lands managed by the National Park Service, pending a showing by a project proponent that adequate information on baseline water and air quality has been compiled and a monitoring plan has been established to ensure that any contamination is quickly identified and addressed.

The list above is not meant to indicate that any areas not listed above are suitable or acceptable for well stimulation. The potential cumulative impacts on any public lands proposed for oil or gas development, and associated resources, should be thoroughly studied in a National Environmental Policy Act process, with full public participation, at appropriate points prior to making decisions regarding leasing and permitting. Such studies, including studies performed by other federal land management agencies, such as the U.S. Forest Service, may identify the need to avoid well stimulation, or all oil and gas development, in additional areas in order to protect other important natural values and resources.

IV. SAFE SETBACKS ARE NEEDED

Setbacks are essential to protect both ground water and surface water, clean air, human health, wildlands and wildlife habitat. Setbacks should be based on scientific analysis and research.

To protect groundwater and surface water, because state setbacks are not sufficient, the BLM should institute appropriate setbacks from all water bodies (i.e., wetlands, lakes, streams, rivers, and reservoirs), public wells, private wells, and surface water intakes. Such setbacks should take into account all relevant factors such as fracture length and interconnectivity, and groundwater flow directions. The Little Snake Field Office Resource Management Plan, for example, establishes a setback prohibiting surface occupancy within 0.25 mile from perennial water sources, which it found necessary to protect surface water and the integrity of streams and their associated riparian values.[10] A standard that is at least this protective should be adopted for all public, Indian and split estate lands.

In addition, hydraulic fracturing activities have been identified as potentially significant sources of air pollutants and there is increasing concern about threats to public health and the environment. The air pollutants associated with hydraulic fracturing can threaten human health

[10] Little Snake Record of Decision and Approved Resource Management Plan, October, 2011, page 37.

at the local, regional and global level. Pollution control technologies are needed to curb emissions of methane, a potent greenhouse gas, which contributes to global climate change and volatile organic compounds (VOCs) and nitrous oxides (NOx) which lead to unhealthy levels of regional ground level ozone. At the local level hydraulic fracturing facilities can threaten the health of nearby communities due to the releases of multiple types of air pollution, including:

Diesel Particulate Matter (PM): Concerns have been raised about increased exposures to diesel PM pollution near hydraulic fracturing sites. Sources of diesel PM include truck traffic, drill rigs, pumps and other construction equipment.[11] A recent workplace health and safety investigation conducted by the National Institute for Occupation Safety and Health (NIOSH) concluded that diesel PM is a "likely health hazard" for workers at hydraulic fracturing sites.[12] Given the proximity of these sites to homes, worksite health hazards are likely also problems for community members. The health impacts of diesel pollution are well characterized and include cancer, respiratory and cardiovascular impacts, and adverse birth outcomes. Diesel PM concentrations are known to decrease rapidly with distance and health guidelines to protect vulnerable populations have recommended separation distances of up to 1,000 ft from sources of large quantities of diesel pollution.[13]

Silica: Hazardous levels of silica exposure for workers have been documented at hydraulic fracturing sites.[14] As a result, NIOSH has issued an Occupational Health Safety Alert. Silica exposures result from clouds of respirable dust created during the handling of hydraulic fracturing sands at drill sites. The proximity of drill sites to homes and people has raised questions about the potential for community exposures to unsafe levels of silica. Unsafe silica exposure is known to cause silicosis and lung cancer.

Air Toxics: A whole suite of volatile organic compounds (VOCs) can be present in the gas and liquids brought to the surface during oil and natural gas development. Many of these VOCs are known carcinogens and/or respiratory, neurological, developmental, and reproductive toxicants and others have yet to be characterized for their health impacts. These compounds are released to the air when the wells are drilled and hydraulically fractured, and through evaporation from waste pits. Once released into the air, these compounds present an inhalation hazard to workers and community members in the vicinity of the facilities. Due to these risks, health guidelines to protect vulnerable populations have recommended separation distances of 1,000 ft from significant sources of air toxics.[15]

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[11] Allen L. Robinson, 2012 Air Pollutant Emissions from Shale Gas Development and Production, Institute Of Medicine Roundtable, *available at* http://www.iom.edu/Activities/Environment/EnvironmentalHealthRT/2012-APR-30.aspx; Witter R, McKenzie L, Towle M, Stinson K, Scott K, Newman L, Adgate J, Draft Health Impact Assessment for Battlement Mesa, Garfield County Colorado (2010).

[12] Esswein E et al 2012, NIOSH Field Effort to Assess Chemical Exposures in Oil and Gas Workers: Health Hazards in Hydraulic Fracturing, Institute Of Medicine Roundtable, *available at* http://www.iom.edu/Activities/Environment/EnvironmentalHealthRT/2012-APR-30.aspx.

[13] California Air Resources Board, Air Quality and Land Use Handbook (2005).

[14] Esswein E et al 2012, NIOSH Field Effort to Assess Chemical Exposures in Oil and Gas Workers: Health Hazards in Hydraulic Fracturing, Institute Of Medicine Roundtable, *available at* http://www.iom.edu/Activities/Environment/EnvironmentalHealthRT/2012-APR-30.aspx.

[15] California Air Resources Board, Air Quality and Land Use Handbook (2005).

USEPA's inventory of hazardous air pollutants released from oil and natural gas production and processing facilities includes eight carcinogens, seven pollutants which harm the respiratory system, eight pollutants which harm the nervous system, five reproductive/developmental toxicants, and other pollutants toxic to the liver, kidney, cardiovascular and immune system and this list does not include emissions from gas wells or wastewater pits.[16] Although comprehensive monitoring data near oil and gas facilities is lacking, the monitoring conducted in local and state investigations has detected these compounds in the air near residences and in some cases, at levels that exceed health-based standards.[17]

In the past six months, two groundbreaking studies have been published which demonstrate air quality impacts from volatile organic compounds near natural gas facilities. In a study published in the *Journal of Geophysical Atmospheres* and titled, "Hydrocarbon Emissions Characterization in the Colorado Front Range – A Pilot Study." Pétron et al. determined that the emissions from oil and gas facilities in the study area (Front Range of Colorado) were likely responsible for increased levels of hydrocarbons, and benzene in particular, measured at both the stationary and mobile testing sites. Second, the authors concluded that the available inventories of hydrocarbon emissions from oil and gas facilities in the study area did not correlate with observed atmospheric observations and were likely underestimates. The authors note that the increase in hydraulic fracturing in the study area may be contributing to the pollution levels documented in the study.[18]

In the second study, titled "Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources" and published in *Science of the Total Environment*, the researchers reported elevated levels of hydrocarbons in the ambient air at a fixed monitoring site located in the midst of rural home sites, ranches and natural gas developments sites and also found that concentrations were, generally, higher at sampling sites closer to well pads.[19] For example, median xylene levels were found to be 9 times greater in the samples taken closer to the wells. Using standard risk assessment methodology, the researchers found that the measured levels of hydrocarbons correspond to elevated cancer and non-cancer risks, particularly those associated with levels measured near well pads. Elevated non-cancer hazard indices include neurological, respiratory, and hematologic impacts and estimated cancer risks exceed one in a million. The researchers also note that the health risks they estimated are consistent with subchronic health effects, such as headaches, and throat and eye irritation reported by residents during natural gas development activities and hydraulic fracturing in particular.

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[16] U.S. Envtl. Protection Agcy., Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews; Final Rule, 77 Fed. Reg. 49,490 (Aug. 16, 2012).

[17] Agency for Toxic Substances and Disease Registry, Health Consultation: Public Health Implications of Ambient Air Exposures to Volatile Organic Compounds as Measured in Rural, Urban, and Oil & Gas Development Areas Garfield County, Colorado (2008); Witter R, McKenzie L, Towle M, Stinson K, Scott K, Newman L, Adgate J, Draft Health Impact Assessment for Battlement Mesa, Garfield County Colorado (2010), Wolf Eagle Environmental, Town of DISH, Texas Ambient Air Monitoring Analysis Final Report (2009), ERG, City of Fort Worth Natural Gas Air Quality Study (2011).

[18] Petron et al 2012. Hydrocarbon Emissions Characterization in the Colorado Front Range – A Pilot Study. Journal of Geophysical Atmospheres.

[19] McKenzie et al 2012. Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources. Sci Total Environ. 2012 May 1;424:79-87.

Taken together, the research demonstrates that oil and natural gas hydraulic fracturing sites can be sources of air pollutants which threaten human health. These risks increase with proximity, particularly for populations more vulnerable to the impacts of air pollution, which include children, the elderly, and those with underlying health problems. In addition, proximity to these facilities can also subject individuals to light and noise pollution and increases health and safety risks from explosions and other malfunctions. Adequate setbacks or buffers around facilities including homes, schools, health care facilities, and other areas of exposure, are needed to protect public health.

V. MORE INFORMATION MUST BE REQUIRED FROM OPERATORS FOR THE BLM TO ADEQUATELY EVALUATE WELL STIMULATION PERMITS

The Bureau of Land Management's proposed rules requiring disclosure related to well stimulation operations are a crucial step forward. They will provide the BLM with information necessary to reduce the environmental and public health risks associated with well stimulation and to help make well stimulation safer and more protective of the environment before permitting its use. All of this information should not only be submitted to the BLM, but should also be fully disclosed to the public in a transparent and readily available manner, as described below. This will also provide the public with necessary information about the impacts of well stimulation on health, the environment, and public resources.

The proposed regulations, however, are not sufficient. Much more information must be submitted by operators in order to allow the BLM to fully evaluate the risks posed by each well stimulation treatment. Detailed recommendations follow in the following sections. Operators can easily submit the information detailed below without undue burden, and the information will significantly increase the BLM's ability to protect the environment and public health. As discussed further in the subsequent sections of these comments, all of this information should also be made easily available to the public.

a. Requirements for Submission of Information to the BLM in the Proposed Rule

i. Proposed Information Required Prior to Treatment (Notice of Intent Sundry)

BLM proposes to collect a range of information in the Notice of Intent Sundry (or on an Application for Permit to Drill, if the operator opts to do so for new wells) prior to well stimulation.[20] As discussed below in sections V(b), V(c), and VIII, additional informational requirements should be added in order to allow BLM to fully evaluate the risks posed by each wells stimulation treatment. However, the information currently required by the proposed rule, laid out in proposed 43 C.F.R. § 3162.3-3 (c)(1) – (c)(6), is all essential to an adequate evaluation. These requirements must be maintained.

The proposed rule requires a description of the formation that will be stimulated and its measured depth, the measured depths of usable water, cement bond logs showing that usable

[20] *See* Proposed 43 C.F.R. § 3162.3-3 (c).

water has been isolated to prevent contamination, and the proposed interval into which stimulation fluids will be injected.[21] All of this information is essential to allow BLM to minimize the risks posed by the well stimulation.

We also support BLM's proposed requirement to include details about proposed water use in the permit application or sundry. Proper pre-drill planning can aid in successful water use and waste water management. Disclosure of fluid source and location is important to understand the impacts on local water resources.

The proposed rules also require the operator to report basic details about the proposed well stimulation including the volume of fluid to be used, the anticipated surface treating pressure range, the maximum injection pressure, and the estimated or calculated fracture length and height. While additional information is necessary for the BLM to fully evaluate the risks posed by a well stimulation treatment, each of the required disclosures in the proposed rule provides valuable information and should be maintained. Reporting the pressures to be used in hydraulic fracturing operations and the anticipated fracture length and height provides information necessary to demonstrate whether fractures will remain confined to the intended zone and whether modification of an operator's plan is required.

The proposed rule also requires reporting information about anticipated volume of flowback and other waste fluids, the proposed methods of handling this waste, and the proposed disposal method. These rules are important for assessing the large volume of waste that will be created by well stimulation and informing strategies to reduce the risks it poses. In addition to stimulation chemicals, flowback can contain toxic substances that are associated with legacy activities or are naturally-occurring underground, including arsenic, barium, lead, mercury, and radioactive elements like radium.[22] Because wastes associated with the exploration, development, or production of oil and gas are exempt from hazardous waste provisions of Subtitle C of the Resource Conservation and Recovery Act (RCRA),[23] even if flowback is dangerous, there is no legal requirement that it be handled or treated based on minimum federal safety standards for other hazardous wastes. We oppose this exemption for oil and gas wastes.[24] However, given that the exemption exists, it is essential that BLM require comprehensive information about the waste that will be created, and how it will be stored and disposed of. Oil and gas wastewater has been shown to pose significant disposal challenges,[25] and it is essential that BLM can require that the waste can be disposed of safely before it permits well stimulation to commence.

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[21] *See* Proposed 43 C.F.R. § 3162.3-3 (c)(1) – (c)(3).
[22] *See* T. Hayes, Gas Technology Institute, *Sampling and Analysis of Water Streams Associated with the Development of Marcellus Shale Gas: Final Report*, 36 tbl.9 (Dec. 31 2009); E.L. Rowan et al., *Radium Content of Oil- and Gas-Field Produced Waters in the Northern Appalachian Basin (USA): Summary and Discussion of Data*, U.S. Geological Survey Scientific Investigations Report 2011-5135, 11 fig.6 (2011).
[23] *See* Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6921 (b)(2)(A).
[24] *See* NRDC, *Resource Conservation and Recovery Act Petition* available at http://docs.nrdc.org/energy/ene_10091301.asp.
[25] *See* Rebecca Hammer & Jeanne VanBriesen, *In 's Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater* (May 2012) available at http://www.nrdc.org/energy/fracking-wastewater.asp.

ii. Proposed Information Required After Completed Operations (Subsequent Report Sundry Notice)

We support the BLM's proposed requirements to report information on the actual stimulation treatment in the Subsequent Report Sundry Notice. The required information is reasonable and appropriate. In particular, we commend the BLM for including information on the handling of recovered fluids. While additional items should be included in the subsequent report, each of the requirements currently included are necessary and should be maintained in the final rule.

The continuous record of the annulus pressure that must be submitted along with the report is a necessary tool for determining whether mechanical integrity was maintained throughout the treatment. Reporting of the actual measured depth that was stimulated, the actual source of water or other base fluid, actual pressures, and the fracture length after the fracturing treatment is complete ensures that the BLM is made aware of any deviations from the anticipated information.

The proposed rule rightly requires information about the stimulation fluids, including trade name, purpose, chemical constituent identities, including Chemical Abstract Service (CAS) numbers, and concentrations. Information on the fluid names and purposes provides important information about the additives used. Chemical Abstract Service numbers are unique numerical identifiers for each chemical assigned by the American Chemical Society. CAS numbers are the global standard for authoritative identification of chemicals and allow each chemical constituent to be unambiguously identified, which is essential to provide an accurate record of the substances used in each well stimulation treatment.

Routine collection of information concerning flowback and other waste fluids from stimulated wells also allows the BLM to determine whether the anticipated volumes were accurate and whether the methods of handling and disposal were adopted as proposed. Such records are also critical to tracking the disposal and progress in recycling of flowback and waste water. Each of these disclosures to the agency is important in evaluating the operator's compliance with the permit and the actual risks that waste fluids pose and for establishing data needed for improved regulation.

b. <u>Prior to Well Stimulation: Recommended Additions to Notice of Intent Sundry</u>

As noted above, BLM's proposed information collection requirements are a significant improvement over the status quo, given the lack of information that BLM and the public currently have to evaluate well stimulation on public and Indian lands and its impacts. However, a number of improvements in the proposed rule are necessary to ensure that all relevant parties, including the public, the BLM, and any other relevant surface management agencies, such as the U.S. Forest Service are provided with adequate information to evaluate and manage the risks that well stimulation poses to health and the environment.

i. Recommended revisions and additions to proposed regulations

We recommend the following additions and clarifying revisions to the requirements in proposed 43 C.F.R. 3162.3-3(c): (*Note that in various sections of our comments we provide suggested revisions to parts of the proposed rule. In these suggested revisions, additions to proposed regulations are indicated by underlined text while deletions are indicated by text with strikethrough*.)

(c) **What the Notice of Intent Sundry Must Include.** The authorized officer may prescribe that each proposal contain all or a portion of the information set forth in § 3162.3-1 of this title. The Notice of Intent Sundry must include the following:

(1) The geological names, a geological description, and the proposed measured and true vertical depth of the top and the bottom of the formation into which well stimulation fluids are to be injected and of the confining zone; [26]

(2) The proposed measured and true vertical depths (both top and bottom) of all occurrences of usable water and the radial cement evaluation ~~bond~~ logs (or another log acceptable to the authorized officer) proving that the occurrences of usable water have been isolated to protect them from contamination;

(3) The proposed measured and true vertical depth of perforations or the open-hole interval,

(4) A water use plan, including:

(i) the proposed source(s), ~~and~~ location(s), volume by location, and timing of withdrawal of the water used in the stimulation fluid or trade name of the base fluid (if other than water)~~,~~;

(ii) Planned cumulative water use over the life of the well;

(iii) Information concerning water supply, such as rivers, creeks, springs, lakes, ponds, and wells, ~~which may be~~ shown by quarter-quarter section on a map or plat, ~~or~~ and which may also be described in writing;

(iv) ~~It must also identify~~ The source, access route, anticipated transport distances, and transportation method for all water anticipated for use in stimulating the well, and methods to minimize related impacts including but not limited to land disturbance, traffic, vehicle accidents, and air pollution;

(v) Anticipated on-site storage methods;

(vi) A description of methods the operator will use to maximize the use of non-potable water sources including reuse and recycling of wastewater;

(vii) An evaluation of potential adverse impacts to aquatic species and habitat, surface water, groundwater, and wetlands, including the potential for the introduction of invasive species, and methods to minimize those impacts;

[26] "Confining zone" means a geological formation, group of formations, or part of a formation above a zone that will be hydraulically fractured that has sufficient areal extent and permeability to prevent the movement of injected or displaced fluids to protected water, is free of transmissive faults or fractures that could allow the movement of injected or displaced fluids to protected water, and with sufficient thickness and geomechanical properties to prevent or arrest the vertical propagation of fractures.

(5) A certification signed by the operator that the proposed treatment fluid complies with all applicable permitting and notice requirements as well as all applicable Federal, tribal, state, and local laws, rules, and regulations;

(6) A detailed description of the proposed well stimulation design, including:

(i) The estimated total volume of fluid to be used;

(ii) The anticipated surface treating pressure range;

(iii) The maximum injection treating pressure; ~~and~~

(iv) The estimated or calculated fracture length and fracture height;

(v) The operating procedure; and

(vi) The estimated or calculated fracture gradient of the producing and confining zone(s)

(7) A report (table) that discloses all anticipated additives of the stimulation fluid, by additive trade name, vendor, and purpose (such as, but not limited to, acid, biocide, breaker, brine, corrosion inhibitor, crosslinker, demulsifier, friction reducer, gel, iron control, oxygen scavenger, pH adjusting agent, proppant, scale inhibitor, or surfactant);

(8) A report (table) that discloses the complete chemical makeup of all materials anticipated to be used in the stimulation fluid without regard to original source additive. For each chemical, the operator must provide the Chemical Abstracts Service Registry Number as well as the percentage by mass. The percent mass value is the mass value for each component (Mc) divided by the value of the entire fluid mass (Mt) times 100. (Mc/Mt)*100 = percent value. The percent mass values should be for the entire stimulation operation, not for the individual stages.

(9) The following information concerning the handling of recovered fluids:

(i) The estimated volume of fluid to be recovered during flow back, swabbing, and recovery from production facility vessels;

(ii) The proposed methods of handling the recovered fluids, including, but not limited to, tanks, pit requirements, chemical composition of the fluid, pipeline requirements, truck transport, or holding pond use, ~~re-use for other stimulation activities, or injection~~; and

(iii) The proposed disposal method and location of the recovered fluids, including, but not limited to, injection, recycling and reuse (including the purpose for which it is re-used), or discharge. ~~hauling by truck, or transporting by pipeline~~.

(10) Certification by the operator that notice of proposed well stimulation will be provided to the owner of the surface estate, adjacent landowners, any other landowners whose land lies within ½ mile of any part of the wellbore, and non-owning residents of any of the aforementioned lands, at least 30 days and not more than 90 days prior to commencement of well stimulation. Such notification shall include a form letter or brochure prepared by the BLM that includes basic information regarding available information.

(11) The authorized officer may request additional information under this subsection prior to the approval of the Notice of Intent Sundry.

ii. Prior to Well Stimulation: Submission of Chemical Information

The BLM must add a requirement to report all chemicals that the operator anticipates using in well stimulation prior to permit issuance. The anticipated chemicals and their concentrations are necessary for the BLM and other relevant federal agencies, such as the U.S. Forest Service, to evaluate the risks that a particular stimulation treatment poses to the lands and resources these agencies manage. Additionally, the information is necessary in order for the BLM, other

relevant agencies, and private landowners to document baseline conditions, including air and water quality, and to trace negative impacts to their source.

The BLM cannot evaluate the risks that are posed by wells stimulation without prior disclosure of the chemicals to be used in each stimulation treatment. For example, many hydrualic fracturing chemicals are toxic.[27] Some, like formaldehyde, are known carcinogens.[28] Blow-outs, which can send thousands of gallons of stimulation fluids spewing from the well, have occurred during hydraulic fracturing operations.[29] And spills of hydraulic fracturing fluids and other chemicals have polluted streams and lakes.[30] Stimulation fluids and chemicals must be transported to the well site and stored there. Flowback containing these chemicals and a host of other potential contaminants from the formation itself, must be stored at the well site, transported off site, and disposed of. Each of these processes poses risks of accidental spills or release into the environment. The BLM cannot adequately understand and manage these risks without requiring permittees to report the chemicals they anticipate using in each stimulation treatment.

As noted in section VIII, BLM should require operators to perform comprehensive baseline characterization of all usable ground water and all surface water within a designated area of review. However, regardless of whether BLM institutes this requirement, prior disclosure of stimulation chemicals is independently necessary. With advance disclosure, other federal agencies or landowners would be able to conduct their own baseline water and soil quality testing, including testing to determine baseline levels of the substances that will be used in the stimulation treatment. Regulators and members of the public would also be able to conduct baseline testing of local air and surface or ground water quality to document pre-stimulation conditions, including baseline levels of any stimulation chemicals.

BLM staff have previously stated that advance disclosure is not critical because companies generally use the same well stimulation plan within a given field, so local residents who want to conduct baseline tests and others interested in advance information can simply refer to the reports for first stimulation treatment that was conducted and disclosed. Companies, however, customize stimulation fluids for each well and often change recipes based on unique circumstances. There are also other limits on the utility of the system that the BLM proposes. In North Dakota's Bakken Formation, over 3,000 new wells have been drilled in the past five years with over 80 companies leasing, drilling and hydraulically fracturing in the area. Without prior disclosure, a landowner cannot know which operator or service company will be stimulating a particular well, or if stimulation fluids are the same. In newer fields, landowners near the first well that is stimulated should be provided with the same opportunity to conduct baseline water quality tests as those near wells that are stimulated later.

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[27] *See* Theo Colborn et al., *Natural Gas Operations from a Public Health Perspective*, 17 Hum. & Ecological Risk Assessment: An Int'l J. 1039,1040, 1045-46.

[28] *See Id*. at 1050, tbl.2; International Agency for Research on Cancer, List of Classifications by CAS Number Registry, available at http://monographs.iarc.fr/ENG/Classification/index.php.

[29] *See, e.g.*, Andrew Maykuth, *Pa. Investigating Marcellus Well Blowout*, Philadelphia Inquirer (Jan. 26, 2011); s*ee, also.*, Martin Kidston, *5 Years After Gas Well Blow Out, Clark Residents Vent Frustrations*, Billings Gazette (Aug. 4, 2011).

[30] *See, e.g.*, Laura Legere, *Natural Gas Well Suffers Blowout, Releasing Fluids in Bradford County*, The Times-Tribune (Apr. 21, 2011).

Advance disclosure of anticipated stimulation chemicals imposes minimal costs on the oil and gas industry and has been shown to be feasible. For instance, the state of Wyoming implemented a requirement for prior disclosure of all hydraulic fracturing chemicals in September of 2010.[31] These requirements were supported by members of the oil and gas industry.[32] Two years after these rules were implemented, the Wyoming oil and gas industry continues to flourish. Advance disclosure will not delay the permitting process to any meaningful degree and, based on its benefits, BLM should include a requirement for prior disclosure of chemicals in the final rule.

iii. Explanation of Proposed Changes and Other Recommended Additions to Notice of Intent Sundry

For deviated wells, measured depth ("MD") can be much greater than the true vertical depth ("TVD"). Reporting TVD in addition to MD will give regulators an accurate understanding of the vertical distance separating the stimulated formation from formations that contain protected water. This information is important to aid regulators in determining if the stimulation design is appropriate to protect groundwater.

In addition to reporting the source and location(s) of water used in the stimulation fluid, requiring operators to report the volume and timing of withdrawal will aid water resource managers in determining whether withdrawals for stimulation may conflict with other activities that will draw water from the same sources, such as agricultural or industrial activities. This can help ensure that water withdrawals will not impair stream health or ground water.

Requiring operators to submit a description of the operating procedure can aid regulators in determining that the stimulation will be performed using safe and responsible practices. Reporting estimated or calculated fracture gradients is necessary to ensure that hydraulic fracturing operations will not initiate fractures in the confining zone.

Operators must also submit a plan for cumulative water use over the life of the project to the BLM. The plan should include other activities that will draw water from the same sources, such as agricultural or industrial activities; designated best use; seasonal and longer timescale variations in water availability; and historical drought information.

In order to provide adequate information about the location and geological and environmental context of the well, the following additional information must also be required in either the Application for Permit to Drill or the Notice of Intent Sundry:

a. Baseline water quality analyses[33] for all usable ground water and all surface water within the area of review[34]

[31] Wyoming Oil and Gas Conservation Commission Rules, Chapter 3 § 45 took effect on September 15, 2010 and applied to all hydraulic fracturing treatments performed after the effective date of the rule.

[32] *See, e.g.*, Jim Magill, *Wyoming E&P in Fracking Probes*, Intl. Gas R. (Sept. 27, 2010) (quoting a spokesman for Encana, an oil and gas company, noting that the company had "supported the [Wyoming] regulation"); *see also* Inside the EPA, *New Hydraulic fracturing Rules Could Aid Industry Opposition to EPA Oversight*, (June 18, 2010) (quoting an industry source calling the Wyoming rules "workable").

[33] See section VIII, proposed requirements for baseline water testing

[34] The area of review should be the region around a well or group of wells that will be hydraulically fractured where protected water may be endangered. It should be delineated based on 3D geologic and reservoir modeling that

b. Proposed date of the hydraulic fracturing treatment
c. County in which the well is located
d. API number for the well
e. Well name and number
f. Latitude and longitude of the wellhead
g. Information on the geologic structure, stratigraphy, and hydrogeologic properties of the proposed producing formation(s) and confining zone(s), including:
    i. Maps and cross-sections of the area of review
    ii. The location, orientation, and properties of known or suspected faults, fractures, and joint sets that may transect the producing and confining zone(s) in the area of review and a determination that they would not provide migration pathways for injected fluids or displaced formation fluids to USDWs
    iii. Data on the depth, areal extent, thickness, mineralogy, porosity, permeability, and capillary pressure of the producing and confining zone(s); including geology/facies changes based on field data which may include geologic cores, outcrop data, seismic surveys, well logs, and names and lithologic descriptions
    iv. Geomechanical information on fractures, stress, ductility, rock strength, and in situ fluid pressures within the producing and confining zone(s)
    v. Information on the seismic history including the presence and depth of seismic sources and a determination that the seismicity would not affect the integrity of the confining zone(s)
    vi. Geologic and topographic maps and cross sections illustrating regional geology, hydrogeology, and the geologic structure of the local area
    vii. Hydrologic flow and transport data and modeling
h. A list of all wells within the area of review that penetrate the producing or confining zone and a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, records and sundries identifying any incidents or problems, and any additional information the regulator may require.
i. Maps and stratigraphic cross sections indicating the general vertical and lateral limits of all USDWs and any other locally protected and/or usable waters within the area of review, their positions relative to the injection zone(s), and the direction of water movement, where known.

For a discussion of the importance of baseline water quality data, see section VIII. The information listed in section (g) is necessary to demonstrate that stimulation operations are occurring in a location that is geologically suitable. The information listed in section (h) is necessary to determine whether existing wells may act as pathways for injected or displaced fluids to reach groundwater. The information listed in (i) is necessary to evaluate potential impacts to USDWs and other protected and usable waters and ensure that the proposed stimulation operation will not endanger those water resources.

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accounts for the physical and chemical extent of hydraulically induced fractures, injected hydraulic fracturing fluids and proppant, and displaced formation fluids and must be based on the life of the project. The physical extent would be defined by the modeled length and height of the fractures, horizontal and vertical penetration of hydraulic fracturing fluids and proppant, and horizontal and vertical extent of the displaced formation fluids. The chemical extent would be defined by that volume of rock in which chemical reactions between the formation, hydrocarbons, formation fluids, or injected fluids may occur, and should take into account potential migration of fluids over time.

More specifically, in order to protect usable water and the environment from contamination from injected fluids and formation fluid during stimulation, it is critical that the Application for Permit to Drill (APD) or the Notice of Intent Sundry include an assessment of geologic suitability to comprehensively demonstrate that drilling and stimulation will not pose an unacceptable risk of vertical migration or leakage of injected or displaced fluids. To do this we believe that BLM must establish more specific requirements relevant to the language proposed in sections (g)-(i) above.

Operators of wells that will be stimulated must demonstrate to the satisfaction of the regulator that the wells will be sited in a location that is geologically suitable. In order to allow the regulator to determine suitability, the owner or operator must provide:

1. A detailed analysis of regional and local geologic stratigraphy and structure including, at a minimum, lithology, geologic facies, faults, fractures, stress regimes, seismicity, and rock mechanical properties.
2. A detailed analysis of regional and local hydrology including, at a minimum, hydrologic flow and transport data and modeling and aquifer hydrodynamics; properties of the producing and confining zone(s); groundwater levels for relevant formations; discharge points, including springs, seeps, streams, and wetlands; recharge rates and primary zones, and; water balance for the area including estimates of recharge, discharge, and pumping
3. A detailed analysis of the cumulative impacts of well stimulation on the geology of producing and confining zone(s) over the life of the project. This must include, but is not limited to, analyses of changes to conductivity, porosity, and permeability; geochemistry; rock mechanical properties; hydrologic flow; and fracture mechanics.
4. A determination that the geology of the area can be described confidently and that the fate and transport of injected fluids and displaced formation fluids can be accurately predicted through the use of models.

Wells that will be hydraulically fractured must be sited such that a suitable confining zone is present. The operator must demonstrate to the satisfaction of the regulator that the confining zone:

1. Is of sufficient areal extent to prevent the movement of fluids to USDWs, based on the projected lateral extent of hydraulically induced fractures, injected stimulation fluids, and displaced formation fluids over the life of the project;
2. Is sufficiently impermeable to prevent the vertical migration of injected stimulation fluids or displaced formation fluids over the life of the project;
3. Is free of transmissive faults or fractures that could allow the movement of injected stimulation fluids or displaced formation fluids to USDWs; and
4. Contains at least one formation of sufficient thickness and with lithologic and stress characteristics capable of preventing or arresting vertical propagation of fractures.
5. The regulator may require operators of wells that will be stimulated to identify and characterize additional zones that will impede or contain vertical fluid movement.

Operators must establish an Area of Review (AoR) around wells that will be stimulated, delineated with 3D geologic modeling as described in footnote 34. The model must take into account all relevant geologic and engineering information including but not limited to:

1. Rock mechanical properties, geochemistry of the producing and confining zone, and anticipated hydraulic fracturing pressures, rates, and volumes.
2. Geologic and engineering heterogeneities
3. Potential for migration of injected and formation fluids through faults, fractures, and manmade penetrations.
4. Cumulative impacts over the life of the project.

Within the area of review, operators must identify all wells as described in h., above. If any the wells identified are improperly constructed, completed, plugged, or abandoned, corrective action must be taken to ensure that they will not become conduits for injected or formation fluids to USDWs. Operators must develop, submit, and implement a corrective action plan.

iv. Additions to Surface Use Plan Requirements

As part of the Surface Use Plan of Operations requirement to describe, "…the proposed means for containment and disposal of all waste materials," and the required Methods for Handling Waste, operators should submit to the BLM a proposed plan specifically for handling wastewater, such as flowback and produced fluids. For existing wells, the following information should also be included in the Notice of Intent Sundry. Elements of the plan should include but are not limited to:

1. Anticipated cumulative volumes of wastewater over the life of the project, including what volume will be reused/recycled vs. disposed;
2. Anticipated on-site temporary storage methods;
3. Anticipated transport distances and methods (e.g. pipeline, truck) and methods to minimize related impacts including but not limited to land disturbance, traffic, vehicle accidents, and air pollution;
4. An assessment of currently available and anticipated disposal methods, e.g. disposal wells, wastewater treatment facilities, etc. This assessment must enumerate the disposal options available and evaluate the ability of those options to handle projected wastewater volumes. In the case of wastewater treatment facilities, the assessment must also evaluate the ability of those facilities to successfully treat the wastewater such that it would not pose a threat to water supplies into which it is discharged.
5. Anticipated chemical composition of produced and flowback water, with particular attention to those chemicals that would hinder the reuse or recycling of wastewater or pose a challenge to wastewater treatment.

c. Information Required After Completion: Recommended Additions to Subsequent Report Sundry Notice

We recommend the following additions and clarifying revisions to the proposed requirements:

(g) Information that Must be Provided to the Authorized Officer After Completed Operations. The following information must be provided to the authorized officer in the required Subsequent Report Sundry Notice (Form 3160-5, Sundry Notices and Reports on Wells) within 30 days after the operations are completed (see subpart 3160.0-9(c)(1)):

(1) The actual measured and true vertical depth of perforations or the open-hole interval,

(2) the source, ~~and~~ location(s), volume by location, and timing of withdrawal of the water used in the stimulation fluid or trade name of base fluid (if other than water)~~,~~;

(3) type of proppants~~,~~; ~~and~~

(4) actual pump pressures~~.~~;

(5) Information concerning water supply, such as rivers, creeks, springs, lakes, ponds, and wells, ~~which may be~~ shown by quarter-quarter section on a map or plat, ~~or~~ and which may also be described in writing~~.~~;

(6) ~~It must also identify~~ the source, access route, and transportation method for all water used in stimulating the well;

(7) The results of the mechanical integrity tests required at § 3162.3–3 (d)

(8) On-site storage methods for all water used in stimulating the well, and;

(9) Any documented adverse impacts to aquatic species and habitat, wildlife, surface water, groundwater, and wetlands.

(10) The actual total volume of the fluid used;

(11) The actual surface pressure and rate at the end of each fluid stage, and the actual flush volume, rate, and final pump pressure;

(12) A report (table) that discloses all additives of the actual stimulation fluid, by additive trade name, vendor, and purpose (such as, but not limited to, acid, biocide, breaker, brine, corrosion inhibitor, crosslinker, demulsifier, friction reducer, gel, iron control, oxygen scavenger, pH adjusting agent, proppant, scale inhibitor, or surfactant);

(13) A report (table) that discloses the complete chemical makeup of all materials used in the actual stimulation fluid without regard to original source additive (see paragraph (f)(4) of this section). For each chemical, the operator must provide the Chemical Abstracts Service Registry Number as well as the percentage by mass. The percent mass value is the mass value for each component (Mc) divided by the value of the entire fluid mass (Mt) times 100. (Mc/Mt)*100 = percent value. The percent mass values should be for the entire stimulation operation, not for the individual stages.

(14) The actual, estimated, or calculated fracture length and fracture height;

~~(7) The Subsequent Report Sundry Notice (Form 3160-5, Sundry Notices and Reports on Wells) may be completed in whole or in part, as applicable, by attaching the service contractor's job log or other report, so long as the information required in paragraphs (g)(1) through (g)(6) of this section is complete and readily apparent;~~

(15) A certification signed by the operator that the treatment fluid used complied with all applicable permitting and notice requirements as well as all applicable Federal, tribal, state, and local laws, rules, and regulations;

(16) A certification signed by the operator that wellbore integrity was maintained throughout the operation, as required by paragraphs (d), (e)(1), and (e)(2) of this section;

. . .

It is essential that results of mechanical integrity tests are disclosed to BLM and the public, as discussed further in section VIII. The proposed revisions also eliminate the option to attach a service contractor's log in place of completing the BLM Subsequent Report Sundry Notice. This option should be eliminated because allowing job logs to be attached may reduce compliance with information requirements and will increase the burden on BLM staff to ensure that all information was provided as required.

In a review of compliance with state hydraulic fracturing disclosure requirements, states which allowed logs to be attached in lieu of form completion often accepted logs which provided incomplete information, presumably because state staff did not notice that certain information was missing when accepting the forms with attachments. Requiring that the information is transferred to the required form imposes a minimal burden on the operator but enables BLM staff to easily spot areas of the form which have not been completed, increasing compliance and ease of enforcement of the disclosure requirements.

VI. THE PROPOSED PUBLIC DISCLOSURE RULES ARE INSUFFICIENT

The Bureau of Land Management's proposed rules requiring disclosure of information related to the well stimulation process to the public are a critical improvement over current requirements. They will provide the public with necessary information about the impacts of well stimulation and risks to health, the environment, and public resources.

Well stimulation disclosure rules provide nearby residents with information about the timing and location of nearby stimulation operations, methods being used, plans in place, and chemicals being used, transported, and released in their communities. Disclosure provides first responders with critical information necessary for expeditiously responding to accidents and emergencies. Medical professionals also require information about the chemicals their patients may have been exposed to, and the concentrations, for diagnosis and treatment.

Disclosure of the amounts and sources of water used for stimulation provides the public with important information about the impacts of stimulation on local water supplies. Disclosure of information regarding the creation and disposition of stimulation wastes provides an accounting of the waste created, its contents, and the risks its disposal may pose. And disclosure of the chemicals used in stimulation may encourage companies to use safer alternatives, when they are available.

We believe that all of the information collected by the BLM should be disclosed to the public in a transparent and easily accessible manner, and have detailed our recommendations below.

a. Importance of Proposed BLM Public Disclosure Requirements

Other commenters on the proposed rules have argued that the BLM public disclosure requirements are unnecessary because many states have disclosure requirements related to hydraulic fracturing. Closer analysis however, demonstrates the necessity for the BLM to promulgate minimum federal requirements for public disclosure of well stimulation on public and Indian lands.[35] State rules governing disclosure of hydraulic fracturing operations are, at best, inconsistent or, at worst, absent. Therefore, the proposed rules provide a necessary baseline to ensure that the public has a minimum set of information regarding instances of well stimulation where public lands and resources may be impacted.

Currently, hydraulic fracturing is occurring in at least twenty-nine states across the country.[36] There is federal mineral estate within all twenty-nine states with hydraulic fracturing. But a minority of these states—only fourteen—currently have hydraulic fracturing disclosure rules in effect.[37] This fact alone justifies a decision by the BLM to institute its own public disclosure requirements. Furthermore, analysis of existing state disclosure rules has shown that no state rule provides for comprehensive disclosure.[38] Many state rules provide strong disclosure requirements in some areas while neglecting others altogether. This increases the importance of the BLM's proposed requirements. Without these rules, the information necessary to fully evaluate the impacts of wells stimulation operations on public and Indian lands will be unavailable and the information will vary widely from state to state.

As discussed below, the BLM's final rule should require additional information to be made public in order to ensure that all risks are adequately disclosed. However, even with the limited set of information required by the proposed rule, it is clear that the proposed rules provide the public and BLM with certain necessary information which state rules fail to furnish. For instance, no state provides all of the limited set of information that the BLM proposes to collect in advance of well stimulation or after completion.[39]

The fact that no state requires disclosure of the full set of information required by BLM's proposed rule does not call into question the feasibility of those rules. Each of the pieces of information that BLM requires to be disclosed is required by at least one state. Most information required by the proposed rule is included in disclosure requirements in several states. Costs to operators of disclosing each additional piece of information are negligible. However, BLM cannot adequately protect health, the environment, and public resources without a comprehensive picture of the methods and substances used in well stimulation, the waste generated, and its management.

[35] The phrase "on public and Indian lands" is adopted in this comment, as used in BLM's announcement of the proposed hydraulic fracturing rules. Commenters' use of the term parallels that of BLM and includes hydraulic fracturing that occurs on privately-owned surface where the mineral rights are federally-owned.
[36] *See* Matthew McFeeley, *NRDC Issue Brief 12-06-A, State Hydraulic Fracturing Disclosure Rules and Enforcement: A Comparison* 7 (July 2012).
[37] *See Id.*
[38] *See Id.* at tbls. I, II, III, IV & V.
[39] *See* Proposed 43 C.F.R. § 3162.3-3 (c); McFeeley *supra* note 36 at tbls. II & III.

b. Proposed Revisions to Trade Secrets Provisions

The proposed rule allows companies to identify information which they believe should be exempt from public disclosure and prevent BLM from disclosing this information under certain circumstances.[40] However, BLM's rules should allow no such exemptions. Instead, BLM should require public disclosure of all relevant information, including the composition, concentration, and chemical identities of all stimulation fluids that are collected under the rules.

i. Full Disclosure Is Necessary to Protect Public Health and the Environment

Complete disclosure of all chemicals and techniques used in well stimulation is required to adequately protect the environment and public health. No trade secret exemptions should be allowed where doing so would be at the expense of public health. For instance, if the identities of certain chemicals are withheld, physicians may be unaware of certain chemicals to which a patient may have been exposed. This may make it difficult or impossible to accurately diagnose and treat the patient, or to understand the interactive effects that chemicals can have on a patient's health. Because complete information is necessary to "ensure that acute exposures are handled appropriately and to ensure that surveillance programs are optimized," the Pediatric Environmental Health Specialty Units, a network of experts in children's environmental health, have recommended full disclosure of all chemical information.[41] Chemical information is also needed by government regulators and industry to create safer products and by parents and community leaders to protect families from unnecessary toxic exposures. Trade secret exemptions undermine these purposes and put public health at risk. BLM should eliminate any exemption for disclosure of trade secret information in the proposed rule.

ii. The Trade Secrets Act Does Not Prevent BLM from Promulgating Rules Which Require All Information to be Disclosed

In our discussions with BLM, staff members have asserted that the Trade Secrets Act, 18 U.S.C. § 1905, prevents BLM from requiring disclosure of trade secret information submitted to the agency to any party. However, contrary to these assertions, the Trade Secrets Act (TSA) does not prevent BLM from promulgating a rule that would require public disclosure of information that qualifies for common law trade secret protection. Because BLM is not prevented from requiring public disclosure of this information, and full disclosure is necessary to protect public health and the environment, as described above, BLM should modify the proposed rule to eliminate trade secret exemptions from the disclosure provisions.

The Trade Secrets Act prohibits disclosure of information that is a trade secret only if that disclosure is not "authorized by law." *Id.* A disclosure may be authorized by a properly promulgated rule if it meets two criteria: first, the rule must be a substantive rule implementing a statute, and second, the rule must be authorized by a Congressional grant of authority.[42] The

[40] *Proposed* 43 C.F.R. 3162.3-3 (h).
[41] Pediatric Environmental Health Specialty Units, *PEHSU Information on Natural Gas Extraction and Hydraulic Fracturing for Health Professionals* 3 (Aug. 2011) *available at* aoec.org/pehsu/documents/hydraulic_fracturing_and_children_2011_health_prof.pdf.
[42] *See Chrysler Corp. v. Brown*, 441 U.S. 281, 301-302 (1979).

Supreme Court has held that the first criteria is satisfied as long as the regulation creates substantive rules, rather than merely being interpretive, or a general statement of agency policy or practice.[43] This rule clearly fulfills that criteria. Therefore, if BLM promulgates its final rule in compliance with the Administrative Procedures Act, the rule could require public disclosure of trade secret information if the rule is rooted in a Congressional grant of statutory authority.[44]

While simple housekeeping statutes and the Freedom of Information Act are not sufficient to authorize agency disclosure of trade secret information under the TSA, courts have emphasized that the Trade Secrets Act was meant to prohibit unauthorized disclosures by government employees. The U.S. Court of Appeals for the District of Columbia Circuit has noted that the Act reflected "a congressional judgment that private commercial and financial information should not be revealed by agencies that gather it, *absent a conscious choice* in favor of disclosure by someone with power to impart the force of law to that decision."[45] The Act was not meant to prevent agencies from promulgating rules within their statutory authority that require disclosure, but to "forestall casual or thoughtless divulgence – disclosure made without first going through a deliberative process – with an opportunity for input from concerned parties."[46]

Courts have upheld agency determinations to make trade secret information public where the agency has properly promulgated rules, even where the statutes under which the rules were promulgated make no mention of trade secrets. For instance, a federal appeals court upheld the Department of Interior's regulations that required public release of trade secret data submitted by applicants for permits to conduct geophysical and geological exploration of the outer continental shelf.[47] In that case, the Outer Continental Shelf Lands Act provided authority for the Department to collect information, but made no mention of public disclosure or trade secrets.[48]

Likewise, a regulation promulgated by the Occupational Health and Safety Administration was upheld which required employers to provide employees and designated employee representatives with trade secret information concerning the medical and exposure histories of employees exposed to toxic substances or harmful physical agents.[49] In that case, the court found that the rules had been promulgated under a statute which required employers to maintain records and make them available to the Secretary, and under the agency's general authority to "prescribe such rules and regulations as [the Secretary] may deem necessary to carry out [his] responsibilities under this chapter."[50] This authority was found sufficient to enable OSHA to disclose trade secret information publicly based on its stated goal of public health protection and the reasonable relation of the rule to the underlying statute.

The Federal Land Policy and Management Act, 43 U.S.C. § 1701 *et seq.*, (FLPMA) and the Mineral Leasing Act, 30 U.S.C. § 181 *et seq.*, (MLA) two statutes under which the current rule is

[43] *See Id.* at 301.
[44] *See Id.* at 302-303.
[45] *CAN Financial Corp. v. Donovan*, 830 F.2d 1132, 1141 (D.C. Cir. 1987).
[46] *Id*. at 1141.
[47] *United States v. Geophysical Corp. of Alaska*, 732 F.2d 693, 699 (9th Cir. 1984).
[48] *See* 43 U.S.C. § 1352 (a)(1)(A) (Requiring lessees and permittees to "provide the Secretary access to all data and information . . . obtained from [any exploration for, or development or production of, oil or gas]").
[49] *Louisiana Chem. Ass'n v. Bingham*, 550 F. Supp. 1136 (W.D. La. 1982).
[50] See *Id.* at 1138-39, 1143 (quoting 29 U.S.C. § 657(c)(1), (g)(2) (1976)).

promulgated, each provide adequate statutory authority to BLM to require public disclosure of trade secret information from hydraulic fracturing on public lands. FLPMA requires the Secretary to "manage the public lands under principles of multiple use and sustained yield."[51] This includes "coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment."[52] Additionally, one of the purposes of FLPMA is that "the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values . . . and will provide for outdoor recreation and human occupancy and use."[53] The Secretary is directed by statute to promulgate rules and regulations to carry out the purposes of FLPMA.[54] Because public disclosure of trade secret information is clearly related to the purposes of protecting health, the environment, and public resources, and is necessary to protect and provide for those resources, FLPMA provides sufficient authority to BLM to promulgate rules requiring disclosure of all information it collects under the rule, including information claimed to be a trade secret.

The Mineral Leasing Act also provides sufficient authority to BLM to require disclosure of all information, including trade secrets. The MLA provides BLM with authority to lease lands for oil and gas development, to regulate and permit activity that occurs on these lands, and to require "statements, representations, or reports" to fulfill these purposes.[55] Additionally, the Act provides the Secretary with authority to "prescribe necessary and proper rules and regulations and to do any and all things necessary to carry out and accomplish the purposes of [the Act]."[56] Because public disclosure of information about hydraulic fracturing on public lands is clearly related to the purposes of evaluating and permitting activity on public lands, and protecting public lands and resources, the MLA alone provides sufficient authority for BLM to promulgate requirements that all information related to well stimulation on public lands be disclosed publicly. Likewise, 25 U.S.C. §§ 396d and 2107 provide similar authority for BLM to require public disclosure of all information relating to well stimulation on Indian lands, providing statutory authorization for the BLM to regulate oil and gas operations and to promulgate rules and regulations to carry out those tasks.

The Trade Secrets Act does not constrain BLM's ability to require public disclosure of <u>all</u> information that the agency collects related to well stimulation on public and Indian lands. Therefore, based on the clear benefits that full public disclosure would provide for the protection of human health and the environment, BLM should eliminate the trade secret exemptions included in the proposed rule when it promulgates final regulations.

[51] 43 U.S.C. § 1732(a).
[52] 43 U.S.C. § 1702(c).
[53] 43 U.S.C. § 1701(a)(8).
[54] 43 U.S.C. § 1740.
[55] *See* 30 U.S.C. §§ 190, 226.
[56] 30 U.S.C. §189.

iii. Because BLM Leases Incorporate Subsequent Regulations, No Other Law Prevents BLM from Eliminating Trade Secret Exemptions from Proposed Rule

BLM leases have, for many years, required that the lessee comply with subsequent regulations promulgated by the Secretary of the Interior, as long as those regulations are not "inconsistent with rights granted in the lease or specific provisions the lease sets out."[57] Leases specifically note that lessees are required to "take reasonable measures deemed necessary by [BLM]" to "minimize[] adverse impacts to the land, air, and water, to cultural, biological, visual, and other resources, and to other land uses or users."[58]

BLM's regulations concerning disclosure of information regarding well stimulation clearly fall within the ambit of these rules, given the benefits of full disclosure as outlined above. Because oil and gas lessees have agreed to be bound by future regulations and took title to the lease under these conditions, BLM may properly adopt rules which require public disclosure where, as here, those rules are in furtherance of legitimate statutory duties of BLM,. In this case, BLM would be furthering legitimate aims such as protection of the environment, health, and public resources.

iv. If BLM Does Not Require Full Disclosure, the Agency Must at Minimum:

1. Require immediate disclosure to medical professionals and first responders

Medical professionals require full access to information on what their patients may have been exposed to, and in what concentrations, for diagnosis and treatment. And first responders need access to all information related to well stimulation to appropriately respond to accidents and emergencies. A number of state hydraulic fracturing rules include provisions which allow medical professionals and first responders to obtain trade secret information. These states include Arkansas, Colorado, Montana, Ohio, Pennsylvania and Texas. BLM must also ensure that all information is accessible to these parties regarding well stimulation on public lands.

Given that BLM is not prevented by the Trade Secrets Act or any other law from requiring disclosure of trade secret information, it must ensure that first responders and medical professionals have access to that information. There should be a clear process that also ensures they can receive the information immediately in the event of an emergency. To

[57] *See, e.g.*, BLM Oil and Gas Lease Offer, Form 3100-11 (July 2006)) ("Rights granted are subject to . . . regulations and formal orders hereafter promulgated when not inconsistent with lease rights granted or specific provisions of the lease."); *see also Devon Energy Corp. v. United States*, 45 Fed. Cl. 519, 523 (Fed. Cl. 1999) (quoting BLM lease form from 1963 with similar language, requiring the lessee to comply with "all reasonable regulations of the Secretary of the Interior now or hereafter in force, when not inconsistent with any express and specific provisions herein").

[58] BLM Oil and Gas Lease Offer, Form 3100-11 pg. 3, Sec. 6 (July 2006).

ensure that the information is provided without delay, they should be able to obtain the information from both BLM and the company.

2. Strictly apply the definition of protected trade secrets

If BLM does not require disclosure of all trade secret information to the public, at minimum the BLM should ensure that its rules strictly limit the information that companies can claim as trade secrets. Importantly, the rule should make clear that trade secret status for the formula of a product (i.e. the amount of each chemical that goes into the product) is not equivalent to trade secret status for the identity of the chemicals that constitute it. Companies should have to provide separate factual justification for each claim. And the identities of chemicals should only be granted protection if the company can provide information showing that the chemical identity qualifies for trade secret status independent of the trade secret status of the formula.

3. Require chemical family of withheld chemicals to be identified

If BLM continues to allow exemptions from public disclosure for information on chemical identities in the final rule, it should at least require that the chemical family of the substance is identified. This basic information does not implicate an operator's trade secrets, but provides at least some information about what types of chemicals were used by the operator in well stimulation. Such a rule is clearly feasible. A number of states require that the chemical family be disclosed where a chemical's identity is withheld as a trade secret, including: Arkansas, Colorado, Louisiana, Pennsylvania, and Texas.

4. Ensure that a public challenge process exists

If BLM maintains trade secret exemptions in the final rule, it should delineate a clear process for public challenges of trade secret claims. We believe that a reasonable interpretation of the proposed rule would allow members of the public to request records via a Freedom of Information Act request and challenge any failure to produce records on the basis that the trade secret claims were not legitimate. However, BLM should outline the process for maximum clarity and to assist members of the general public in understanding their right to challenge such claims.

Additionally, BLM should ensure that the substantiating information provided to BLM under proposed 43 C.F.R. § 3162.3-3 (h), is disclosed proactively to the public without need for a request of these records. If necessary, confidential information in these documents justifying trade secret exemptions could be redacted. However, it is important to provide the public with the documented claims of exemptions in order to allow the public to evaluate the substantiating information provided by operators when they identify information claimed to be exempt from disclosure.

c. <u>Method of Disclosure</u>

In the proposed rule, BLM states that the information disclosed to BLM is "intended to be posted on a public website" but does not give further details about the method of disclosure other than

stating that BLM is considering the use of FracFocus.org. BLM's decisions regarding the method of disclosure will govern the accessibility of information and should not be overlooked. BLM must ensure that the information disclosed to the public is accurate and complete, easily accessible, and easy to search or aggregate. While FracFocus.org has certain beneficial features, BLM should not adopt its use unless it is improved to ensure full access to all disclosed information and its search and aggregation capabilities are improved.

i. Limited Information Provided by Current FracFocus Disclosure Form

The current FracFocus form provides only an extremely limited subset of the information that will be collected by BLM under the proposed rule. No information is provided by the site about many things BLM seeks disclosure of including: base fluid source, pressures, fracture lengths, or the volume, handling or disposal of recovered fluids, FracFocus also does not allow for pre-disclosure, which we have argued should be included in the final rule, or for much of the information that we believe should be added to post-disclosure forms. If the FracFocus form will not be improved to include all of this information, BLM should ensure that the complete disclosure forms provided to BLM are made publicly available on the internet in some other fashion. The purposes of public disclosure will not be met if the majority of the information collected under the rule is only available by submission of a Freedom of Information Act request. Moreover, the President has directed agencies to proactively make information of interest available to the public.[59] The public should have access to all of the information regarding hydraulic fracturing on public lands, not just a limited subset determined by an existing website designed to encourage voluntary disclosure.

ii. Ambiguities Created by FracFocus Form and Inconsistencies with BLM's Proposed Rules

The FracFocus disclosure form also may conflict with the proposed BLM rules or make disclosure more difficult to understand in certain respects. For instance the FracFocus form provides a space to disclose the "Total Water Volume" but provides no way of indicating if the base fluid is something other than water. Thus, it may be unclear what base fluid was used. The FracFocus form also states that concentration information is "based on the maximum potential for concentration and thus the total may be over 100%." Yet the proposed BLM rules do not allow maximum concentrations to be reported, but require actual concentrations used. FracFocus also states, for example, that chemicals can be reported as proprietary based on the trade secret provisions related to Material Safety Data Sheets in 43 CFR § 1910.1200.[60] Yet BLM has not adopted this standard.

iii. Aggregation and Searchability

BLM should make every effort to ensure that the information provided by the disclosure rule is accessible, and can easily be searched or aggregated. The Natural Gas Subcommittee of the Secretary of Energy Advisory Board, which was directed by the President to make

[59] *See* Freedom of Information Act: Memorandum for the Heads of Executive Departments and Agencies, 74 Fed. Reg. 4683, 4683 (Jan. 21, 2009); *see also* Transparency and Open Government: Memorandum for the Heads of Executive Departments and Agencies, 74 Fed. Reg. 4685, 4685 (Jan. 21, 2009).
[60] *See* http://fracfocus.org/welcome.

recommendations about improving the safety and environmental performance of hydraulic fracturing, recommended that regulators ensure that disclosures are "posted on a publicly available website that includes tools for searching and aggregating data by chemical, well, by company, and by geography."[61]

It is our understanding that FracFocus is in the process of improving search capabilities. This is an important improvement. However, FracFocus prevents aggregation, which unnecessarily restricts full public access and use of the information. The Natural Gas Subcommittee explained that one significant "limitation of FracFocus is that the information is not maintained as a database. As a result, the ability to search for data is limited and there are no tools for aggregating data."[62] Unfortunately, the limitations with FracFocus are not only technical ones. The website's terms of use also purport to prohibit others from compiling the data and publishing it elsewhere.[63] BLM should refuse to use any site which claims to prevent public use of data collected for the public benefit. Public access to the information provided in hydraulic fracturing disclosures is not only useful on a well by well basis, but allows scientists to develop a better understanding of the effects of hydraulic fracturing. BLM should ensure that FracFocus provides searchability and aggregation before selecting it for use or should develop its own solution which provides these characteristics.

iv. Non-compliance

Finally, we are concerned that the use of a website which is not administered by BLM may increase non-compliance with BLM's disclosure requirements. Noncompliance is frequently observed in states which use FracFocus for their mandatory disclosure requirements. For instance, concentration ranges were frequently observed even when a state's rules did not allow them. In other instances, required information is simply omitted from the disclosure. This is likely because while state regulatory staff may check that a disclosure has been made on FracFocus, they do not check each item to ensure full compliance with their rules. If BLM decides to use FracFocus or any other third-party website for disclosure purposes, BLM must create a plan to ensure that each disclosure is reviewed by BLM staff for full compliance with the agency's disclosure requirements.

d. Advance Notice to Owners and Residents of Private Surface

In addition to prior disclosure of stimulation chemicals, BLM should ensure that split estate landowners (those whose ownership of the surface has been severed from federally-owned mineral rights below), nearby landowners, and residents are notified of upcoming stimulation treatments at least 30 days prior to the treatment. The parties notified should include landowners with land on which the well lies, adjacent landowners, and any other landowners whose land lies within ½ mile of any part of the well bore, along with non-owning residents of any of these lands.

[61] Natural Gas Subcommittee of the Secretary of Energy Advisory Board, *90-Day Report*, 24 (Aug. 18, 2011) *available at* http://www.shalegas.energy.gov/.
[62] *Id.*
[63] *See* http://fracfocus.org/terms-of-use Section 7.

Currently, the BLM notifies surface owners before leasing[64] and requires that oil and gas lessees contact a surface owner before entry onto land and engage in good faith efforts to secure a surface use agreement.[65] But no requirement ensures that a surface owner has notice of when stimulation will occur, including fracturing or refracturing that can occur a significant time after a well is drilled. Additionally, no provisions protect nearby landowners or non-owning residents.

Earlier this year, the Idaho legislature approved new rules requiring companies to notify all home owners, water well owners and owners of public drinking water systems located within ¼ mile of an oil and gas well of proposed well treatments.[66] Colorado's rules also provide for notification of hydraulic fracturing to landowners within 500 feet of a well to be hydraulically fractured, and require landowners to notify residents of these lands.[67]

The BLM should ensure that split estate surface owners, adjacent land owners and residents are provided with notice of every stimulation treatment by adding a requirement that the operator notify nearby surface owners and residents in advance of each stimulation treatment. These landowners and residents should be provided with 30 days notice to ensure that they have adequate time to arrange for any baseline testing of air or water quality they desire to conduct, and to allow them time to document the condition of the surface before stimulation begins.

VII. COMMENTS ON BLM'S OTHER PROPOSED REGULATIONS

§ 3160.0–3

We support BLM's proposed action to delete the term "fresh water."

3162.3–3(c)(2)

We support BLM's proposed requirement to obtain cement bond logs for all casing strings that are used to isolate usable water. However, the term "cement bond log" refers to out-dated technology and the term "radial cement evaluation log" is preferable. Cement integrity and location must be verified using cement evaluation tools that can detect channeling in 360 degrees. A poor cement job, in which the cement contains air pockets or otherwise does not form a complete bond between the rock and casing or between casing strings, can allow fluids to move behind casing from the reservoir into USDWs. Verifying the integrity of the cement job is crucial to ensure no unintended migration of fluids. Traditional bond logs cannot detect the fine scale channeling which may allow fluids to slowly migrate over years or decades and therefore the use of more advanced cement evaluation tools is crucial and must be required.

[64] Instruction memorandum 2009-184.
[65] Onshore Oil and Gas Order #1, Part VI.
[66] IDAPA 20.07.02 – 055.01.m.
[67] Colorado Oil and Gas Conservation Commission Rule 305(e).

Recommended revisions to the BLM's proposed regulations:

(2) The proposed measured depths (both top and bottom) of all occurrences of usable water and the radial cement ~~bond~~ evaluation logs (or another log acceptable to the authorized officer) proving that the occurrences of usable water have been isolated to protect them from contamination;

Additional recommendations:

Operators must be required to run radial cement evaluation logs to verify placement and integrity of cement behind any string of casing through which stimulation operations will be performed (i.e. intermediate or production casing). If stimulation operations occur through casing with improper or insufficient cement, a loss of mechanical integrity can occur, which may allow stimulation fluids, formation fluids, or hydrocarbons to migrate into protected water.[68]

The BLM must also require a cement evaluation log for any casing strings used to isolate potential flow zones[69] (and where cement evaluation tools are not otherwise required to be run), if cement operation parameters such as fluid return volumes, displacement volumes, etc. indicate inadequate cement coverage.

If cement evaluation logs indicate inadequate cement coverage, remedial action must be performed prior to continuing operations. If the problem cannot be remediated, the well must be plugged and abandoned.

Mechanical Integrity testing prior to well stimulation § 3162.3–3(d)

Mechanical integrity testing prior to well stimulation is critically important and we support the proposed requirements. However, the proposed regulations do not include any steps that must be taken if the mechanical integrity test is not successful. In addition to the regulations proposed, BLM should include the following additional requirements:

Recommended additions to the BLM's proposed regulations:

§ 3162.3–3(d)(4) If the requirement at (d)(3) is not met, the operator must:

(i) Orally notify the authorized officer as soon as practicable but no later than 24 hours following the failed test, and;

(ii) Perform remedial work to restore mechanical integrity.

Stimulation operations may not begin until a successful mechanical integrity test is performed.

[68] See Section IX, case study of ground water contamination in Bainbridge Township, Ohio

[69] Defined in API Standard 65-Part 2 as, "Any zone in a well where flow is possible when wellbore pressure is less than pore pressure."

Monitoring and recording during well stimulation § 3162.3–3(e)

§ 3162.3–3(e)(1)

Recommended revisions to BLM's proposed regulations:

(1) During the well stimulation operation, the operator must continuously monitor and record the pressures in each well annuli ~~annulus pressure at the bradenhead. If an intermediate casing has been set on the well that is being stimulated, the pressure in the annulus between the intermediate casing and the production casing must also be continuously monitored and recorded~~. The operator must also continuously monitor and record surface injection pressure, slurry rate, proppant concentration, fluid rate, and sand or proppant rate. A continuous record of all monitored parameters ~~the annulus pressure~~ during the well stimulation must be submitted with the required Subsequent Report Sundry Notice (Form 3160–5, Sundry Notices and Reports on Wells) identified in paragraph (f) of this section.

These recommended revisions and additions are consistent with API Guidance Document HF1, Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines.

§ 3162.3–3(e)(2)

Recommended revisions to the BLM's proposed regulations:

(2) If during the stimulation the annulus pressure: (i) increases by more than 500 pounds per square inch as compared to the pressure immediately preceding the stimulation, or (ii) exceeds 80% of the API rated minimum internal yield on any casing string in communication with the hydraulic fracturing treatment the operator must orally notify the authorized officer as soon as practicable, but no later than 24 hours following the incident. Within 15 days after the occurrence, the operator must submit a report containing all details pertaining to the incident, including corrective actions taken, as part of a Subsequent Report Sundry Notice (Form 3160–5, Sundry Notices and Reports on Wells).

Additional recommendations:

We support BLM's proposed requirements for reporting pressure increases during well stimulation. However, the proposed regulations do not include requirements for the operator to cease operations or evaluate mechanical integrity if anomalous conditions are observed.

In addition to the regulations proposed, BLM should include the following additional requirements:

If at any point during the hydraulic fracturing operation the monitored parameters indicate a loss or potential loss of mechanical integrity, if injection pressure exceeds the fracture pressure of the confining zone(s), or if there are any indications that injected fluids or displaced formation fluids have contacted a transmissive fault or fracture or improperly constructed or plugged well, the

operation must immediately cease. If any of the preceding occurs, the operator must notify the regulator within 24 hours and must also take all necessary steps to determine the presence or absence of a leak or migration pathways to USDWs. Prior to any further operations, mechanical integrity must be restored and demonstrated to the satisfaction of the regulator and the operator must demonstrate that the ability of the confining zone(s) to prevent the movement of fluids to USDWs has not been compromised. If a loss of mechanical integrity is discovered, if the integrity of the confining zone has been compromised, or if fluids have reached a transmissive fault or improperly constructed or plugged well operators must take all necessary steps to evaluate whether injected fluids or formation fluids may have contaminated or have the potential to contaminate any unauthorized zones. If such an assessment indicates that fluids may have been released into a USDW or any unauthorized zone, operators must notify the regulator within 24 hours, take all necessary steps to characterize the nature and extent of the release, and comply with and implement a remediation plan approved by the regulator. If such contamination occurs in a USDW that serves as a water supply, a notification must be placed in a newspaper available to the potentially affected population and on a publically accessible website and all known users of the water supply must be individually notified immediately by mail and by phone.

§ 3162.3–3(f)

Produced water and flowback fluid can contain hydraulic fracturing chemicals, salts, heavy metals, volatile organic compounds, hydrocarbons, and naturally occurring radioactive material ("NORM"). (U.S. Geological Survey, 1999) (Otton, 2006) As discussed in greater detail in sections VIII and IX, the use of pits and/or centralized surface impoundments to capture or dispose of flowback water can result in greater surface disturbance and higher risk of leaks and spills, which can result in groundwater or surface water contamination. Pits can also be a significant source of hazardous and toxic air pollution and impacts to wildlife.

BLM should institute a complete prohibition on the use of unlined pits, regardless of the intended use or contents. The use of pits and/or centralized surface impoundments to capture or dispose of flowback water from Federal/Indian leases should also be prohibited. Closed-loop systems should be used to collect flowback for treatment and reuse or transportation to a disposal facility unless an operator can demonstrate that use of such a system is technologically infeasible—which we anticipate would be rare. Sufficient tanks must be utilized to capture the entire anticipated flowback volume and be located within secondary containment.

A geochemical analysis should be performed on all flowback and produced water, including for all contaminants for which EPA has set primary and secondary drinking water standards, hydrocarbons, standard inorganic ions, radionuclides, and hydraulic fracturing chemicals. Samples should be taken at appropriate intervals to determine changes in chemical composition with time and sampled until such time as chemical composition stabilizes. The results of such analyses should be: (1) used as a guide to determine the most appropriate disposal method and (2) made publicly available on a well-by-well basis through an online, geographically based reporting system.

All recovered fluids should be tracked using a manifest system to ensure proper transportation and final disposal. While recycling of flowback and waste water is preferred, any residual wastes must be subject to hazardous waste regulations to RCRA Subtitle C. Post-treatment residual wastes contain the same pollutants of concern as the original wastewater, but in much greater concentrations.[70]

Recommended revisions to BLM's proposed regulations:

(f) Storage of all recovered fluids must be in ~~either~~ tanks ~~or lined pits~~. The authorized officer may require additional measures to protect the mineral resources, other natural resources, and environmental quality from the release of recovered fluids.

Requesting a variance from the requirements of this section § 3162.3–3(j)

While we recognize that in certain circumstances a variance may be needed, this section is of concern given that the goal of minimum, enforceable standards is to ensure equal and adequate protection in all circumstances. We support BLM's proposed requirement that a variance be granted, "…only if the BLM determines that the proposed alternative meets or exceeds the objectives of the regulation for which the variance is being requested." In addition, we recommend that a variance only be granted if the proposed alternative will not result in increased risks to the environment or human health.

The public needs to be assured that operators are adhering to enforceable, uniform standards. As such, when a variance is requested, we recommend that the request be made public as part of BLM's mandatory 30-day public notification requirements.

VIII. ADDITIONAL REGULATION IS NEEDED TO PREVENT ENVIRONMENTAL IMPACTS: THE CASE FOR BASELINE WATER TESTING AND IMPROVED WELL CONSTRUCTION AND WASTE WATER HANDLING PRACTICES

> EXPLORATION FOR AND PRODUCTION OF PETROLEUM HAVE CAUSED MAJOR DETRIMENTAL IMPACTS TO SOILS, SURFACE AND GROUND WATERS, AND THE LOCAL ECOSYSTEMS IN THE UNITED STATES. (KHARAKA & OTTON, 2003)

[70] *See* Rebecca Hammer & Jeanne VanBriesen, *In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater* (May 2012).

> …THE SUCCESSFUL EXTRACTION OF NATURAL GAS FROM UNCONVENTIONAL RESOURCES REQUIRES SPECIALIZED DRILLING AND COMPLETION TECHNIQUES. SUCH APPROACHES TEND TO GENERATE GREATER ENVIRONMENTAL RELEASES THAN THOSE ASSOCIATED WITH CONVENTIONAL GAS PRODUCING TECHNIQUES. (USEPA, 2008)

Oil and gas exploration and production in the United States has left behind a legacy of pollution and environmental impacts. Although progress has been made since the first oil well was drilled in Titusville, PA in 1859, the evolution in technology used to extract oil and gas tends to outpace regulation intended to protect the environment. Such is the case with the Bureau of Land Management ("BLM") regulations that apply to oil and gas development on public lands.

Among the most commonly cited environmental impacts of oil and gas production are degradation of soils and water caused by releases of hydrocarbons and co-produced brine, known as "produced water." (Kharaka & Dorsey, 2005) The critical importance of properly regulating oil and gas production is demonstrated by the many tens of studies describing the environmental impacts of hydrocarbon and produced water releases. (Otton, 2006) A multi-year, interdisciplinary study of hydrocarbon and produced water releases at an oil production site in Oklahoma undertaken by the United States Geological Survey ("USGS") found that soil and groundwater at the site were still polluted after more than 60 years of natural attenuation. (Kharaka & Otton, 2003) Another multi-decade study by the USGS at the site of a crude oil spill in Minnesota found that contamination continues to persist after more than 30 years of natural attenuation and despite remediation attempts. (Essaid, Bekins, Herkelrath, & Delin, 2011)

Contamination caused by releases of hydrocarbons and produced water can be extremely technologically and financially difficult to remediate, if not impossible. It is therefore critically important to prevent contamination from happening in the first place. This requires putting in place effective regulations that reduce the risks of releases associated with the highest risk pathways: the wells themselves and the pits and tanks used to store wastewater.

Baseline water testing

Neither existing nor proposed BLM rules require operators to perform baseline characterization of usable ground water and surface water.

Recommended solution

BLM should require operators to perform baseline characterization of all usable ground water and all surface water within a designated area of review, including testing for hydrocarbons and all proposed chemicals, before any activity begins.

Operators should submit to the regulator a statistically significant sample, as determined by the regulator, of existing and/or new geochemical analyses of any and all sources of water that serve as USDWs within the area of review in order to characterize baseline water quality. This data should be made publically available through an online, geographically-based reporting system. The sampling methodology must be based on local and regional hydrologic characteristics such as rates of precipitation and recharge and seasonal fluctuations. At a minimum, characterization should include:

1. Standard water quality and geochemistry[71]
2. Stable isotopes
3. Dissolved gases
4. Hydrocarbon concentration and composition. If hydrocarbons are present in sufficient quantities for analysis, isotopic composition should be determined
5. Chemical compounds or constituents thereof, or reaction products that may be introduced by the drilling or hydraulic fracturing process. The use of appropriate marker chemicals is permissible provided that the operator can show scientific justification for the choice of marker(s).

Operators should also consider testing for environmental tracers to determine groundwater age.

Well Construction

While BLM's proposed rules for mechanical integrity testing are important, mechanical integrity issues cannot be meaningfully addressed without addressing well construction. BLM's well construction rules are outdated and inadequate.

Recommended solution

BLM must revise and update its well construction rules to reflect technological advancements in oil and gas extraction techniques. Proper well design and construction are crucial first step to ensuring long-term mechanical integrity. Operators must demonstrate that wells will be designed and constructed to ensure both internal and external mechanical integrity. Internal mechanical integrity refers to the absence of leakage pathways through the casing; external mechanical integrity refers to the absence of leakage pathways outside the casing, primarily through the cement.

Casing must be designed to withstand the anticipated stresses imposed by tensile, compressive, and buckling loads; burst and collapse pressures; thermal effects; corrosion; erosion; and hydraulic fracturing pressure. The casing design must include safety measures that ensure well control during drilling and completion and safe operations during the life of the well.

[71] Including: Turbidity, Specific Conductance, Total Solids, Total Dissolved Solids, pH, Dissolved Oxygen, Redox State, Alkalinity, Calcium, Magnesium, Sodium, Potassium, Sulfate, Chloride, Fluoride, Bromide, Silica, Nitrite, Nitrate + Nitrite, Ammonia, Phosphorous, Total Organic Carbon, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Bromide, Cadmium, Chromium, Cobalt, Copper, Cyanide, Iron, Lead, Manganese, Mercury, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Thorium, Uranium, Vanadium, Zinc, Cryptosporidium, Giardia, Plate Count, Legionella, Total Coliforms, and Organic Chemicals including Volatile Organic Compounds (VOCs).

For all casing strings, the design and construction should be based on Good Engineering Practices (GEP), Best Available Technology (BAT), and local and regional engineering and geologic data. All well construction materials must be compatible with fluids with which they may come into contact and be resistant to corrosion, erosion, swelling, or degradation that may result from such contact. BLM's existing well construction regulations are insufficient to protect water and other natural resources. Therefore, we recommend the following new well construction regulations:

CONDUCTOR CASING:

Depending on local conditions, conductor casing can either be driven into the ground or a hole drilled and the casing lowered into the hole. In the case where a hole is excavated, conductor casing should be fully cemented to surface. A cement pad should also be constructed around the conductor casing to prevent the downward migration of fluids and contaminants.

SURFACE CASING:

Surface casing is used to: isolate and protect groundwater from drilling fluids, hydrocarbons, formation fluids, and other contaminants; provide a stable foundation for blowout prevention equipment; and provide a conduit for drilling fluids to drill the next section of the well.

Surface casing setting depth must be based on relevant engineering and geologic factors, but generally should be:

- Shallower than any pressurized hydrocarbon-bearing zones
- 100 feet below the deepest USDW

Surface casing must be fully cemented to surface by the pump and plug method. If cement returns are not observed at the surface, remedial cementing must be performed to cement the casing from the top of cement to the ground surface. If shallow hydrocarbon-bearing zones are encountered when drilling the surface casing portion of the hole, operators must notify regulators and take appropriate steps to ensure protection of USDWs.

INTERMEDIATE CASING:

Depending on local geologic and engineering factors, one or more strings of intermediate casing may be required. This will depend on factors including but not limited to the depth of the well, the presence of hydrocarbon-or fluid-bearing formations, abnormally pressured zones, lost circulation zones, or other drilling hazards. When used, intermediate casing should be fully cemented from the shoe to the surface by the pump and plug method. Where this is not possible or practical, the cement must extend from the casing shoe to 600 feet above the top of the shallowest zone to be isolated (e.g. productive zone, abnormally pressured zone, etc). Where the distance between the casing shoe and shallowest zone to be isolated makes this technically infeasible, multi-stage cementing must be used to isolate any hydrocarbon- or fluid-bearing formations or abnormally pressured zones and prevent the movement of fluids.

PRODUCTION CASING:

To be most protective, one long-string production casing (i.e. casing that extends from the total depth of the well to the surface) should be used. This is preferable to the use of a production liner – in which the casing does not extend to surface but is instead "hung" off an intermediate string of casing – as it provides an additional barrier to protect groundwater. The cementing requirements are the same as for intermediate casing.

PRODUCTION LINER:

If production liner is used instead of long-string casing, the top of the liner must be hung at least 200 feet above previous casing shoe. The cementing requirements for production liners should be the same as for intermediate and production casing.

GENERAL:

For surface, intermediate, and production casing, a sufficient number of casing centralizers must be used to ensure that the casing is centered in the hole and in accordance with API Spec 10D (Specification for Bow-Spring Casing Centralizers) and API RP 10D-2 (Recommended Practice for Centralizer Placement and Stop Collar Testing). At a minimum, casing should be centralized at the top, shoe, above and below a stage collar or diverting tool (if used) and through all protected water zones. This is necessary to ensure that the cement is distributed evenly around the casing and is particularly important for directional and horizontal wells. In deviated wells, the casing will rest on the low side of the wellbore if not properly centralized, resulting in gaps in the cement sheath where the casing makes direct contact with the rock. Casing collars should have a minimum clearance of 1.25 inches on all sides to ensure a uniformly concentric cement sheath.

For any section of the well drilled through fresh water-bearing formations, drilling fluids must be limited to air, fresh water, or fresh water based mud and exclude the use of synthetic or oil-based mud or other chemicals. This typically applies to the surface casing and possibly conductor casing portions of the hole.

Current BLM requirements for casing pressure testing, at OOGO#2 – III(B)(1)(h) are best practice.

Cement must conform to API Specification 10A, Specifications for Cement and Material for Well Cementing (April 2002 and January 2005 Addendum). Further, the cement slurry must be prepared to minimize its free water content, in accordance with the same API specification, and it must contain a gas-block additive.

Current BLM requirements for waiting on cement time at OOGO#2-III(B) are best practice. In addition, the cement mixture must have a 72-hour compressive strength of at least 1200 psi and the API free water separation must average no more than six milliliters per 250 milliliters of cement, tested in accordance with API RP 10B-2.

For cement mixtures without published compressive strength tests, the operator or service company must perform such tests in accordance with the current API RP 10B and provide the results of these tests to regulators prior to the cementing operation. The test temperature must be within 10 degrees Fahrenheit of the formation equilibrium temperature at the top of cement. A

better quality of cement may be required where local conditions make it necessary to prevent pollution or provide safer operating conditions.

Prior to cementing, the hole must be prepared to ensure an adequate cement bond by circulating at least two hole volumes of drilling fluid and ensuring that the well is static and all gas flows are killed. Current BLM requirements for the use of plugs and/or spacer fluids at OOGO#2 – III(B)(1)(g) is best practice.

As recommended in API Guidance Document HF1: Hydraulic Fracturing Operations--Well Construction and Integrity Guidelines, casing shoe tests should be performed immediately after drilling out of the surface or intermediate casing. This should be required for all wells, not only those listed at OOGO#2-III(B)(1)(i). These tests may include Formation Integrity Tests (FIT), Leak-Off Tests (LOT or XLOT), and pressure fall-off or pump tests. Casing shoe tests are used to ensure casing and cement integrity, determine whether the formations below the casing shoe can withstand the pressure to which they will be subjected while drilling the next section of the well, and gather data on rock mechanical properties. If any of the casing shoe tests fail, remedial action must be taken to ensure that no migration pathways exist. Alternatively, the casing and cementing plan may need to be revised to include additional casing strings in order to properly manage pressure.

When well construction is completed, the operator should certify, in writing, that the casing and cementing requirements were met for each casing string.

IX. CASE STUDIES AND BACKGROUND INFORMATION IN SUPPORT OF ENHANCED REGULATION

a. *Baseline testing and well construction*

Establishing baseline conditions when conducting scientific investigations is a fundamental scientific principle. A baseline is a starting point against which to measure a hypothesized change in key parameters. For example, to investigate potential groundwater contamination, water chemistry would need to be determined prior to the activity that might introduce contaminants into the water. In order for the baseline to be meaningful, testing must establish the absence or presence and concentration of the actual contaminants that may be introduced. Without a proper baseline, the presence of contamination can be established but determining the source of that contamination is challenging and subject to a great deal of uncertainty.

Proper oil and gas well construction is paramount in protecting groundwater. The layers of steel casing and cement are what isolate usable water from hydrocarbons and any injected or naturally occurring contaminants. Mechanical integrity refers to an absence of leakage pathways through the casing and cement. Testing for mechanical integrity can reveal problems but only sound well design and construction can ensure that mechanical integrity is achieved in the first place.

The potential for oil and gas extraction – in particular extraction involving hydraulic fracturing – to contaminate groundwater is a growing concern. Summarized below are several cases of groundwater contamination in which oil and gas production activities are the suspected cause of contamination. Poorly constructed or abandoned wells are recognized as one of the most likely ways by which contaminants may reach groundwater. (USEPA, 1980) (Kharaka & Otton, 2003)

In each of the water contamination cases described below, improper well construction is cited as a confirmed or potential cause of groundwater contamination. Despite the rigorous scientific investigation performed for these studies, in each case critics have cited a lack of baseline data to call into question the validity of the results and conclusions. Baseline data is essential to conducting a comprehensive scientific investigation of suspected water contamination. Proper well construction is crucial to preventing water contamination.

Pavillion, WY

> "THE LACK OF BACKGROUND OR BASELINE DATA TO COMPARE TO THE CURRENT DATA SETS…PREVENTS MEANINGFUL CONCLUSIONS FROM BEING DRAWN." (COHEN, GRIGSBY, BESSINGER, MCATEER JR, & BALDASSARE, 2012)

> "IT IS POSSIBLE THAT WELLBORE DESIGN AND INTEGRITY ISSUES WERE ONE CAUSATIVE FACTOR IN DEEP GROUND WATER CONTAMINATION AT THIS SITE…" (USEPA, 2011C)

The U.S. Environmental Protection Agency ("EPA") initiated an investigation into potential groundwater contamination near the town of Pavillion, Wyoming in response to homeowner concerns about objectionable taste and odor in well water. The domestic water wells in question overlie the Pavillion natural gas field. The field has been developed since the 1960s with the most intensive development occurring in the early 2000s. The field contains approximately 169 production wells and hydraulic fracturing has been used as a completion technique for several decades.

Water sampling began in March of 2009 and is ongoing. A preliminary draft report released by EPA in December 2011 concluded that oil and gas production activities had led to contamination of both shallow and deep groundwater. Surface pits were identified as a source of shallow groundwater contamination. Hydraulic fracturing was identified as a source of deep groundwater contamination. (USEPA, 2011c)

The principle findings of the study are:

- Water samples taken from two EPA monitoring wells had anomalously high pH values (highly alkaline) that could have been caused by small additions of potassium hydroxide (KOH), a constituent of two hydraulic fracturing chemicals used in oil and gas wells in the area.
- Groundwater from the Wind River formation in the two EPA monitoring wells had inorganic geochemical compositions distinct from both shallow groundwater and the

typical geochemical composition of Wind River formation water. Both wells had elevated potassium levels and one well had elevated chloride levels. Potassium and chloride were constituents of multiple hydraulic fracturing chemicals used in oil and gas wells in the area.

- A number of synthetic organic chemicals were detected in samples from both monitoring wells, including isopropanol, diethylene glycol, and triethylene glycol. Each of these was a constituent of one or more hydraulic fracturing chemicals used in oil and gas wells in the area. In addition, tert-butyl alcohol (TBA), which is a known break-down product of chemicals used in hydraulic fracturing, was detected in one well.
- Petroleum hydrocarbons including BTEX, trimethylbenzenes, and naphthalene were detected in one monitoring well and diesel range organics (DRO) and gasoline range organics (GRO) were detected in both wells. Each of these was a constituent of one of more hydraulic fracturing chemicals used in oil and gas wells in the area.
- Reviews of well completion reports for oil and gas wells showed that in some cases surface casing did not extend below the deepest domestic wells, production casing was not fully cemented to surface, there were multiple instances of poor cement bonding behind production casing, and hydraulic fracturing occurred in or near zones with inadequate cement.
- This area lacks a suitable confining zone to separate formations that are hydraulically fractured from groundwater.
- While some migration of gas into groundwater would be expected above gas fields such as Pavillion, isotopic chemical evidence, methane concentrations, well construction practices, and the timing of citizen complaints relative to the timing of hydraulic fracturing indicate that gas migration has been enhanced by natural gas production activities.

EPA determined that hydraulic fracturing chemicals and methane could have reached groundwater by migrating through the annular space of poorly constructed wells, through subsurface formations due to lack of a lithologic barrier (a.k.a. confining zone), or through fractures generated or enlarged by hydraulic fracturing.

The results of the preliminary study have been criticized by the oil and gas industry, Wyoming state officials, and consultants hired by the oil and gas industry to review the study. The controversy notwithstanding, more stringent well construction standards, thorough identification of geologic and hydrologic conditions, and safer waste management methods would have reduced the risk to ground water. Baseline data would have allowed a more thorough analysis of impacts, helped to more accurately identify the most likely sources and pathways of contamination, and helped address these criticisms.

Dimock, PA

"EPA CHOSE TO INCLUDE SPECIFIC DATA POINTS WITHOUT ADEQUATE KNOWLEDGE OR CONSIDERATION OF WHERE OR WHY THE SAMPLES

WERE COLLECTED, WHEN THEY WERE TAKEN, OR THE NATURALLY OCCURRING BACKGROUND LEVELS FOR THOSE SUBSTANCES THROUGHOUT THE SUSQUEHANNA COUNTY AREA." (CABOT OIL & GAS CORPORATION, 2012)

"ON MAY 13, 2009, THE DEPARTMENT ISSUED CABOT A NOTICE OF VIOLATION FOR FAILING TO PROPERLY CEMENT CASING AT CERTAIN OF THE CABOT WELLS, AND FOR FAILING TO PREVENT GAS FROM ENTERING GROUNDWATER…" (PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION, 2009)

On January 1, 2009, an explosion was reported in a water well pit at a home in Dimock Township, Susquehanna County, PA. The Pennsylvania Department of Environmental Protection ("PA DEP") began an investigation to determine the cause. Due to the proximity of the affected water well to natural gas wells drilled and operated by Cabot Oil and Gas Corporation ("Cabot"), PA DEP sought to determine if the incident was a result of Cabot's activities. In the subsequent investigation, PA DEP documented elevated levels of methane in numerous drinking water wells near the Cabot natural gas wells. (Pennsylvania Department of Environmental Protection, 2009)

PA DEP concluded that the elevated methane in drinking water was a result of Cabot's failure to properly case and cement several of its gas wells, which allowed methane to migrate from the deep subsurface into drinking water. (Pennsylvania Department of Environmental Protection, 2009) Cabot disputed this finding and contended that the methane was naturally occurring and not a result of gas drilling activities.

Nevertheless, Cabot and PA DEP entered into a Consent Order and Agreement ("COA") under which Cabot was, among other things, prohibited from drilling or hydraulically fracturing any additional wells within the affected area and required to improve casing and cementing practices and replace water supplies for affected residents. (Pennsylvania Department of Environmental Protection, 2009)

Following a request from concerned residents, EPA reviewed water sample data provided by PA DEP and Cabot and then took its own additional water samples from approximately 61 home wells to determine if harmful contaminants other than methane were present in drinking water. (USEPA 2011a, USEPA 2012a) In mid 2012, EPA completed its testing and concluded that five of 64 wells sampled had, "hazardous substances, specifically arsenic, barium or manganese, all of which are also naturally occurring substances, in…levels that could present a health concern." (USEPA, 2012c). The ATSDR is continuing its review of water sampling results in Dimock, including those collected by EPA as well as by Cabot and PA DEP. Among other things, it is examining the risks of long-term exposures to the water through showering, drinking, bathing and washing, as well as risks that might be compounded when people are exposed to multiple toxicants.

In this case, more stringent well construction standards would have reduced the risk of this type of contamination, and baseline data would have would have improved the ability of investigators to determine the cause and source of contamination. Pennsylvania has sinced strengthened its casing and cementing regulations.

Garfield County, CO

> "DUE TO THE ABSENCE OF HISTORIC WATER QUALITY DATA PRIOR TO DRILLING OF GAS WELLS TO SERVE AS A BASELINE IN THE AREA, THE WATER QUALITY ISSUES OBSERVED IN THE STUDY AREA COULD PREDATE GAS WELL DRILLING ACTIVITIES. WE CANNOT MAKE A DEFINITIVE STATEMENT OTHER THAN THE WATER QUALITY ISSUES COULD BE CAUSED BY NATURAL CONDITIONS AND/OR POTENTIALLY THE PRESENCE OF GAS WELLS IN THE AREA." (URS CORPORATION, 2006)

In 2004, citizens notified the Colorado Oil and Gas Conservation Commission ("COGCC") of the presence of gas bubbling in the West Divide Creek, Garfield County, CO, near the Mamm Creek Gas Field. Subsequent investigations identified the gas as thermogenic gas from the Williams Fork (Mesaverde) Formation, which is the primary gas-bearing target in the Mamm Creek Field. Water testing also detected the presence of BTEX compounds above regulated limits. It was determined that the gas and other contaminants were leaking from a nearby wellbore which had been improperly cemented, Encana's Schwartz #2-15B.

Analysis of the groundwater and surface water and potential impacts from natural gas exploration and other human activities in the area were conducted by numerous parties including: URS Corporation and S.S. Papadopulos and Associates, engaged by the State of Colorado; Dr. Geoffrey Thyne, engaged by Garfield County; Bill Barrett Corporation; Dr. Anthony Gorody of Universal Geoscience Consulting, Inc., a consultant for Encana Corporation; and the United States Geological Survey ("USGS"), in cooperation with the Colorado Department of Public Health.

The following findings were generally consistent throughout all the studies considered:

1. Some domestic water wells had increased concentrations of methane, relative to background
    a. Both biogenic and thermogenic methane were detected
2. Some domestic water wells had concentrations of fluoride, selenium, nitrate, and/or arsenic which exceeded health-based standards

    a. Fluoride and selenium concentrations do not appear to be related to oil and gas activity
    b. Nitrate concentrations are most likely related to agricultural activity, septic system effluent, and/or animal waste
3. Some domestic water wells had concentrations of chloride, iron, manganese, and/or total dissolved solids ("TDS") which exceeded aesthetic-based standards.

High chloride and TDS concentrations indicate the mixing or interaction of shallow groundwater with deeper formation water. (URS Corporation, 2006) (Papadopulos & Associates, Inc., 2008) (Thyne, 2008) (McMahon, Thomas, & Hunt, 2011)

Several areas of dispute arose among the various studies, including:

1. Evidence for a temporal correlation of methane and chloride contamination and natural gas activity
2. The nature and origin of methane in domestic water wells
3. The primary mechanism for deep Wasatch or Mesaverde formation water to mix with shallow groundwater (URS Corporation, 2006) (Papadopulos & Associates, Inc., 2008) (Thyne, 2008) (Donato, Sterrett, & Hanna, 2009) (Gorody, 2009) (Papadopulous & Associates, Inc., 2009) (McMahon, Thomas, & Hunt, 2011)

<u>Key Observations</u>

Despite the areas of dispute discussed above, some key observations and conclusions emerged from the studies. (URS Corporation, 2006) (Papadopulos & Associates, Inc., 2008) (Thyne, 2008) (McMahon, Thomas, & Hunt, 2011)

- Some domestic water samples contain methane and deep formation water which may have migrated to water wells through either natural pathways or gas wellbores or both.
- The study area is naturally faulted and fractured. Fault and fracture density increases near structural features, such as the Divide Creek Anticline.
- Regulations were updated in 2004 to require that all new wells have surface casing set below the lowest USDW and cemented to surface and production casing cemented to 500' above the top of gas in the Mesaverde (Williams Fork) Formation. There is no requirement to cement over the deep, gas-bearing Wasatch Formation. Older wells may have been constructed using different standards and may not have been properly abandoned.
- Gas production wells with persistent or recurring elevated bradenhead pressures have been identified near structural features.
- Domestic water wells with elevated methane and chloride concentrations are often coincident with structural features.
- Natural fractures and faults may provide migration pathways for gas and fluids, both to groundwater and to the uncemented annular space of wellbores. Fractures and faults may also cause complications in well drilling, construction, and completion and result in well integrity problems.

Due to a lack of baseline water quality information, researchers could not agree on the cause of contamination. Baseline testing would have would have improved the ability of investigators to determine the cause and source of contamination. Improved well construction and abandonment practices could have helped reduce the risk of water contamination.

Bainbridge Township, Geauga County, Ohio

> "MOST WATER SUPPLIES WITHIN THE BAINBRIDGE INVESTIGATION AREA DO NOT HAVE WATER ANALYSES PREDATING LOCAL OIL AND GAS ACTIVITIES" (ODNR, 2008)

On December 15th, 2007, an explosion was reported in the home at 17975 English Drive, Bainbridge Township, Geauga County, Ohio. Early investigations determined that methane was entering homes in the vicinity of the explosion through domestic water wells. The Ohio Department of Natural Resources ("ODNR"), Division of Mineral Resources Management ("DMRM") inspected local gas wells to identify the source of the gas. When inspectors arrived at the English No. 1 gas well owned by Ohio Valley Energy Systems Corp ("OVESC"), representatives from OVESC were on location examining the well and discussing remedial cementing operations. (ODNR, 2008)

Sequence of Events Leading to Natural Gas Invasion into Drinking Water Aquifers

OVESC spud the English No. 1 well on October 18th, 2007. Conductor casing was installed to a depth of 88 feet, through glacial till and into bedrock. The well was drilled through the groundwater aquifers and surface casing was set at 263 feet and cemented to surface. Drilling continued until the total depth of the well, 3,926 feet, was reached on October 26th. Conditions encountered during open-hole logging and casing and cementing operations indicated potential problems with the well. The logging tool bridged out at 3,658 feet, the depth of the Packer Shell, due to an apparent filter cake build up. The logging tool could not be moved below the bridge and open-hole logs were not obtained. OVESC proceeded to set 4-1/2" production casing. Casing was run into the hole and became stuck at 3,659 feet, the depth of the Packer Shell. The casing was washed down to 3,873 feet, became differentially hung, and could not be lowered further. OVESC then proceeded to cement the production casing. Prior to cementing, circulation of the wellbore was established but was subsequently lost during the cementing operation and could not be re-established. The cementing operation was concluded and, due to the lost circulation event, a cement bond log was run to establish the top of cement ("TOC"). (ODNR, 2008) (Bair, Freeman, & Senko, 2010)

Based on the cement job design, TOC should have been 700-800 feet above the top of the Clinton formation. The cement bond log revealed TOC to be at 3,640 feet, the depth of the Packer Shell. This finding and the previous drilling, logging, and casing problems suggest the Packer Shell thieved a large quantity of cement due to the presence of localized fracturing.

Despite the inadequate primary cement job, OVESC continued to complete the well. The well was perforated from 3720-3740 feet, leaving only approximately 80 feet of cement covering the Clinton between the top perf and the TOC/open annulus, and the planned hydraulic fracture treatment proceeded on November 13th. The original frac design called for 105,000 gallons of water and 600 sacks of proppant. After pumping less than half the planned fluid and proppant, fluid circulated out of the open valve on surface-production casing annulus. Pump pressure and rate were reduced, 4000 gallons of fresh water was pumped to flush and recover sand, and the frac job was discontinued. (ODNR, 2008) (Bair, Freeman, & Senko, 2010)

In the three days following the well completion, most of the frac fluid was recovered and pressure on the surface-production casing was recorded. The pressure increased each day and stabilized at 320 psi on the third day and gas was periodically blown off to reduce pressure. Construction was completed and the well was shut in for the next 31 days. (ODNR, 2008) (Bair, Freeman, & Senko, 2010)

While the well was shut in, gas from the Clinton, Newburg, and Ohio Shale formations migrated into the uncemented annular space behind the production casing and caused the annulus to become overpressured, reaching a maximum recorded pressure of 360 psi. This gas then migrated from the high-pressure annulus, through fractures, into the shallow low-pressure aquifer and subsequently into domestic water wells, culminating in the explosion on English Drive. (ODNR, 2008) (Bair, Freeman, & Senko, 2010)

<u>Primary Causes of Gas Invasion into Drinking Water Aquifers</u>

1. Poor Primary Cement Job: The poor primary cement job left the shallow Newburg Dolomite and Ohio Shale gas-bearing zones open to the annulus behind the production casing, allowing high-pressure gas to migrate into the annulus.
2. Decision to Hydraulically Fracture the Well Despite the Poor Cement Job: Circulation of fluid and oil in the surface-production casing annulus during hydraulic fracturing indicates that the fractures grew "out-of-zone" and allowed the frac to communicate directly with the wellbore. The frac likely compromised the 80 feet of cement between the top perf and the open annulus, causing a loss of cement bond between the formation and production casing. This likely allowed Clinton gas to also migrate into the annulus behind the production casing.
3. Shutting in the Well for 31 Days: The decision to shut in the surface-production casing annulus for 31 days allowed the annulus to become over-pressured and gas to migrate from the high-pressure annulus, through fractures, to the groundwater aquifer and eventually into domestic water wells. (ODNR, 2008) (Bair, Freeman, & Senko, 2010)

b. ***Waste water handling***

Numerous studies have identified flowback and produced water pits as one of the most common sources of environmental pollution from oil and gas operations. These pits pose a great risk to health and the environment even when they are lined. They can endanger surface water, groundwater, air, soil and wildlife.

Both unlined and lined pits pose serious risks to the environment. A 1987 study conducted by EPA found that "oil and gas brine pits were identified by 22 states as a significant source of groundwater pollution; two of the states identified these pits as the primary cause of pollution." (Kharaka, Thordsen, Kakouros, & Abbott, 2003). In 2008, the New Mexico Oil Conservation Division ("OCD") released data documenting 366 cases of groundwater contamination associated with pits. (New Mexico Oil Conservation Division, 2008) A 2011 study prepared for the Ground Water Protection Council ("GWPC") found that in Ohio, "Over the 25 year study period, inadequately constructed or maintained reserve pits were the number one cause of oilfield-related groundwater contamination…" (Kell, 2011) In August of this year, the Pennsylvania Department of Environmental Protection released a concept paper outlining new proposed regulations in which they recommend eliminating the use of pits to store produced fluid, stating, "The long-term storage of production fluids in a pit presents an unacceptable risk to the environment through leaks or overtopping of the pit." (PADEP, 2012)

In 2001, exploration and production ("E&P") wastes from the Black Mountain disposal facility in Colorado contaminated nearby soil and groundwater when its clay lined pits began to leak.[72] The Colorado Oil and Gas Conservation Commission ("COGCC") documented several pits at the same pad site in Garfield County whose liners had torn and allowed wastes to be released on multiple occasions between April and August 2008.[73] The reports indicated that the pits were located on rocky terrain and that some of the liners had been torn by rocks on the site.[74] In total, more than 6,000 barrels of pit contents escaped the pits because of the tears.[75] In May, 2008, a Colorado citizen drank water from his spring and fell ill. The COGCC found benzene in the groundwater that exceeded standards by 32 times and benzene in faucet water that exceeded standards by 13 times, as well as elevated levels of toluene and xylenes. In July, 2010, the COGCC found that the operator failed to properly permit, construct, maintain, and repair the pit, leading to a release or releases of E&P waste that impacted groundwater. The agency found that the liner had been stretched over rocks and had improperly sealed seams, thereby allowing their contents to be absorbed by unprotected ground.[76]

Pennsylvania's Department of Environmental Protection (PADEP) has documented several incidents of dangerous waste releases into the environment from pits. At two of Atlas Resources LLC's well sites in Pennsylvania, "compromised" pit liners allowed fracturing flowback fluids to escape.[77]

[72] Kim Weber, Regarding Support of HB 1414—Evaporative Waste Facilities Regulations.
[73] Colorado Oil And Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Doc. Nos. 1630424, 1630426, 1630427, 1630428, 1630429, 1630430.
[74] Colorado Oil And Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Doc. No. 1630428.
[75] Colorado Oil And Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Doc. Nos. 1630424 (714 Bbls), 1630426 (2000 Bbls), 1630427 (500 Bbls), 1630428 (1250 Bbls), 1630429 (204 Bbls), 1630430 (2017 Bbls).
[76] Colorado Oil and Gas Conservation Commission, Cause No. 1V, Order No. 1V, Docket No. 1008-OV-06
[77] Consent Assessment of Civil Penalty, In re Atlas Resources LLC, Dancho-Brown 4, ¶¶ AV–AZ, Groves 8, ¶¶ BA–BE.

A study conducted in New Mexico found that eliminating pits, traditionally considered the cheapest disposal method, is actually more cost-effective than their continued use.[78]

Pits can also be significant sources of hazardous and toxic air pollution. EPA states that, "…light organics can be volatilized from recovered hydrocarbons or from solvents or other chemicals used in the production process for cleaning, fracturing, or well completion." (USEPA, 1987) These pollutants include but are not limited to alkanes, benzene, toluene, ethylbenzene, xylenes, and methanol. (USEPA, 2009) (Brown, 2011c) In its 2009 draft Supplemental Generic Environmental Impact Statement ("DSGEIS") for Marcellus Shale development, the New York State Department of Environmental Conservation concluded that the use of centrallized impoundments to store flowback fluid could result in emission of hazardous air pollutants at levels of concern, stating, "Based on an assumed installation of ten wells per wellsite in a given year, an annual methanol air emission of 32.5 tons (i.e., "major" quantity of HAP) is theoretically possible at a central impoundment." (NYSDEC, 2009)

Allowing flowback fluids to be captured in open pits rather than closed tanks can also release significant amounts of methane, a greenhouse gas with a global warming potential ("GWP") at least 25 times greater than CO_2. (Solomon, et al., 2007) EPA estimates that 9,000 MCF (thousand cubic feet) of natural gas may be released from the completion of a single hydraulically fractured natural gas well when emissions controls are not used to either capture or flare the gas. (USEPA, 2012b)

Pits also pose significant risks to wildlife. The U.S. Fish and Wildlife Service has documented impacts to migratory birds and other species from contact with or ingestion of waste contained in pits and estimate that 500,000 to 1 million birds are lost annually. (Ramirez Jr, 2009) (USFWS, 2009) They recommend eliminating the use of pits and instead using closed-loop systems.

USGS OSPER A & B Sites, Oklahoma

> "THESE RELEASES AND THE IMPROPER DISPOSAL OF PRODUCED WATER ARE NATIONAL ISSUES THAT CONCERN MANAGERS OF NATIVE AMERICAN, FEDERAL, AND STATE LANDS, AS WELL AS OIL AND GAS PRODUCERS AND LESSEES, MINERAL RIGHTS AND LEASE OWNERS, STATE AND FEDERAL REGULATORS, AND SURFACE LANDOWNERS." (KHARAKA & OTTON, 2003)

[78] Dorsey Rogers, Gary Fout, & William A. Piper, New Innovative Process Allows Drilling Without Pits In New Mexico (2006).

The U.S. Geological Survey ("USGS") led a multi-year, interdisciplinary study to examine the environmental impacts of produced water and hydrocarbon releases at the Osage-Skiatook Petroleum Environmental Research (OSPER) "A" and "B" sites, located in Osage County, Oklahoma. Beginning in 2001, over 20 researchers from government and academia performed multiple studies to understand the fate, transport, and natural attenuation of the salts, trace metals, radionuclides, and organic compounds in produced water and their impacts to soil, water, vegetation, and fauna. (Kharaka & Otton, 2003)

Oil and gas production has occurred at these sites for approximately 100 years. The sites are wholly federally owned: the Osage Nation holds the mineral rights, the Bureau of Indian Affairs ("BIA") and the EPA have trust responsibility, and the Army Corps of Engineers owns the surface rights. The sites are located near Skiatook Lake, a 4,250-hectare lake that provides drinking water to Tulsa suburban communities and a rural water district and is used for recreational boating and fishing. (Kharaka & Otton, 2003)

Significant impacts to soil and water have been measured at both sites: "Results to date show that impacts of produced water and associated hydrocarbons on soil and ground and surface waters at both sites and surrounding areas are widespread and pervasive. All wells show some degree of contamination from produced water and/or associated petroleum or its degradation products." (Kharaka & Otton, 2003)

The OSPER A site is inactive, oil production no longer occurs at these leases. This area drains into Skiatook lake. During active production, the site contained two redwood oil tanks, two unlined pits that contained produced water and oil, unlined trenches to carry produced fluids from the tanks to the pits, and a pipe leading from the pits, presumably to transfer fluids from the pits to trucks. The area continues to be impacted by spills of produced water that primarily occurred 65-90 years ago. Early brine spills killed the pre-existing oak forest and prevented trees from regrowing. The pits and soils around these features are contaminated with hydrocarbons. (Otton & Zielinski, 2003)

The OSPER B site is actively producing oil and gas and is under waterflood for enhanced recovery. Ongoing produced water releases are impacting an approximately 1.0 hectare area. The site contains an active tank battery and associated large pit, and old tank battery, an injection well and adjacent tank and pit, a second injection well, and pipelines. Salt scars emanate from the sites of all three tank batteries. Oil-saturated soils occur at multiple locations. An attempt was made to remediate the three salt scars associated with the tank batteries but salt crusts still persist and replanted vegetation has mostly died. (Otton & Zielinski , 2003)

Geophysical measurements show the presence of saline water in the subsurface beneath both sites. (Smith, Bisdorf, Horton, Otton, & Hutton, 2003) Although salts have essentially been removed from the soils and bedrock through flushing with fresh water at the A site, a plume of high-salinity water is present at intermediate depths extending from below the pits to Skiatook lake. At site B, all water samples taken show contamination with produced water and, "significant amounts of produced water from the two active brine pits percolate into the surficial rocks and flow towards the Skiatook Reservoir…" (Kharaka, Thordsen, Kakouros, & Abbott, 2003)

Research into the hydrologic controls on subsurface transport of brine at the B site show that two main mechanisms are at work: 1) slow, steady flow of saline ground water from the pit to the lake and 2) relatively fast overland flow of saline surface runoff during rainfall. Results show that travel time of saline ground water from the pit to the lake is 2-4 years. (Herkelrath & Kharaka, 2003)

The long-term environmental consequences of mishandling produced water are made clear by the following conclusion: "Results to date clearly show that significant amounts of salts from produced-water releases and petroleum hydrocarbons still remain in the soils and rocks of the impacted area after more than 60 years of natural attenuation." (Kharaka & Otton, 2003) Whether lined or unlined, pits have a higher risk of spills and leaks than tanks. Spills and leaks of produced water have a lasting environmental impact. The contaminants present in produced water are extremely difficult, if not impossible, to remove from soil and ground water. Reducing the risk of spills through collection and storage in tanks instead of pits is crucial.

X. DIESEL MUST BE BANNED IN HYDRAULIC FRACTURING

BLM should ban the use of diesel fuel and related products in well stimulation. Diesel can contain carcinogenic compounds such as benzene, toluene, ethylbenzene, and xylene ("BTEX"). The Department of Energy Secretary of Energy Advisory Board Shale Gas Subcommittee found that, in light of these risks and the available alternatives, "there is no technical or economic reason to use diesel as a stimulating fluid."[79]

BLM should similarly examine other common or particularly hazardous chemicals and determine whether they should be categorically prohibited. While there is currently not an available methodology for assessing the toxicity of each chemical proposed to be introduced into a well and for determining less hazardous alternatives that are equally effective, BLM should coordinate with relevant federal agencies and research institutions (e.g. EPA, NIOSH, OSHA, CDC, NIH, etc.) to develop protocols for performing such analyses.

XI. STRONGER RULES MAKE ECONOMIC SENSE

The BLM conducted an estimate of the anticipated costs and benefits of the proposed rule. Attached is an economic analysis of the BLM estimate provided by economist Michele Haefele, PhD, which is hereby incorporated into these comments.

To summarize the Haefele comments, the BLM found that the proposed rule will have no discernible impact on the timing of approval of Applications for Permits to Drill (APDs) if well stimulation documents are submitted at the time of initial APDs and are reviewed promptly.

[79] Natural Gas Subcommittee, First 90-day interim report, (August 18, 2011), http://www.shalegas.energy.gov/resources/081811_90_day_report_final.pdf

Dr. Haefele points out that non-commodity resources from public lands are increasingly recognized as important economic assets for nearby communities, and details studies that have found that recreation opportunities, natural amenities, diverse economies, and protected lands have been linked with community economic growth. Dr. Haefele concluded that the BLM took a conservative approach to estimating the benefits of the proposed rule and omitted non-market benefits, thereby underestimating the benefits of the rule.

XII. DESCRIPTIONS OF ORGANIZATIONS SUBMITTING THESE COMMENTS

Biodiversity Conservation Alliance is a nonprofit conservation group based in Laramie Wyoming that works to protect wildlife and wild places in Wyoming and surrounding states. It has taken a special interest in ensuring that oil and gas development proceeds responsibly, with adequate protections for sensitive wildlife, special landscapes, and water and air quality.

The **Buckeye Forest Council** (BFC) is a membership-based, grassroots organization dedicated to protecting Ohio's native forests and their inhabitants. The BFC uses education, advocacy and organizing to address the need for forest preservation and low-impact recreation over logging and resource extraction. It seeks to instill in Ohioans a sense of personal connection to and responsibility for Ohio's native forests and to challenge the exploitation of land, wildlife and people.

Californians for Western Wilderness is a citizens group founded to secure protection for the remaining wilderness areas and other public lands in the western United States. The organization works to encourage and facilitate direct citizen democracy through participation in administrative and legislative actions, creating a constituency in California for wilderness across the West.

Catskill Citizens for Safe Energy is an all volunteer grassroots organization working to prohibit dangerous hydraulic fracturing (fracking) since 2008.

The **Center for Biological Diversity** ("the Center") is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center also works to reduce greenhouse gas emissions to protect biological diversity, our environment, and public health. The Center has over 38,000 members, including many who live in the areas affected by oil and gas development on BLM-managed lands. Center members have visited these public lands for recreational, scientific, educational, and other pursuits and intend to continue to do so in the future, and are particularly interested in protecting the many native, imperiled, and sensitive species and their habitats that may be affected by oil and gas development.

Clean Air Task Force is a nonprofit organization dedicated to reducing atmospheric pollution through research, advocacy and private sector collaboration, and is actively involved in state and federal efforts to reduce environmental and climate impacts from oil and gas operations.

Clean Water Action is a national citizens' organization, founded in 1972, of over 1million members and is active in over a dozen states. Clean Water Action works for strong public health and environmental protections with an emphasis on those that impact water resources.

Conserving Arkansas' Agricultural Heritage (CAAH) project was initiated by Dr. Brian Campbell and the University of Central Arkansas Anthropology program to conserve the knowledge, history, and genetics of traditional Arkansas agriculture. Many Arkansas farmers and gardeners do in fact maintain heirloom varieties and are enthusiastic about participating in their conservation. CAAH conserves Arkansas's agricultural heritage by documenting heirlooms and associated knowledge and history, passing them around, growing them out, establishing markets, and saving the seed each year. It strives to establish a dialogue between seed savers, hopefully passing on both seeds and important knowledge, and to establish a more localized food system along the way.

Earthjustice is a non-profit public interest law firm originally founded in 1971. Earthjustice works to protect natural resources and the environment, and to defend the right of all people to a healthy environment. Earthjustice is actively addressing threats to air, water, public health and wildlife from oil and gas development and hydraulic fracturing in the Marcellus Shale and Rocky Mountain regions.

Earthworks is a nonprofit organization dedicated to protecting communities and the environment from the impacts of irresponsible mineral and energy development while seeking sustainable solutions. The organization fulfills its mission by working with communities and grassroots groups to reform government policies, improve corporate practices, and influence investment decisions. Earthworks has been working specifically on hydraulic fracturing issues for more than a decade.

EcoFlight advocates for the protection of remaining wild lands and wildlife habitat through the use of small aircraft. The aerial perspective and our educational programs encourage an environmental stewardship ethic among citizens of all ages.

Friends of Blackwater works to protect the Monongahela National Forest and the High Alleghenies of West Virginia.

Heartwood is a cooperative network of grassroots groups, individuals, and businesses working to protect and sustain healthy forests and vital human communities in the nation's heartland and in the central and southern Appalachians. Heartwood, Heartwood members and member groups regularly use BLM lands and their concerns for impacts to flora, fauna, water resources and recreation inform these comments.

Founded in 1919, **National Parks Conservation Association** represents more than 750,000 members and supporters through its DC headquarters and 24 regional and field offices, all working to "protect and enhance America's National Park System for present and future generations."

The **Natural Resources Defense Council** (NRDC) is a non-profit environmental membership organization with more than over 565,000 members throughout the United States. NRDC members use and enjoy public lands across the country. NRDC members use and enjoy these lands for a variety of purposes, including: recreation, solitude, scientific study, conservation of natural resources, and sources of clean drinking water. NRDC has had a longstanding and active interest in the protection of public lands and national forests, the responsible development of oil and gas resources, and the protection of public health from environmental threats.

Ozark Society is celebrating 50 years of protecting and preserving our streams, rivers, wetlands, wilderness and natural areas. Its mission is Conservation, Education and Recreation.

The **Ozark Water Protection Alliance's** mission is to preserve and protect the pristine waters of the Ozark Mountain region. It is a coalition of organizations, groups, and individuals working together to ensure that the waters of our region are not polluted or squandered by shortsighted land management decisions, greed, or ignorance. Its work includes public education, issue related campaigns, project reviews and comments, and, correspondence with agencies and elected officials.

The **Sierra Club** is a non-profit environmental membership organization with more than 600,000 members living throughout the United States. Sierra Club members live near and recreate in public lands throughout the country. Reducing the harmful effects of oil and gas production on the environment and human health is a priority for both Sierra Club's Beyond Natural Gas and Beyond Oil campaigns, which work on both state and federal levels.

The **Southern Environmental Law Center** is a regional non-profit organization working to conserve the environment and health of the Southeast, including the national forests and other public lands. The national forests in the Southern Appalachian mountains, in particular, support globally significant levels of plant and animal diversity, shelter the headwaters of the South's major rivers, supply drinking water to many cities, and provide outstanding recreation opportunities within a day's drive of half of the U.S. population.

The Wilderness Society's mission is to protect wilderness and inspire Americans to care for our wild places. The Wilderness Society and its more than 500,000 members and supports care deeply about our public lands, including ensuring that energy development is conducted responsibly and the many other resources of our public lands are safeguarded for future generations.

The **Upper Green River Alliance** works to protect and preserve the clear air, clean water and abundant wildlife that define the extraordinary Upper Green River Valley in Western Wyoming. It ensures balanced, responsible energy development conducted in a common-sense manner and at a moderate pace that does not impact our valuable natural resources and the connected, human environment.

The **Western Environmental Law Center** is a non-profit public interest law firm that works to protect and restore western wildlands and advocates for healthy environments on behalf of communities throughout the West.

The **Western Organization of Resource Councils** (WORC) is a regional network of seven grassroots community organizations that include 10,000 members and 38 local chapters. WORC is committed to building sustainable environmental and economic communities that balance economic growth with the health of people and stewardship of their land, water, and air resources.

Wild Virginia is a non-profit, grassroots organization dedicated to preserving wild forest ecosystems in Virginia's national forests. It works to ensure that the ecological integrity and biodiversity of these public lands are protected for future generations.

Wilderness Workshop (WW) is a 501(c)(3) dedicated to preservation and conservation of the wilderness and natural resources of the White River National Forest and adjacent public lands. WW engages in research, education, legal advocacy and grassroots organizing to protect the ecological integrity of local landscapes and public lands. WW focuses on the monitoring and conservation of air and water quality, wildlife species and habitat, natural communities and lands of wilderness quality. WW is the oldest environmental nonprofit in the Roaring Fork Valley, dating back to 1967 with a membership base of 700. Many of our members live, work, recreate and otherwise use and enjoy public lands that are currently leased for oil and gas development or under development by oil and gas operators. Our members have an interest in the protection and enhancement of local public lands. Our members have an interest in ensuring that oil and gas development occurs in appropriate locations and in ways that protect other resources, other uses, and other users. Our members also have an interest in full disclosure of chemicals used during oil and gas drilling and production of public minerals. Also, our members have an interest in meaningful opportunities for public comment. WW has been closely monitoring oil and gas related proposals, developments, and management actions on local public lands for many years.

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Benefits and Costs of Proposed Bureau of Land Management Well Stimulation Rules

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In May 2012 the Bureau of Land Management drafted proposed rules regarding well stimulation, including hydraulic fracturing ("fracking") on BLM and Tribal lands (U.S. Bureau of Land Management 2012a). These rules would require operators to obtain permits from the BLM prior to conducting well stimulation, would require several actions intended to increase the integrity of the well to prevent the accidental contamination of ground and surface water, and would require operators to submit reports on these actions along with a disclosure of chemicals used in the well stimulation operations. The proposed rules incorporate several elements of the American Petroleum Institute (API) guidelines for hydraulic fracturing (American Petroleum Institute 2009) and thus represent the oil and gas industry's own best management practices.

Per Executive Order 12866, BLM conducted an estimate of the anticipated costs and benefits of the proposed rule (U.S. Bureau of Land Management 2012b). In response, the Western Energy Alliance (WEA) an oil and gas industry advocacy group, contracted with John Dunham & Associates (JDA) to conduct another estimate of the industry costs (John Dunham & Associates 2012).

This document compares these two reports and critiques the many instances of inadequate documentation of sources. It also discusses the inadequacy of the BLM estimates of the benefits of the proposed rules, and finally describes the broader benefits associated with better regulation and oversight of oil and gas operations on our public lands.

Comparison of BLM and WEA/JDA analysis of costs

Use of unverifiable data

Both the BLM and WEA/JDA estimates of costs appear to use many of the same data sources, often with no verifiable source cited. BLM uses the phrase "industry sources" but does not give any additional detail. The WEA/JDA report apparently uses BLM's estimate as the basis, but in several cases described below inflates these estimates with unverifiable sources. The result is that the two estimates are considerably different, with the WEA/JDA estimate being more than 20 times the magnitude of that of the BLM. Both reports rely on industry input to estimate costs of the various parts of the proposed regulations and with few exceptions, none of these sources are independently verifiable.

Differences between BLM and WEA/JDA estimates of costs

The WEA/JDA analysis results in much larger costs for industry. This section discusses the source of the cost differences between WEA/JDA and BLM.

- *Cost of Cement Bond Logs*

The largest source of disagreement between the cost estimates in these reports is the estimated cost to comply with the proposed requirement that the oil and gas operators submit a cement bond log to BLM. The WEA/JDA report claims that compliance with this requirement will oblige operators to "…ensure that all drilling and field equipment is maintained at the site while the cement cures." (p. 7) According to the report, the cost of this compliance is $1,950 per hour but no verifiable citation for this cost is given.

This assertion also fails to take into account practices that minimize or eliminate this cost, such as setting water-protective casing with different drilling and field equipment than is used to set deeper casing, thereby eliminating standby time while cement cures and bond logs are run. This claim by industry results in an estimated cost for compliance with the CBL requirement which is 15 times that of BLM's estimate and is the main source of the large divergence between the estimates.

- *Additional* Casing Costs

The next largest source of disagreement between the estimates of the cost of the proposed rules lies in a category which only WEA/JDA included – additional casing costs. This category represents 34% of the total cost estimate in the industry analysis and per the WEA/JDA report results from the supposedly new requirement that oil and gas operations protect "usable groundwater." The WEA/JDA report does not give any citation for the purported additional casing depth upon which this very large cost component is based, but rather simply states that much greater depths would be needed to comply.

The WEA/JDA report refers to this requirement as a "…change in the definition of usable groundwater…" where usable water is defined as water containing up to 10,000 parts per million of total dissolved solids. (p. 7). But in fact a more careful reading of existing and proposed BLM rules shows that the term "usable water" (with the same definition) and the requirement for operators to protect usable water have existed since the promulgation of Onshore Oil and Gas Order No. 2 in 1988. The proposed rules don't change the definition of useable water, they simply delete the term "fresh water" to eliminate confusion. Therefore, the proposed rules should not result in any changes to the way wells have to be constructed and therefore impose no additional casing costs, as reflected in BLM's cost analysis.

Furthermore, the proposed rule uses the same definition which is used in the API (2009) industry guidelines for hydraulic fracturing. This implies that this definition is one which is currently used by the oil and gas industry. The industry guidelines specifically recommend protection of this resource: "At a minimum, it is recommended that surface casing be set at least 100 ft below the deepest USDW encountered while drilling the well." (API 2009, p. 11) USDW is defined in the API guidelines as any aquifer which supplies a public water system or other drinking water or contains fewer than 10,000 milligrams per liter of total dissolved solids – which is the same definition used in the proposed rules.

- *Cost of Permitting Delays*

The final source of disagreement between the WEA/JDA cost estimate and the BLM estimate is the cost of delay in permitting. BLM asserts that the proposed rule will have no discernible impact on the timing of approval of Applications for Permits to Drill (APDs) when the well stimulation documents are submitted at the time of initial APDs and that approval for well stimulation for existing wells will be "reviewed promptly." (U.S. BLM 2012a, p.20) The WEA/JDA report makes unsubstantiated assertions about the current approval times and then apparently uses these unsubstantiated approval times to construct some simulated additional delay time which they anticipate as a result of the proposed rules. WEA/JDA states, without citation, "…it is probably not unreasonable to assume that the approval time for these permits with the additional requirements to add about a third of that of approving the existing drilling permits, and will likely be much longer." (JDA 2012, p. 7) The analysis then goes on to assume that work will stop and start by another unsubstantiated number of days despite the fact that for new wells the well stimulation permitting could be applied for as part of the regular APD. If there is a stoppage, in most cases that delay would be entirely due to the choice of the operator.

The final numbers used by WEA/JDA to estimate the potential delay are derived using Monte Carlo simulation, however legitimate use of this technique requires that the analyst have data on the

underlying probabilities of the random variable being simulated (in this case the number of delay days) and preferably some additional actual (non-simulated) data on other factors which would influence the variable being simulated. In this instance the technique is being applied based on what are clearly unsubstantiated assumptions.

The WEA/JDA report does not document how the several elements described are actually used to arrive at the final cost estimate. For example, average drilling costs, average production costs and anticipated revenue are all listed but it is unclear how exactly these elements are incorporated into the final estimates. Neither the BLM nor the WEA/JDA cost estimates provide verifiable sources for the data used, nor does either report satisfactorily explain the reasoning behind the assumptions used.

Estimation of Benefits

The WEA/JDA analysis covers only the costs and is thus incomplete. The BLM regulatory assessment does include an estimate of the benefits of the proposed well stimulation rule, and while not a thorough compilation of all the potential benefits, it does at least provide a balance to the cost analysis.

The BLM takes a conservative approach to estimating the benefits of the proposed rule and thus (as they note) understates these benefits. The BLM notes that the public disclosure of chemicals used in hydraulic fracturing will have benefits which are not measured, claiming that quantitative monetary estimates of these values are too difficult to achieve. These include the potential to inhibit the use of some chemicals by industry, the benefit to scientists and Federal land managers studying the impacts of hydraulic fracturing and, "…benefits to water uses from avoiding harms that could not be compensated by alternate water supplies." (BLM 2012b, p. 34)

These benefits noted are among the many non-market benefits likely to accrue to the citizens of the U.S. if the proposed rules are implemented. The most important omitted non-market benefits of the proposed rule are those associated with clean water. Several peer-reviewed research studies have estimated the non-market values for clean water and healthy water-based ecosystems including Bockstael et al. (1989), Carson and Mitchell (1993), Wilson and Carperter (1999), and Loomis et al. (2000) all of which find significant positive values for clean water.

Economists and others have spent decades developing methods to assess non-market values, and these methods should be applied to the economic analysis in order to derive a complete and more accurate estimate of the net benefits of the proposed rules. See Freeman (2003) and Champ et al. (2003) for general guidelines on state-of-the-art non-market valuation techniques.

The BLM analysis of benefits includes only the avoidance of costs associated with remediation of spills or contamination. They devise two scenarios a low-risk, low remediation cost scenario and a high-risk, high-remediation cost scenario, both of which rely on unsubstantiated sources.

The low-risk scenario uses only the cost to drill a replacement water well, asserting a range of $35,000 to $50,000, but with no citation of the source of these data. They then use the mean of these two end points ($42,000) as the assumed cost (and thus benefit of prevention).

The high-risk scenario "…uses an assumed cost that would proxy for the remediation of the contaminated aquifer." (U.S. BLM 2012b, p.36). BLM refers to the Federal Remediation Technologies Roundtable and notes that this entity, "…makes a number of case studies available on its website." (p. 36) The BLM then says, "This analysis assumes a cost of $1M to remediate contamination to an aquifer." (p. 36), but gives no explanation whatsoever of how this number was arrived at. The reader is left with the impression that BLM used data from the FRTR case studies, but this is unclear. No specific verifiable source is given.

The BLM sums up the estimate of benefits as such: "Estimates of total remediation costs also vary depending on the number of contamination events, which rely on assumptions made about the likelihood of contamination occurring on the number of wells where the requirements or tests are not conducted." (p. 36) BLM must account for information on the current number of incidents in which any oil and gas operation results in an unintended release of any fluid to either ground or surface waters. The regulations should (as described) reduce the number of these incidents and thus the costs associated with remediation. This would allow the agency to make a much more precise estimate of the benefits associated with avoided remediation costs.

BLM also includes the "average remediation of surface risk" (in Table 3, p. 37) but gives no explanation whatsoever of how this figure is arrived at or how it is used in the estimates of either costs or benefits. The values range from $25,000 (for the low-risk scenario) to $75,000 (for the high-risk scenario). Without any explanation of where these values come from it is difficult to know whether they are appropriate.

The net benefits estimated for the low-risk scenario are actually negative, but BLM notes "Given the assumptions made and the fact that certain benefits were not quantified, the range of estimated outcomes could underestimate the actual net benefits, meaning, where net benefits are estimated to be negative, the net benefits would be greater (or less negative)." (p. 42) BLM should make some effort to quantify the important non-market benefits associated with public disclosure of hydraulic fracturing chemicals (which they note as an omission) along with the non-market benefits of clean water which are omitted altogether.

Benefits to Local Economies from Protected Public Lands

While there are certainly benefits from oil and gas extraction, there are also costs to local communities. In the case of public minerals, these communities may be adjacent to public land or even above federal minerals in a split estate situation. Preventing or reducing these costs must also be considered when estimating the benefits of the proposed well stimulation rules. As BLM notes the agency is required by the Federal Land Management and Policy Act to "…manage the public lands so as to prevent unnecessary or undue degradation, and to manage lands using the principles of multiple use and sustained yield." (U.S. BLM 2012a, p. 13). Among the multiple uses prescribed by FLPMA are the protection of wilderness, wildlife habitat, water quality and recreation. These resources are undoubtedly subject to some risk from oil and gas operations in general and from well stimulation, therefore the proposed rules will have additional benefits not accounted for in the BLM analysis.

BLM must assess the current economic conditions in communities where oil and gas drilling is taking place and estimate the potential benefits from better regulating ongoing oil and gas operations which the proposed rules would bring about. As new oil and gas development is evaluated, the potential benefits to communities will likely be higher with the proposed rules in place given that they are likely to better protect the valuable non-commodity assets on surrounding public lands. The proposed rules will lead to a better regulated oil and gas industry which is more likely to be compatible with the other economic uses of our public lands. This analyses can be achieved by incorporating the economic impact of industries which rely on the non-commodity outputs in the overall economic analyses performed under NEPA. See Haefele et al. (2007) for additional discussion of these kinds of economic factors.

- *Protected Public Lands Attract Businesses and Residents*

These non-commodity resources from public lands are increasingly recognized as important assets for rural communities, where public lands have long been seen as economically important. Economists

and other social scientists have studied the relationship between public lands and rural economies for decades. Many find that the non-commodity assets or values of public lands have positive economic impacts in rural communities. Natural amenities which are protected on undeveloped public lands have been found to attract population and economic activity in rural areas (Rudzitis 1999, McGranahan 1999). Vias (1999) found that population growth in high amenity areas often occurs prior to employment growth, hypothesizing that these migration decisions are based on the amenities and that the migrants themselves are starting businesses and increasing local economic activity.

Some researchers have also noted that many migrants to amenity-rich areas initially visit the area for recreation or vacation, eventually becoming full-time residents (Beyers and Nelson 2000, Bartos et al. 2008, Snepenger et al. 1995). Cromartie and Nelson (2009) project that as members of the baby boom generation enter retirement they will tend to migrate to rural high-amenity counties, resulting in an overall increase in population in these rural counties and a demographic shift to older residents. Gunderson et al. (2008) find that migration flows into high amenity counties tend to be inversely correlated with the proportion of total personal income that is wage & salary income, indicating that much of this migration is driven by retirees. Deller (1995) estimates substantial economic impacts associated with amenity-driven retiree migration to rural areas in Maine.

Natural amenities and recreation opportunities have also been found to motivate business to locate in a particular area (Johnson and Rasker 1993, 1995, Rasker and Hansen 2000, Snepenger et al. 1995, Rasker and Glick 1994, Whitelaw and Niemi 1989).

While many counties in the rural West are isolated from larger markets which often hinders economic growth, Rasker et al. (2004) found that such out-of-the-way counties which had abundant natural and other amenities combined with protected public lands actually grew at a rate 60 percent faster than similar counties without protected lands, perhaps indicating that these lands and the amenities they provide may help overcome the handicap of remoteness. English et al (2000) find that rural recreation-dependent counties experienced higher income, population, employment growth and greater increases in housing availability and value. Shumway and Otterstrom (2001) find that high amenity counties attract in-migrants with higher incomes. Deller et al. (2001) find that employment, income and population growth are all significantly and positively related to amenities, including measures of public land management, private land recreation, recreational infrastructure, and climate.

Weiler and Seidl (2004) focus on the total economic impacts to local economies from public lands designations. These researchers analyzed visitation to several units of the National Park Service before and after conversion from National Monuments to National Parks and find that such designation results in a statistically significant increase. Focusing on a case study of the Great Sand Dunes National Monument (now National Park) and employing input-output (IMPLAN) models Weiler and Seidl estimate that a designation-induced increase in visitation will have positive economic impacts in the local economy.

- *Recreation and Local Economies*

Recreation and tourism activities on public lands also generates economic benefits which would be protected by the proposed rules. Over 87.5 million people participated in wildlife-associated recreation (hunting, fishing and wildlife watching) in the United States in 2006, generating over $122 billion in expenditures (U.S. Fish & Wildlife Service and U.S. Census Bureau 2007). Researchers at the Federal Reserve Bank of Kansas City have noted that wildlife recreation has the potential to be an important industry for rural America (Henderson 2004).

The Outdoor Foundation estimates that people participating in active recreation spent more than $298 billion in 2006 spurring other spending in local economies and generating significant local tax revenue—

making the total national economic contribution of outdoor recreation more than $730 billion (Outdoor Industry Foundation 2006a).

- *Economic Diversity*

Another way in which communities benefit when the non-commodity assets on public lands are protected is the enhancement of a wider array of local industries or greater economic diversity. The proposed rules will help protect these other assets and thus may contribute to sustaining economic diversity and protecting communities against the hazards associated with focusing on only a single or a few industries.

Extractive industries are prone to cycles of boom and bust, and researchers have found that these communities often experience high rates of poverty even during boom times (Brabant and Gramling, 1997, Fortmann et al. 1989, Freudenburg 1992, Freudenburg and Gramling 1994, Goldsmith 1992, Gulliford 1989, Headwaters Economics 2008a, Hoffman and Fortmann 1996, Humphrey et al. 1993, Limerick et al. 2002) .

Increased economic diversity can mitigate these issues because when one industry experiences a downturn, a larger variety of industries will be more able to absorb the unemployed. Conversely, areas dominated by one industry often lack this capacity (Wagner 1998, Malizia and Ke 1993, Wagner and Deller 1998). Malizia and Ke (1993) find that areas with greater economic diversity have lower unemployment rates and greater employment stability, and that areas with high concentrations of employment in unstable industries such as mining that have higher overall unemployment rates.

In the West, most energy-focusing counties have experienced slower economic growth than other counties in the region (Headwaters Economics 2008). Wagner (2000) notes that pursuit of a growing industry is an appropriate short-term strategy for economic growth, but is best coupled with policies designed to increase economic diversity to provide long-term stability.

The proposed rule may help mitigate the impacts associated with oil and gas development, allowing rural areas to protect other public lands amenities which in turn will aid economic stability, strength and diversity.

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