

# Newsletter



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## PERF Board of Directors & Legal Counsel

### PERF Officers

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Bruce Randolph, *Phillips66*
- **Vice Chair:**  
Kate Martin, *Chevron*
- **Treasurer:**  
Martine Hoeksma, *Shell*
- **Secretary / Webmaster:**  
Frederic Perie, *Total*  
Corentin Perrachon, *Total*
- **Past Chair:**  
Veronica Blackwell, *Chevron*

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- Dave Fashimpaur, *BP*
- Samer Adham, *ConocoPhillips*
- Todd Ririe, *BP*
- Yasser Kattan, *Saudi Aramco*

### Legal Counsel

- F. Joseph Gormley, *Gormley Jarashow Bowman*

June 2016

► [Learn more at perf.org](http://perf.org)

## PERF Overview

The **Petroleum Environmental Research Forum (PERF)** is a research and development joint venture, formed to provide a stimulus to and forum for the collection, exchange, and analysis of research information relating to the development of technology for health, environment & safety, waste reduction and system security in the petroleum industry. PERF is a non-profit organization of Members which are corporations engaged in the petroleum industry that recognize the importance of a clean, healthy environment and are committed to support cooperative research and development. PERF does not itself participate in research projects but provides a forum for Members to collect, exchange, and research information relating to practical and theoretical science and technology concerning the petroleum industry and a mechanism to establish joint research projects in the field.

## Board Announcement

Currently, the PERF Board of Directors has a single vacancy. Under the PERF charter, only full member companies can offer Board of Directors members. Presently, the companies with Board representation are BP, Chevron, ConocoPhillips, ExxonMobil, Phillips 66, Saudi Aramco, Shell and Total. At the fall meeting, elections for Board representation will be held, and slate of nominations will be prepared and made available for review in late August. However, we will also be accepting nominations from the floor during the meeting. Any eligible company is welcome to submit a nomination now (send to Bruce Randolph at [bruce.b.randolph@p66.com](mailto:bruce.b.randolph@p66.com)) or at the Fall Meeting.



## Announcing the 94<sup>th</sup> PERF Meeting



**Phillips 66** will host the **94<sup>th</sup> PERF Fall Meeting** November 9 & 10 at their R&D headquarters in **Bartlesville, OK**. The agenda is still under development but following topics are under consideration to be covered in both **Water** and **Air** areas :

- Future changes to National Ambient Air Quality Standards and their impacts on operations
- Techniques for measuring and estimating emission sources
- Implementation challenges for the new ozone standard
- Air quality model development, application and evaluation
- Emission factors and inventories
- Techniques for emission reduction
- Water use efficiency
- Novel advances in water treatment technology
- Nutrient removal for refinery wastewater streams
- Emerging bioaccumulation models for toxic compounds in water
- Effects of injection wells on seismicity
- Implications of the EPA's petroleum effluent limit guidelines study

More details coming soon !





**Member Companies**

- BP
- Chevron
- ConocoPhillips
- ExxonMobil
- Hess Corporation
- Petrobras
- Phillips66
- Qatar Petroleum
- Repsol
- Saudi Aramco Oil Company
- Shell
- Statoil
- Suncor
- Syncrude Canada Ltd
- Total
- Tullow

**Associate Members**

- AECOM
- CH2MHill
- DNV GL
- Degremont LTD, Poseidon Water Treatment Division
- GeoSyntec
- Nalco Champion
- Ramboll Environ
- Test America
- Tetra Tech
- Trihydro
- Veolia Water

**External Group Liaisons**

- American Petroleum Institute
- Argonne National Laboratory
- Battelle
- Centre of Documentation, Research and Experimentation
- U.S. Department of Energy
- Electric Power Research Institute
- Energy & Environmental Research Center
- Houston Advanced Research Center
- Lawrence Berkeley National Laboratory
- International Association of Oil and Gas Producers
- Oak Ridge National Laboratory
- Pacific Northwest National Laboratory
- RTI International
- UK Astronomy Technology Centre
- Flemish Institute of Science and Technology
- SINTEF
- Water Environmental Research Foundation
- World Ocean Council

**Highlights from the 93<sup>rd</sup> PERF Meeting**



**“From Strategy to Action: What New Air Emissions Policies Mean for the Oil and Gas Industry”**

On **May 4<sup>th</sup> and 5<sup>th</sup> 2016**, **Chevron** hosted the 93<sup>rd</sup> PERF Meeting in **London, UK**. The general theme of the meeting was **“From Strategy to Action: What New Air Emissions Policies Mean for Oil & Gas Industry”**.

The objective of the meeting was to identify implications of recent Paris COP 21 agreements on the O&G industry and to analyze how EU Industrial Emissions Directive and the US Refinery Sector Rule will influence activities. More than 50 people attended the meeting.

The complete agenda and the presentations are available in the PERF website members’ area [www.perf.org/membersarea.html](http://www.perf.org/membersarea.html).

The meeting began with a presentation from IEA which expressed a favorable view on COP 21 and identified the main implications for the Oil & Gas industry. Following speakers addressed consequences of the Paris agreement on fossil fuels activities considering IPIECA’s “Five Pieces of the Paris Puzzle” as a guideline:

- Meeting Energy Needs : UN shared COP 21 outcomes related to technology development and transfer
- Effective Policy : IETA presented an overview of EU Emissions Trading System (ETS) and the future steps of Emissions Trading in Europe following Paris agreement
- Natural Gas : if NG plays a pivotal role in a shift towards a low-carbon economy, NG and methane monitoring are issues currently assessed (ReFINE, NPL presentations)
- Managing Emissions : improving energy efficiency is key to reduce GHG emissions
- Carbon Capture & Storage (CCS) : Global CCS Institute analyses indicate CCS will be required to meet climate targets, and Shell shared its competencies and projects progressing CCS globally.

On day two, the meeting covered other new policies and rules besides Paris COP 21, such as EU refinery BREFs and Industrial Emissions Directives, as well as a review of the US Refinery Sector Rule. The last presentation by Amec Foster Wheeler on Circular Economy was the opportunity to raise the possibility of recycling or reusing materials used in O&G industry after decommissioning.

The meeting ended on 2 PERF proposals made by Chevron:

- Potential Workshop : “ Ambient Air Sensor”
- Potential Project : “State of Science / Technology / Risk Assessment for Carbon Capture”

[Final agenda](#) is available.



Board Meeting, London, May 3<sup>rd</sup> 2016





### Highlights from the PERF Life Cycle Analysis Workshop



#### “Life Cycle Analysis approach applied to the oil and gas industry”

The last PERF workshop was held **November 17<sup>th</sup> & 18<sup>th</sup> 2015** and was hosted by **Total** with **CIRAIG** (International Reference Center for the Life Cycle of Products, Processes and Services) on the campus of **Polytechnique Montréal**, Canada. Around 13 people participated in this workshop focused on **Life Cycle Analysis approach applied to the oil and gas industry**. Aramco Services, Chevron, Exxon Mobil, Phillips 66, Ramboll Environ, Shell, Total and TriHydro were represented. The workshop was also attended by a number of CIRAIG researchers and analysts.

A total of 18 presentations were given over the 2-day meeting. They are posted in the PERF website members’ area at [www.perf.org/membersarea.html](http://www.perf.org/membersarea.html). The positive interaction between attendees was favorable to discussions and resulted in 4 PERF project proposals. [Final agenda](#) is downloadable.



LCA Workshop, Montreal, November 18<sup>th</sup> 2016



### Highlights from the 92<sup>nd</sup> PERF Meeting



#### “Environmental Issues Associated with Unconventional Oil and Gas”

The **92<sup>nd</sup> PERF meeting** was held **October 6 & 7<sup>th</sup>** and was hosted by the Energy & Environmental Research Center (**EERC**) at their facility on the campus of the University of North Dakota in **Grand Forks**. The theme of the meeting was “**Environmental Issues Associated with Unconventional Oil and Gas**”. There were 43 people registered for the meeting which was also hosted by EERC eleven years ago. The agenda and presentations are posted in the PERF website members’ area at: [www.perf.org/membersarea.html](http://www.perf.org/membersarea.html) which also includes the topics for the three new PERF project proposals that were presented at this meeting.

On day one, the meeting covered a wide array of topics related to unconventional oil and gas. Highlights include an overview of EERC activities and capabilities, sustainable shale development, water treating, environmental hazards and assessments, a look at future energy needs, and a detailed discussion of regulatory challenges and their resolution status.

For day two there was an increased focus on topics related to the Bakken resource in North Dakota (which also have applications for other shale basins). Topics included tight oil characterization, with a focus on crude by rail, vapor pressure and associated work by Sandia National Labs on flammability tests; Bakken water use, trends and future demand; results from laboratory scale work using ethane/CO2 mixtures as EOR fluids; and the efforts the North Dakota Petroleum Council have championed for engaging various stakeholders in the oil & gas exploration and production arena.

The Bakken is the largest oil field by area in the world (24,000 square miles) and development of this field has propelled North Dakota to currently being the second highest oil producing state in the United States. The challenges faced by the rapid development of this oil field have presented a number of environmental challenges that have been the focus of much of the research that was presented on day two.

[Final agenda](#) is available.



### Update on the Upstream Water Discussion Group

The Upstream Water Discussion Group continues to meet quarterly to discuss and advance upstream water projects. The Discussion Group works on project proposals with the identified opportunity to lower the cost of produced water management while managing risks of reuse and/or disposal to the environment. These proposals are part of a Produced Water Program shaping plan that includes four project themes around understanding produced water, potential impact / risk assessment, treatment technology and communication.

At the last conference call in April, the Discussion Group decided to refresh its shaping plan and will be brainstorming ideas for identifying potential opportunities for leveraging research being conducted outside oil and gas, such as government agencies and national laboratories.

Oil companies represented in the Discussion Group include Aramco, BP, Chevron, ConocoPhillips, ExxonMobil, Hess, Petrobras, Shell and Total. For more information on the Upstream Water Discussion Group, or if you would like to participate in ongoing discussions to develop upstream water projects, please contact Lily Baldwin at [lilysbaldwin@chevron.com](mailto:lilysbaldwin@chevron.com)

### Completed Projects

#### ↘ Flare Destruction Efficiency Estimation and Operating Practices Ref. 2011-07

<b>Leading Company</b>	ExxonMobil	<b>Starting date</b>	February 2014
<b>Project type</b>	Sharing + Funded	<b>Duration</b>	12 months
<b>Participating Companies</b>	BP	<b>Final report</b>	October 2014 for Phase 1, August 2015 for Phase 2.
	Chevron Suncor Energy Total	<b>For more information, please contact</b>	Duane R. McGregor <a href="mailto:Duane.R.McGregor@ExxonMobil.com">Duane.R.McGregor@ExxonMobil.com</a>

**Brief Description:** The objectives of this project were to evaluate existing flare configuration, operating, and combustion/destruction efficiency data, and from that data, develop options for estimating efficiency and flare emissions based upon known operating parameters. The project had two Phases. Phase 1 surveyed industry on flare types, flare operations, and flare efficiency data to develop a database for assessing gaps in flare configuration relative to available combustion efficiency data. The second phase analyzed existing efficiency data to understand if flare efficiency varies with flare type/operation, and used the efficiency data to develop methodologies for estimating flare emissions for lightly to fully instrumented flares.

**Focus:** Upstream + Downstream

#### ↘ Stranded Wastes and Recyclables in Developing Countries Ref. 2012-02

<b>Leading Company</b>	Chevron	<b>Starting date</b>	May 2013
<b>Project type</b>	Sharing + Funded	<b>Duration</b>	34 months
<b>Participating Companies</b>	BP	<b>Final report</b>	January 2015
	Hess Repsol Shell Saudi Aramco ExxonMobil Total	<b>For more information, please contact</b>	Amy Gropp <a href="mailto:Amy.Gropp@chevron.com">Amy.Gropp@chevron.com</a>

**Brief Description:** The purpose of the PERF Stranded Wastes project is to share and develop ideas and methods for waste minimization, treatment, reuse, and recycling for international locations where issues, such as the lack of infrastructure or technology, are barriers to many traditional methods. Other issues included in the scope of the Stranded Wastes proposal include: remote location, limitations from government or regulations, lack of customers/suppliers/end users for materials, no or poor quality third-party waste management or recycling facilities, or lack of advanced technical/operational skills. The phase 1 "sharing" is completed. The phase 2 "joint funded" for a consultant began in March 2014, and resulted in a final summary report in January 2015. Phase 3 scoping began in February 2015 and extended through February 2016 and resulted in the decision not to continue the project.

**Focus:** Upstream



Cost Effective Reverse Osmosis Concentrate/Brine Management

Ref. 2012-04

<b>Leading Company</b>	ConocoPhillips	<b>Starting date</b>	February 2014
<b>Project type</b>	Sharing + Funded	<b>Duration</b>	15 months
<b>Participating Companies</b>	BP	<b>Final report</b>	September 2015
	Chevron Saudi Aramco Total	<b>For more information, please contact</b>	Samer Adham <a href="mailto:samer.adham@conocophillips.com">samer.adham@conocophillips.com</a>

**Brief Description:** The overall goal of this project was to identify technically, economically and environmentally viable methods for managing the concentrated brine produced by reverse osmosis units used in oil & gas operations. Technologies were ranked based on their technical suitability, cost-effectiveness and environmental impact in various applications. For those technologies deemed most promising, life cycle cost analyses was developed. The final report was shared with all participating organization.

**Focus:** Upstream + Downstream

Active Projects

Refinery Stream Speciation Update

Ref. 2013-07

<b>Leading Company</b>	ExxonMobil	<b>Starting Date</b>	December 2014 for Phase 1
<b>Project type</b>	Sharing + Funded	<b>Duration</b>	12 months +
<b>Participating Companies</b>	BP	<b>Final report expected in</b>	4Q2016 for Phase 2
	Chevron Phillips 66 Shell	<b>For more information, please contact</b>	Yun Yang <a href="mailto:yun.yang@ExxonMobil.com">yun.yang@ExxonMobil.com</a>

**Brief Description:** : The PERF Stream Speciation database, developed over 15 years ago, may be used to estimate air toxics emissions from tanks, fugitives, loading, and other emission sources. The objective of the program is to verify whether changes in refinery feeds, operating conditions and product slates warrant updating the existing PERF report, and revise the speciation data, if necessary, using currently available company data. The project is planned in two phases. Phase 1 assessed incentives/data availability (completed 4Q 2015), and Phase 2 will update the PERF stream speciation (on going).

**Focus:** Downstream

Pressure Relief Valve (PRV) Stability Research Program

Ref. 2013-10

<b>Leading Company</b>	ExxonMobil	<b>Starting Date</b>	November 2014
<b>Project type</b>	Sharing + Funded	<b>Duration</b>	12 months +
<b>Participating Companies</b>	Bayer MaterialScience	Phillips 66	<b>Final report expected in</b>
	BP	Shell	
<b>Participating Companies</b>	Chevron	Siemens Energy	<b>For more information, please contact</b>
	EMRE	Smith & Burgess	
	Flint Hills Resources	Dow Chemical	
	LyondellBasell	Valero Energy	
	Marathon Petroleum		
			Clark Shepard <a href="mailto:clark.d.shepard@exxonmobil.com">clark.d.shepard@exxonmobil.com</a>

**Brief Description:** The objective of this project is to determine the engineering factors that lead to stable Pressure Relief Device Operation to provide more solid engineering and scientific basis for the guidance in API STD 520 Part II, and to provide guidance to the refining and petrochemical industry on the installation of pressure relief devices to prevent chatter that could lead to a loss of containment. This study is a continuation of a previous PERF Study (99-05) which was extended several times with additional funding for more scope and completed in 2011.

**Focus:** Downstream



➤ **Assessment of Commercial Airborne Methane Remote Sensing Capabilities**

**Ref. 2014-06**

<b>Leading Company</b>	Chevron	<b>Starting Date</b>	November 2016
<b>Project type</b>	Funded	<b>Duration</b>	Phase 1 – 12 months
<b>Participating Companies</b>	ExxonMobil	<b>Final report expected in</b>	Phase 1 Report – September 2016
		<b>For more information, please contact</b>	Andrea Steffke <a href="mailto:Andrea.steffke@chevron.com">Andrea.steffke@chevron.com</a>

**Brief Description:** There are Health, Environmental, and Safety (HES) and cost implications of fugitive methane emissions from oil and gas (O&G) industry activities. Estimates of fugitive methane emissions from the natural gas supply chain have ranged from 2-9% of produced volume. Various members of the O&G industry have invested Research and Development (R&D) effort focused on methane identification and quantification using remote sensing with research-grade instrumentation. However, there is a gap in knowledge concerning capabilities of currently available commercial airborne instruments designed specifically for leak detection. The goal of this project is to perform a review and assessment of the capabilities of currently available commercial airborne remote sensing systems for fugitive methane emissions detection and mapping.

**Focus:** Upstream

➤ **Direct Monitoring of Flare Combustion Efficiency**

**Ref. 2014-10**

<b>Leading Company</b>	ExxonMobil	<b>Starting Date</b>	4Q2015
<b>Project type</b>	Funded	<b>Duration</b>	12 months +
<b>Participating Companies</b>	Chevron USA Chevron Phillips Chemical Co Eastman Chemical EMRE Phillips 66 Saudi Aramco	<b>Final report expected in</b>	2Q2017
		<b>For more information, please contact</b>	Talar Varjabedyan <a href="mailto:talar.varjabedyan@exxonmobil.com">talar.varjabedyan@exxonmobil.com</a>

**Brief Description:** The objective of this project is to evaluate technologies that can directly and remotely measure flare combustion efficiency. The project will conduct field tests of remote monitoring technologies, some of which are capable of direct and continuous measurement in real-time, comparing the results to extractive ground truth data. The goal is to improve the accuracy and cost of monitoring flare performance and emissions using direct real-time methods over existing indirect approaches. The impact of the program is expected to be global, as requirements for flare monitoring are considered outside the U.S.

**Focus:** Upstream + Downstream

**Project Proposals**

➤ **Explore and Evaluate Potential Produced Water Reuse for Irrigation**

**Ref. 2014-09**

<b>Leading Company</b>	Total	<b>Proposal Date</b>	November 2014
<b>Project type</b>	Sharing + Funded	<b>For more information, please contact</b>	Monica Burgos-Egido <a href="mailto:monica.burgos@total.com">monica.burgos@total.com</a>

**Brief Description:** Produced water is currently handled as a waste product whereas, if managed as a resource, it has the potential to be used beneficially. Reuse for irrigation is a suitable alternative especially in water-scarce regions, with limited freshwater resources. The objective of this project is to understand the barriers for beneficial reuse (social, regulatory, water quality treatment objectives) to draw lessons from past experiences and to identify what solutions can be implemented. Values of this project are to 1) propose alternative water resources at a minimal cost, 2) grow plants or trees as a new resource for the region, 3) minimize the cost of reinjection.

The project could be split in 3 phases :

- Phase 1: Sharing company experiences on what has been done in the field of produced water reuse for irrigation
- Phase 2: If opportunities are identified, collaborative research or joint funding for a consultant or research organization.
- Phase 3: Defining a conceptual study for implementation of an irrigation pilot and potential construction of the pilot.

**Focus:** Upstream



➤ **Impacts of Processing Tight Oils on Refinery WWTP Operations**

**Ref. 2014-12**

<b>Leading Company</b>	ExxonMobil	<b>Proposal Date</b>	November 2014
<b>Project type</b>	Sharing+ Funded	<b>For more information, please contact</b>	Ronald Vaughan <a href="mailto:ronald.l.vaughan@exxonmobil.com">ronald.l.vaughan@exxonmobil.com</a>

**Brief Description:** With opportunities to bring in unconventional crudes as refinery feedstock, there is a need to better understand the impacts on refining WWTP operations. Potential issues could arise in both primary treatment (emulsion formation) and secondary treatment (damaging for biomass, increased conventional pollutant loading). The objective of this project is to study experiences and issues observed with WWTP operations that were associated with processing unconventional crudes. Minimizing upsets and disruptions to the WWTP will lead to improved WWTP operations and compliance.

**Focus:** Upstream + Downstream

➤ **Critical Evaluation of NSZD Rate Variability**

**Ref. 2014-13**

<b>Leading Company</b>	ExxonMobil	<b>Proposal Date</b>	September 2014
<b>Project type</b>	Sharing + Funded	<b>For more information, please contact</b>	Harley Hopkins <a href="mailto:harley.hopkins@exxonmobil.com">harley.hopkins@exxonmobil.com</a>

**Brief Description:** Natural Source Zone Depletion (NSZD) describes the contaminant mass loss and transformation from subsurface LNAPL source areas, under ambient conditions. Quantifications of NSZD provides a basis to : 1) Understand the current contribution towards site cleanup by unassisted biological and physical losses, 2) Estimate long term natural attenuation cleanup times and 3) assess the incremental value of any engineered remedial options under consideration at a site.

The objectives of this project are to identify the sources of variability within and between the available NSZD datasets that may account for the differences provided y different NSZD measurement techniques (e.g., CO2 traps, flux chambers, gradient based, thermal flux) and to leverage the findings to improve NSZD measurement technologies, SOPs and field data collection strategies. A draft agreement is currently circulating among likely participants.

**Focus:** Upstream + Downstream

➤ **Alternative Lab Techniques for Toxicology Assessment**

**Ref. 2014-15**

<b>Leading Company</b>	BP	<b>Proposal Date</b>	November 2014
<b>Project type</b>	Sharing	<b>For more information, please contact</b>	Oliver Pelz <a href="mailto:oliver.pelz@bp.com">oliver.pelz@bp.com</a> Dan Touzel <a href="mailto:touzeldf@bp.com">touzeldf@bp.com</a>

**Brief Description:** BP and Sintef have developed an alternative laboratory methodology for the determination of persistence of compounds with low solubility. The main results were published in 2016 under the reference : Chemosphere 2016 May 10;156:191-194. The method was developed to improve risk assessment of upstream produced water discharges and initially tested with alkylated phenols but has potential applicability to downstream discharges. Further research is required to establish the methodology and to communicate the findings to relevant regulatory bodies.

**Focus:** Upstream + Downstream

➤ **Polycyclic Aromatic Hydrocarbons Issues**

**Ref. 2015-01**

<b>Leading Company</b>	ExxonMobil	<b>Proposal Date</b>	December 2015
<b>Project type</b>	Shared + Funded	<b>For more information, please contact</b>	Ganesh Ghurye <a href="mailto:Ganesh.l.ghurye@exxonmobil.com">Ganesh.l.ghurye@exxonmobil.com</a>

**Brief Description:** Polycyclic aromatic hydrocarbons (PAHs) are a group of semi-volatile organic compounds that are listed as priority pollutants by the US EPA and the EU, and better understanding their presence and concentration in refinery discharges is of continuing importance to the Oil & Gas industry. The project's objectives are to better characterize the concentration of PAHs in discharges, to evaluate the adequacy of current analytical methods to provide meaningful concentration information about them, and to understand and evaluate current and emerging technologies for their removal from wastewaters.

**Focus:** Downstream



➤ **Use of Mechanical Dispersants**

**Ref. 2015-02**

<b>Leading Company</b>	BP	<b>Proposal Date</b>	April 2015
<b>Project type</b>	Sharing	<b>For more information, please contact</b>	Dan Touzel <a href="mailto:touzeldf@bp.com">touzeldf@bp.com</a>

**Brief Description:** The size distribution of oil droplets formed in subsea oil and gas blowouts is known to have strong impact on their subsequent fate in the environment. Fine droplets are frequently neutrally buoyant and within the full body of water they are available for biodegradation. Subsea Dispersion Injection SSDI is an integral part of achieving this goal, lowering the interfacial tension between the oil and water. However, despite their many advantages, the use of SSDI are limited both by the logistical constraints of deployment and legislative restrictions over its use. Adding to the toolkit of methods that achieve subsea dispersion without the use of chemicals would therefore enhance oil spill response capability. There are other ways of reducing the effects of interfacial tension within the oil such as increasing the interfacial shear by introducing more turbulence within the rising oil plume. Further research is required to explore this potential new technology, through a combination of CFD modeling and laboratory experiments.

BP in partnership with Sintef has explored alternative methods for dispersion oil subsea and the initial results are now published : SPE-179331-MS Subsea Mechanical Dispersion, Adding to the Toolkit of Oil Spill Response Technology

**Focus:** Upstream

➤ **Shale Gas : Subsurface Environmental Risks**

**Ref. 2015-05**

<b>Leading Company</b>	Total	<b>Proposal Date</b>	October 2015
<b>Project type</b>	Sharing+ Funded	<b>For more information, please contact</b>	Kirsty Speirs <a href="mailto:kirsty.speirs@total.com">kirsty.speirs@total.com</a>

**Brief Description:** Shale gas and fracking activities generate debate, especially over potential environmental and health impacts linked to groundwater contamination, GHG emission release, induced seismicity and local community impacts to name a few. As a result there can quite often be some conflict between scientific fact and public perception. This project consists of the development of a tool or a methodology which uses site specific characteristics and evaluation of existing research in order to fully identify subsurface risk factors, determine the risk severity of each factor and of each corresponding scenario. It is expected to be a short term project with global applicability. This proposal is currently on hold.

**Focus:** Upstream

➤ **Onshore Unconventional High TDS Produced Water Treatment**

**Ref. 2015-06**

<b>Leading Company</b>	Chevron	<b>Proposal Date</b>	October 2015
<b>Project type</b>	Sharing + Funded	<b>For more information, please contact</b>	Bhavana Karnik <a href="mailto:bhavanakarnik@chevron.com">bhavanakarnik@chevron.com</a>

**Brief Description:** Alternatives to deep underground injection for PW disposal are important for the industry. The objective of this project is to share company experiences, challenges, or barriers with onshore unconventional high total dissolved solids (TDS) produced water treatment (greater than 50,000 mg/L). The project will investigate and assess cost-effective, reliable, and sustainable technology alternatives for high-TDS produced water disposition.

The project will be executed in three phases :

- *Phase 1:* Sharing company experiences and challenges with onshore high TDS PW treatment
- *Phase 2:* If opportunities are identified, engage a technical consultant to conduct comprehensive analysis for technology landscape and technology development areas
- *Phase 3:* If opportunities are identified, collaborative research or joint funding for a technology partner or research organization

**Focus:** Upstream