OCCUPATIONAL EXPOSURE ASSESSMENT AND CONTROLS

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Employees of well-servicing companies perform a range of tasks, including constructing well pads, operating drill rigs and fracturing wells, monitoring/gauging tanks and transporting products and waste. While much of the attention given to risks associated with the UO&G industry has focused on potential environmental, community and political impacts of these activities, there are numerous occupational risks associated with oil and gas development. Ramboll Environ is currently evaluating occupational hazards of the new technologies driving the industry.

Exposure Risks

Worker exposure assessments have included crystalline silica (sand), which is used as a proppant to keep
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open the fractures created during the fracturing phase of well development. With up to one percent of the fracturing mixture comprised of proppant, large quantities of sand are used at each job site. National Institute for Occupational Safety and Health (NIOSH) surveys found that workplace concentrations were above occupational exposure standards. However, exposure was relatively easy to control with a few on-site modifications, including reducing airborne dust by enclosing drop-and-transfer points of sand, providing closed booths for workers in the area, implementing additional baghouse controls and using personal protective equipment (PPE) during tasks with the greatest potential for exposure.

NIOSH also recently reported nine fatalities, and identified inhalation of volatile petroleum hydrocarbons as a possible contributing factor. The incidents occurred between 2010 and 2014—with six in 2014—and were associated with tank gauging, sampling or fluid transfer, including opening hatches on oil and produced-water tanks. Ramboll Environ is working with representatives from the UO&G industry and NIOSH to develop and validate controls to limit these exposures.

Exposure Assessment Strategy

Ramboll Environ applies the American Industrial Hygiene Association (AIHA) exposure assessment strategy to evaluating operations throughout the upstream UO&G industry. This approach is comprised of four steps: qualitative assessment, quantitative assessment, implementation (of exposure controls) and verification.

Qualitative assessment involves visiting job sites and interviewing management and employees to identify similar exposure groups (SEGs)—groups of employees who perform similar tasks and would be expected to have similar exposure profiles. Our experts use a matrix to categorize risk associated with SEGs on a low-to-high scale. Results of the qualitative assessment allow clients to better understand how to allocate resources for additional evaluation (sampling) and/or exposure controls.

Quantitative assessment includes collecting samples, and measuring high- and moderate-risk potential exposures. When possible, sampling is carried out randomly in a worker population. These data are then analyzed using statistical tools to determine the likelihood that exposures will exceed occupational exposure limits.

When there is an unacceptable level of exposure, or any uncertainty remains, we develop exposure controls. The first-tier control is to attempt to eliminate the hazard (i.e., modifying tanks so that fluid levels can be measured without opening a hatch). If eliminating the hazard altogether is not an option, we explore engineering controls (i.e., using ventilation to move contaminants away from an employee’s breathing zone). Finally, our team helps clients consider PPE (i.e., respirators) if hazard elimination or engineering controls are not practical solutions.

Ramboll Environ also performs verification in order to ensure that the controls put in place are protecting employees. For example, if respirators are used as a control, validation includes ensuring that the proper respirator was selected and is being properly used.

We are currently working with landfill operators to modify and validate portable “gas-guzzler” ventilation systems, the technology for which could be applicable to the UO&G industry. If validated, this engineered solution would provide a higher level of protection than traditional PPE. We are excited to partner with our clients on the front lines of developing innovative solutions for protecting worker health.
Natural gas production in the US is increasingly driven by new technologies, including hydraulic fracturing to access previously uneconomical shale and tight sandstone formations. In 2013, shale gas overtook all other types of natural gas production to become the largest share of natural gas production in the US. Increased demand for cleaner fuel and new associated technologies, as well as tightening restrictions on criteria and hazardous air pollutant emissions from coal-fired power plants and other combustion sources, will create growing markets for this resource. Power plants in the US produced approximately 760 million megawatt-hours of energy from natural gas in 2005, representing 18.7 percent of the country’s total annual net generation. This number rose in 2013 to 1.12 billion megawatt-hours, representing 27.4 percent of US total annual net generation.2

The campaigns to promote climate benefits of natural gas can be traced back to policies from the early 2000s, which identified natural gas as a “bridge fuel” to renewable energy. Natural gas releases less CO2 than coal-per-unit energy when used for power generation or other combustion applications, and—combined with the large US natural gas reserves—made for a powerful argument in favor of switching to natural gas in the short term while slowly ramping up renewable energy sources.

The benefits of this approach have come under scrutiny in the last few years, as researchers from universities, state and federal agencies, and environmental advocacy groups have criticized the natural gas industry for larger-than-expected rates of methane leakage during unconventional gas extraction.3,4 If methane leakage rates are sufficient enough, this offsets lower natural gas CO2 emissions relative to coal for reducing greenhouse gas emissions. Determining exact methane leakage rates is tricky—methods are inconsistent and vary by location. However, most researchers agree that above a leakage rate of several percent, natural gas fares worse than coal due to methane’s powerful global warming potential.

A team that includes researchers from Ramboll Environ, the National Oceanic and Atmospheric Administration (NOAA), the National Renewable Energy Laboratory (NREL) and Colorado State University is working to improve understanding of methane emissions from unconventional gas production. The study will specifically address why atmospheric measurements from aircraft and ground-based monitoring predict much higher methane emissions than bottom-up emission inventories. The goal of this work is to understand this discrepancy, improve emission inventories, and provide information on which factors cause and contribute to methane leakage.

The team is investigating such phenomena as “super emitters”—facilities and/or wells that are statistical outliers of methane emissions from similar facilities. Ramboll Environ is leveraging our wealth of experience in quantifying large-scale unconventional gas development emissions,5,6 as well as detailed knowledge of emission sources, in order to understand the causes of super emitters. Sources under investigation include non-routine events—such as well maintenance or pressurized system venting—and equipment (particularly pneumatically driven equipment) or control technology malfunctions (flares). We are also investigating whether sources that have not traditionally been included in unconventional emission inventories are potentially significant; these sources include transmission stations, natural gas storage fields, and leaking plugged and/or abandoned wells.

This work will be combined with methane emission field measurements using both aircraft and ground-based mobile monitoring equipment. Ramboll Environ is designing and constructing detailed surveys to gather equipment and processes data, and evaluate field development activities. We are also researching and developing activity inventories for a host of new sources to help provide the most detailed UO&G emission inventory to date. The result will be a combined look at measurements and bottom-up inventories for a simultaneous time period and geographic domain, with a focus on reconciling these two data sources.

Click here for more information.

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1 http://www.eia.gov/todayinenergy/detail.cfm?id=18951
2 http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_01
6 http://wrapair2.org/phaseII.aspx
OIL AND GAS BEAT

Here we provide a brief snapshot of the most recent regulatory and news developments in the UO&G arena.

Tribal NSR Update

On August 18, 2015, USEPA proposed a federal implementation plan (FIP) to implement the Tribal Minor New Source Review (NSR) program for oil and gas production sources on Indian land. USEPA has been phasing in the Tribal Minor NSR program since its adoption in 2011 to address a regulatory gap on Indian land, where states lack authority and most Indian tribes do not have environmental programs. The proposed plan would allow oil and gas sources to register new construction with USEPA without having to wait for an air permit.

NSPS Subpart OOOO/OOOOa

On September 18, 2015, USEPA published proposed updates to the New Source Performance Standards (NSPS) at 40 CFR Part 60 Subpart OOOO and new Subpart OOOOa that proposes methane (CH4) and volatile organic compound (VOC) requirements for additional sources in the oil and gas industry. USEPA provides a summary table comparing facility and process types that are already covered by the existing 2012 NSPS Subpart OOOO standards for VOCs, as well as new sources that would be covered by the proposed 2015 NSPS Subpart OOOOa standards.

Source Determination

USEPA proposed changes to their source determination language for the oil and natural gas sector, clarifying the term “adjacent” for oil and gas industry sites. This affects how oil and gas sites may be aggregated to determine applicability of air permitting rules in the Prevention of Significant Deterioration (PSD), Nonattainment New Source Review (NNSR) and Title V programs.

TRI for Natural Gas Processing

On October 22, 2015, USEPA provided a response to a petition from the Environmental Integrity Project and 16 other organizations requesting that the oil and gas extraction industrial sector be added to the scope of sectors covered by reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA), known as the Toxics Release Inventory (TRI). USEPA granted part of the petition—determining that natural gas processing facilities were appropriate to include in the scope of TRI—and denied part of the petition, declining to add the remainder of the oil and natural gas extraction sector to the scope of TRI at this time.

Endocrine Activity Related to Hydraulic Fracturing Chemical Exposure

In a recent study published in Endocrinology, Duke University researchers exposed male mice to 23 “commonly used oil and natural gas operation chemicals,” and reported the activation and inhibition of estrogen, androgen, glucocorticoid, progesterone and/or thyroid receptors during in vitro analyses. Click here to read the study.

Ramboll Environ Experts Contribute to UO&G Reference Book

Senior Manager Debra Kaden conceived of and co-edited Environmental and Health Issues in Unconventional Oil and Gas Development, published by Elsevier on December 15, 2015. This reference book highlights national and international environmental and health issues discussed by leading UO&G experts from various industries. Authors include several Ramboll Environ experts who delve into key industry issues, including drinking water contamination associated with hydraulic fracturing, solutions to water use and wastewater management issues, and international perspectives on shale gas extraction challenges. Click here to learn more, or order the book.

New UK Onshore Oil and Gas Licenses

The Oil and Gas Authority (OGA)—the UK’s oil and gas regulator—has offered 159 onshore blocks to successful industry applicants as part of its 14th Onshore Oil and Gas Licensing Round in December 2015. The blocks will be incorporated into 93 onshore licences, and will likely serve as a focus for shale gas exploratory work in the UK throughout 2016.
ABOUT RAMBOLL ENVIRON

A premier global consultancy, Ramboll Environ is trusted by clients to manage their most challenging environmental, health and social issues. We have earned a reputation for technical and scientific excellence, innovation and client service. Our independent, science-first approach ensures that our strategic advice is objective and defensible. We apply integrated multidisciplinary services and tailor each solution to our client’s specific needs and challenges.

At the end of 2014, ENVIRON joined forces with Ramboll, Northern Europe’s leading engineering, design and management consultancy, to create a global practice called Ramboll Environment and Health. Together we provide an even higher level of service to our clients and address the environmental, health, water management and facilities engineering needs of the oil and gas industry.

Ramboll Environ’s network of experts includes more than 2,100 employees across 130 offices in 30 countries around the world. The entire Ramboll network, including the water and oil and gas divisions, employ 13,000 practitioners across 300 offices. Our vibrant and collaborative work environment continues to attract—and retain—many of the world’s top consultants.

Air Quality Management

Our worldwide practice is characterized by the highest level of technical and scientific skills, informed by the specific needs of our clients.

We offer:

- Unique regional modeling capabilities, with worldwide experience
- Specific expertise in the oil and gas sector for upstream permitting, midstream support for pipeline and processing infrastructure permitting and auditing, and downstream regulatory compliance
- Air quality expertise with numerous models, including CAMx and CalEEMod (which we have developed and applied in the field), CMAQ, AERMOD, ADMS, CalPuff and SCICHEM

Water Services

Our experts address global water and climate challenges by working throughout the water cycle, from water resources and supply, transportation logistics, on-site storage options analysis, flowback and produced-water management, wastewater treatment, recycling and reuse, and final disposition. We work with our oil and gas clients to create innovative and sustainable solutions that cost-effectively meet their compliance obligations.

We deliver a wide range of water-related consulting services—from early phase strategic analyses and project scoping to designing and implementing infrastructure solutions.

Our consultants—engineers, hydraulic specialists, water consultants, landscape architects, economists, legal advisors and management consultants—have more than 50 years of proven experience with global water issues.