Appendix I

Narrative of Completion and Stimulation

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Hydraulic fracturing is the process of applying high pressure to a subsurface formation via a wellbore, to the extent that the pressure induces fractures in the rock. Typically the induced fractures will be propped open with a granular "proppant" to enhance fluid connection between the well and formation. The process was developed experimentally in 1947 and has been used routinely since 1950. The Society of Petroleum Engineers (SPE) estimates that over one million hydraulic fracturing procedures have been pumped in the United States and tens of thousands of horizontal wells have been drilled and hydraulically fractured. It can greatly increase the yield of a well, and development of hydraulic fracturing methods and the drilling technology in which it is applied (in particular, long wells drilled horizontally within the targets) have enabled production of oil and gas from tight formations formerly not economically feasible.

Hydraulic Fracturing Technology

A description of the hydraulic fracturing technology follows:

- All exploratory, testing, and production wells are multiply cased and sealed with cement between the wellbore and the formation. Well integrity is tested throughout the process.
- All drilling and hydraulic fracturing fluids are fully contained in a pitless system (above-ground tanks) and cuttings are contained in roll-off boxes for hauling to disposal (surface casing interval cuttings are spread over the site during reclamation).
- Hydraulic fracturing fluids are recovered to a large degree in "flowback" or produced water when the well is tested or produced.
- All recovered fluids are to be captured in steel tanks and disposed of in an approved disposal facility in Utah (Clean Harbors).
- Per the BLM, drilling cuttings will be land farmed and buried on site 3 feet below root zones. Any cuttings that do not fit this waste profile will be disposed of at an approved disposal facility in Utah (Clean Harbors).

Regulation

- Gas and oil exploration and production are subject to federal, state, and local regulations, including:
- Clean Water Act regulates surface water discharges and storm water management;
- Clean Air Act sets rules for emissions from engines, equipment, and all associated sources;
- The Safe Drinking Water Act regulates the disposal of liquid waste by injection into deep reservoirs isolated from any drinking water aquifer;
- The National Environmental Policy Act requires permits and environmental assessments for drilling on federal lands (this EA);

- The Occupational Safety and Health Act sets standards to keep workers safe. These include requirements for posting Material Safety Data Sheets (MSDS) on site;
- Emergency Planning & Community Right-to-Know Act requires appropriate storage of regulated chemicals and reporting certain quantities annually to local and state emergency responders;
- The Resource Conservation and Recovery Act (RCRA) sets standards and limits for the disposal of solid wastes from drilling and producing actions. The definition of hazardous substances under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) includes any "hazardous waste" as defined in the RCRA of 1976, as amended, 42 U.S.C. 6901 et seq., and its regulations. The term hazardous material also includes any nuclear or nuclear by-product material as defined by the Atomic Energy Act of 1954, as amended, 42 U.C.S. 2011 et seq. The term does not include petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated as a hazardous substance under CERCLA Section 101 (14), 42 U.S.C. 9601 (14) nor does the term include natural gas;
- The BLM has proposed a rule to regulate hydraulic fracturing on public and Indian Land. The rule would provide disclosure to the public of chemicals used in hydraulic fracturing on public and Indian land, strengthen regulations related to well-bore integrity, and address issues related to flowback water. The rule is set forth to provide useful information to the public and to assure that hydraulic fracturing is conducted in a way that adequately protects the environment.

National Research Council on Induced Seismicity

The Committee on Induced Seismicity Potential in Energy Technologies issued a 239 page draft report through the National Academies Press in 2012, on investigation of seismicity induced by injection of fluids by several industries. The preface states that "the study took place during a period in which a number of small, felt seismic events occurred that had been caused or were likely related to fluid injection for energy development. Because of their recent occurrence, peer-reviewed publications about most of these events were generally not available. However, knowing that these events and information about them would be anticipated in this report, the committee attempted to identify and seek information from as many sources as possible to gain a sense of the common factual points involved in each instance, as well as the remaining, unanswered questions about these cases."

The Executive Summary of this report states:

- The process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events;
- Injection or disposal of waste water derived from energy technologies into the subsurface does pose some risk for induced seismicity, but very few events have been documented over the past several decades relative to the large number of disposal wells in operation."

The report notes that in 2010, there were 52,016 oil and gas waste injection wells (Class II) in Texas, 874 in Colorado, and 18 in Nevada.

Hydraulic Fracturing in Colorado

Colorado is a state with a burgeoning tight oil field (Niobrara), and groundwater protection rules among the toughest in the country. Colorado is the base for Noble's Marys River project. Colorado instituted baseline groundwater sampling initially on a voluntary basis for all oil and gas drilling in the state, and Noble has committed to such sampling in Nevada.

There are currently (1/7/2013) 50,055 active oil and gas production wells in Colorado. Every one of these has been hydraulically fractured, whether relatively short, vertical coal bed methane producers, or the newer, deep and long horizontal wells. Amongst them there are a few wells with documented problems which are being addressed. There have been no instances of fracturing fluid escaping into groundwater, excepting one infamous case with a faulty casing seal allowing shallow leakage. The rare problems have motivated ever more stringent regulation.

Society of Petroleum Engineers - Paper 152596

The Society of Petroleum Engineers publishes public information papers. The 80 page paper referenced here was presented in 2012 to a SPE hydraulic fracturing technology conference in Texas. The abstract states that "the furor over fracturing and frac waste disposal was largely driven by lack of chemical disclosure and the pre-2008 laws of some states…Transparency requires cooperation from all sides in the debate. To enable more transparency on the oil and gas side, both to assist in the understanding of oil and gas activities and to set a foundation for rational discussion of hydraulic fracturing risks, a detailed explanation of well development activities is offered in this paper., from well construction to production, written at a level of general public understanding, along with an initial estimation of hydraulic fracturing risk and alternatives to reduce the risk, documented by literature and case histories."

SPE 152596 emphasizes the depth of hydraulic fracturing operations compared to groundwater aquifers. Methane found in water wells is sometimes suggested to have leaked from hydraulic fracturing targets, but is usually found in shallow formations such as coal in such instances, or occasionally has leaked up old and poorly completed wells. The Marys River project area has neither coals nor old wells.

The paper gives a general description of chemicals used in hydraulic fracturing. "There are very few chemicals used in hydraulic fracturing and definitely not the 'hundreds of toxic chemicals' claimed in (the movie) GasLand….Most of the (shale) hydraulic fracturing treatments are water with a friction reducer and no significant gel…Basic slick water formulation is 98-99% water, a friction reducer such as polyacrylamide, biocide, surfactant, gel such as guar gum and cellulose polymer, gelling agents, scale inhibitor, acid, and corrosion inhibitor (one of the few compounds that may be toxic)…"

Project Area Groundwater Study

Noble understands the importance of protecting water resources in Nevada and has entered into a Memorandum of Understanding (MOU) with the State of Nevada through the Nevada Division of Minerals, the Nevada Department of Environmental Protection, and the Board of Regents of the Nevada System of Higher Education on behalf of the Desert Research Institute (DRI) to establish the Aquifer Quality Assessment Program (Aqua Program) to gather and share data and information on groundwater and geological conditions associated with the fate and transport of chemicals used for hydraulic fracturing.