

Environmentally Friendly Drilling Systems Program

*Balancing
Environmental Tradeoffs*



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**US Department of Energy
Secretary of Energy Advisory Board
Natural Gas Subcommittee**

June 28, 2011

Items to Discuss

1. The Environmentally Friendly Drilling Systems (EFD) Program

- Incentives and Objectives
- Background
 - How did it start
 - who are the players
 - Funding
- Issues being addressed
- Outreach and Technology Transfer

2. Complementary Programs

3. The EFD Scorecard

- Measuring Processes
- Development of the Scorecard
- Comparison of Processes
- Status

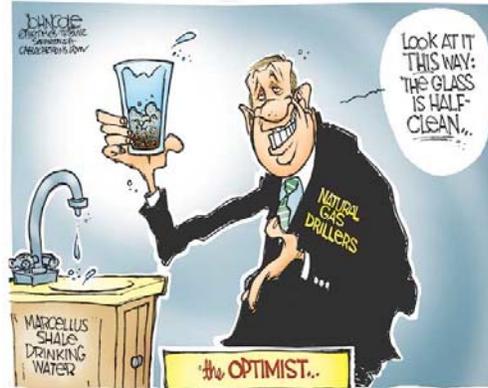


Opposition to O&G Activities

**NO DRILLING!
NO COMPROMISE!**

The land and water cannot depend on the hollow promises of politicians and corporations. Over and over, regulations and fail to protect the land and water that gives us life. Counting on the government to protect us is no safer than counting on the oil and gas companies to drill safely. That's why we started Finger Lakes Earth First! To make space in the gas drilling debate for those of us that are ready to take action to defend our home.

www.FingerLakesEarthFirst.org



EFD Program Overview

Focus on technologies for **environmentally sensitive development** of **energy sources** that can be used to maintain our standard of living and preserve our quality of life.

The objective is to **identify**, **develop** and **transfer** critical, **cost effective**, new technologies that can provide policy makers and industry with the ability to develop reserves in a **safe** and **environmentally friendly** manner.

***What gets measured, gets done.
What gets identified, gets dealt with.
What gets expected, gets respected.***



EFD Program History

- Formed Team in 2005 (6 years)
- Texas A&M University took lead to obtain U.S. Department of Energy Funding
- Formed Joint Industry Partnership to guide and co-fund program
- Engaged Environmental Organizations
- Phase 2 led by HARC with RPSEA funding
- Formed University/National Lab Alliance
- Initiated EFD-EU



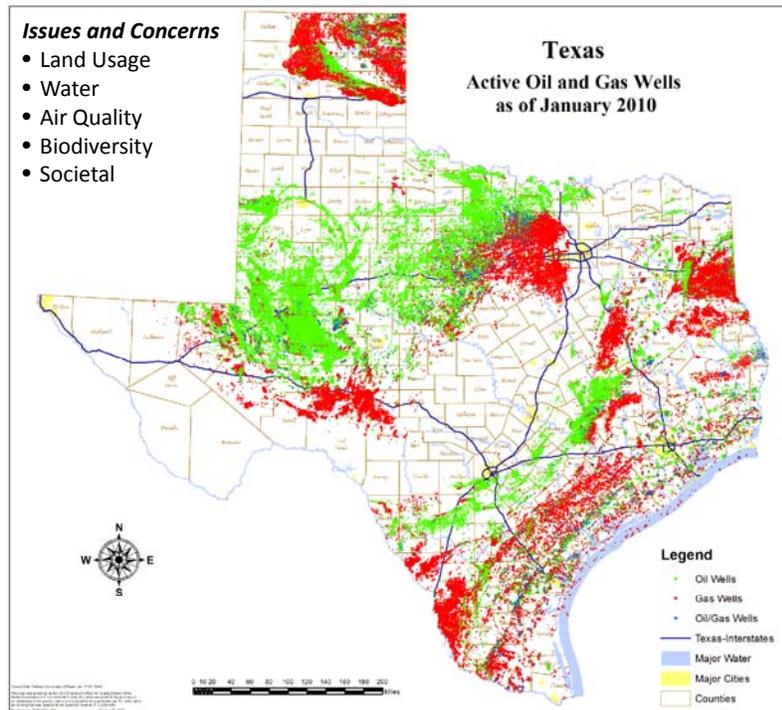
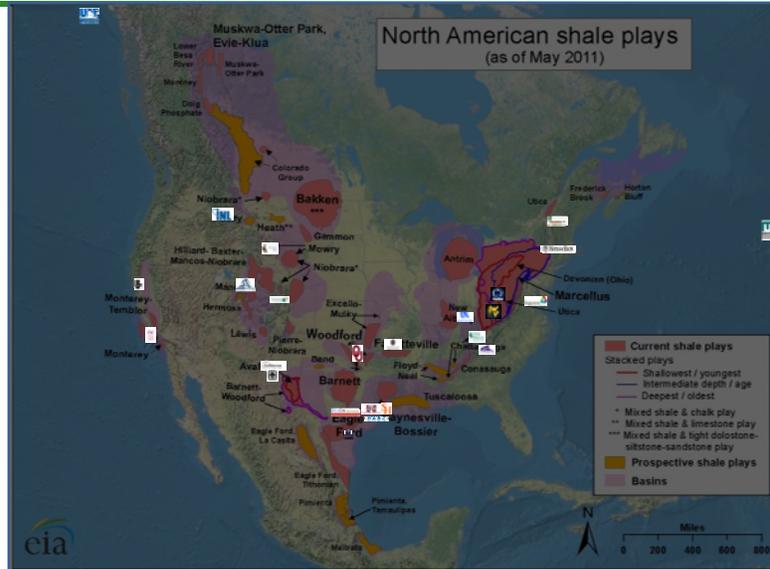
The EFD Team

Co-funded by RPSEA, BOEMRE, Industry, Environmental Organizations

<p>SPONSORS</p>	<p>MANAGEMENT TEAM</p>	<p>ENVIRONMENTAL ORGANIZATIONS</p>
		<p>COLLABORATORS</p>
	<p>ALLIANCE MEMBERS</p>	



EFD Alliance responding to local issues





Program Highlights



Sponsor Directed Projects

Dope-Free Connection Case Study



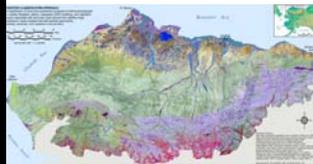
Study the effectiveness of the state-of-the-art and dope-free pipe connection technology, including regulatory issues and a field study.

Energy Production and the Attwater's Prairie Chicken



Investigate the effects of gas production operations on the Attwater's Prairie Chicken.

Ecosystem and Biodiversity Measurement and Assessment



Develop tools for adaptive ecosystem management to assist integrated management of land, water and living resources that promotes conservation and sustainable use.



Outreach and Technology Transfer



From time of RPSEA Award:

25+ Publications/Articles

50+ Presentations

14+ Workshops

4+ Exhibits



Complementary Programs

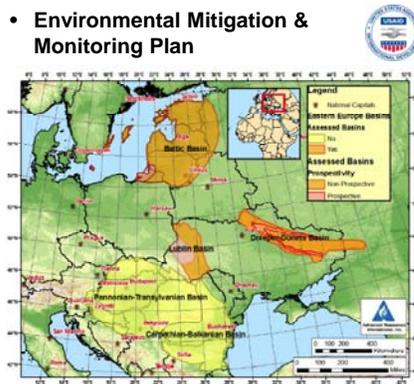
Coastal Impacts Technology Program (CITP)

- Technology Road Mapping
- Environmental Impact Mitigation
- Inter-State Collaboration
- Workforce Development



Environmental Assessment for Shale Gas Development in Ukraine

- Environmental Scoping Statement
- Special Studies
- Environmental Assessment
- Environmental Mitigation & Monitoring Plan





What Will it Take to Do Better?



Making Environmental Stewardship a Core Value

Oil and Gas Sector Report Card

Produced by IPIECA and OGP
for the UNEP Report 'Advancing Progress: Industry as a partner for sustainable development'



SPE 126616

Environmental Performance in the E&P Industry: Data for 2007 and 2008
A.J. Findlay and W.M. Poore, International Association of Oil and Gas Producers, London

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This paper was prepared for presentation at the SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production held in Rio de Janeiro, Brazil, 12-14 April 2010.
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Scorecard Concepts

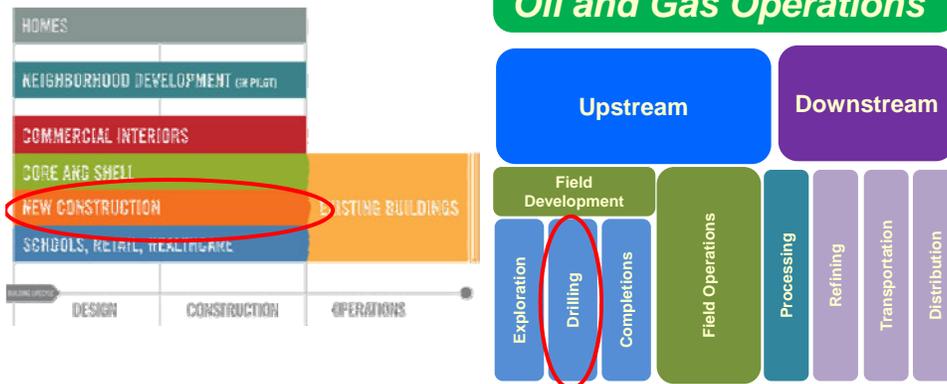


Blg. 27 Astronaut Quarantine Facility
LEED® Project # 1486
LEED Version 2 Certification Level: CERTIFIED
2/24/2006

Points Achieved	Possible Points	Possible Points	Possible Points
52	69	13	15
Sustainable Sites		Materials & Resources	
10	14	13	13
Water Efficiency		Indoor Environmental Quality	
5	5	15	15
Energy & Atmosphere		LEED Accredited Professional	
17	17	1	1

Focus Scorecard on Operation

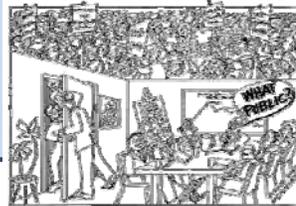
Concept – USGBC LEED Program



Stakeholder Engagement is Important!

Stakeholders are all those who are affected, interested in or have the capacity to influence a project.

Academia	Environmental Organizations	Industry	State/Federal Agencies
<ul style="list-style-type: none"> Texas A&M University College Station Texas A&M University Kingsville University of New Hampshire UT Medical Center Mississippi State University Sam Houston State University of South Alabama John Hopkins University University of Arizona University of Texas University of Houston 	<ul style="list-style-type: none"> Natural Resources Defense Council Environmental Defense Fund The Nature Conservancy Conservation International Mercer Arboretum Bureau of Applied Anthropology/Arizona Clinton Climate Initiative Rocky Mountain Clean Air McFaddin Ranch 	<ul style="list-style-type: none"> API Ballard Exploration BP Shell Chevron StatoilHydro ConocoPhillips Devon King Exploration Halliburton Huisman National Oil Well – Varco MI Swaco TerraPlatform T. Baker Smith Weatherford Derrick Equipment Composite Mats Ecology and Environmental Inc. PTTC IADC 	<ul style="list-style-type: none"> US Department of Energy Bureau of Land Management US Park Service Texas Railroad Commission Texas General Land Office Texas Dept. of Agriculture Texas Dept. of Transportation US Minerals Management Services Texas Parks & Wildlife Texas Water Board Texas Commission on Env. Quality US Environmental Protection Agency US Fish and Wildlife Argonne National Laboratory Big Thicket Preserve Idaho National Laboratory



Source: Connor Development Services Ltd



Tradeoff Scorecard Development

EFD Facts		
Project:		
Location:		
Ecosystem:		
	Max	Score
AIR	10	0
WATER	15	0
SITE	15	0
WASTE MANAGEMENT	20	0
BIODIVERSITY/HABITAT	20	0
SOCIETAL	20	0
	100	0 EFD

Environmentally Friendly Drilling Scorecard

Points Achieved: 0/100 (0 stars)

Points Possible: 100 (5 stars)

Category	Points Possible	Points Achieved
Phase 1	15	0
Phase 2	15	0
Phase 3	15	0
Phase 4	15	0
Phase 5	15	0

Project: _____

Location: _____

Ecosystem: Semi-Arid

Date: _____

Category	Points Possible	Points Achieved
Phase 1	15	0
Phase 2	15	0
Phase 3	15	0
Phase 4	15	0
Phase 5	15	0

EFD Facts

Project: _____

Location: _____

Ecosystem: _____

Category	Max	Score
AIR	10	0
WATER	15	0
SITE	15	0
WASTE MANAGEMENT	20	0
BIODIVERSITY/HABITAT	20	0
SOCIETAL	20	0
	100	0 EFD

Comparison of IPIECA and EFD Scorecard Indicators

Note: the highlighted colors indicate potentially comparable indicators/data points

BLUE = air quality/GHG emissions

PURPLE = energy/power use

YELLOW = wildlife/plant life/biodiversity

GREEN = water

RED = waste

GREY = spill prevention

GOLD = community engagement

*Indicators not color-coded do not share a category with indicators in the other reporting system

IPIECA Indicators

Environmental Indicators	<ul style="list-style-type: none"> - Climate change and energy <ul style="list-style-type: none"> o Greenhouse gas (GHG) emissions o Energy use o Alternative energy sources o Flared gas - Ecosystem services <ul style="list-style-type: none"> o Biodiversity and ecosystem services o Fresh water - Local environmental impact <ul style="list-style-type: none"> o Other air emissions o Spills to the environment o Discharges to water o Waste
Health and safety indicators	<ul style="list-style-type: none"> - Workforce protection <ul style="list-style-type: none"> o Workforce participation o Workforce health o Occupational injury and illness incidents - Product health, safety and environmental risks <ul style="list-style-type: none"> o Product stewardship - Process safety and asset integrity <ul style="list-style-type: none"> o Process safety
Social and economic indicators	<ul style="list-style-type: none"> - Community and society <ul style="list-style-type: none"> o Local community impacts and engagement o Indigenous peoples o Involuntary resettlement o Social investment - Local content <ul style="list-style-type: none"> o Local content practices o Local hiring practices o Local procurement and supplier development - Human rights <ul style="list-style-type: none"> o Human rights due diligence o Human rights and suppliers o Security and human rights - Business ethics and transparency <ul style="list-style-type: none"> o Preventing corruption o Preventing corruption involving business partners o Transparency of payments to host governments o Public advocacy and lobbying - Labor practices <ul style="list-style-type: none"> o Workforce diversity and inclusion o Workforce engagement o Workforce training and development o Non-retaliation and grievance system

EFD Scorecard Indicators

<p>Air</p>	<ul style="list-style-type: none"> • Prerequisites <ul style="list-style-type: none"> ○ Regulatory compliance • Credits <ul style="list-style-type: none"> ○ Contractual obligations for logistics <ul style="list-style-type: none"> ▪ 1 point: require all contractors and subcontractors associated with any logistical support or well site operations to use retrofit technology on all on-road vehicles that have Tier I or lower engines ▪ 1 point: require all contractors and subcontractors associated with any logistical support to use clean Tier II (or higher) engines for on-road vehicles ○ Site emissions <ul style="list-style-type: none"> ▪ 1 point: use clean Tier III/Type III engines for all non-road vehicles or ensuring application of retrofit technology to non-road vehicles that are Tier II or lower ▪ 1 point: use Tier IV engines for all applications ○ Dust suppression <ul style="list-style-type: none"> ▪ 2 points: submit a dust suppression plan and implementing/documenting the plan ○ Clean power <ul style="list-style-type: none"> ▪ 1 point: use tier IV diesel engines or natural gas from the field to power electric motors to run the drill rig ▪ 1 point: connect the drill rig to the electric grid ▪ 1 point: connect the drill rig to the electric grid and certify that the electricity is generated by solar or wind ○ Green completions <ul style="list-style-type: none"> ▪ 1 point: submit and implement a plan to use green completion practices
<p>Water</p>	<ul style="list-style-type: none"> • Prerequisites <ul style="list-style-type: none"> ○ Develop and implement a stormwater management plan that prevents or mitigates discharge of stormwater runoff. Use acceptable best management practices to reduce sources of contaminants from stormwater runoff. ○ Integrity testing of surface casing • Credits <ul style="list-style-type: none"> ○ Water cycle management plan <ul style="list-style-type: none"> ▪ 3 points: develop and implement a water management plan ▪ 2 points: develop and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and storm water categories ▪ 2 points: identify opportunities and implementing a program to prevent or reduce wastewater pollution through such measures as recycle/reuse within the development area ▪ 1 point: assess the possibility of treating wastewater discharges for reuse ▪ 1 point: perform baseline hydrology studies, mapping and hydrochemistry studies and documenting water quality in the nearby area prior to operations. ○ Setbacks from streams/sources <ul style="list-style-type: none"> ▪ 2 points: contact all stakeholders that have water wells, streams, wetlands, or other water sources within 1,000 feet of the proposed operation ▪ 1 point: contact all stakeholders within 500 feet of 5,000 feet downstream of the operation of any stream that is within 1,000 feet of the proposed operation ▪ 1 point: hold a stakeholder meeting to discuss the operation, any risk to the fresh water sources and all risk mitigation efforts that are planned ○ Mitigation measures to protect ground water <ul style="list-style-type: none"> ▪ 2 points: develop and implement a detailed monitoring program to ensure that mitigation measures are in place, functional and adequate ▪ 2 points: include monitoring the non-contact runoff to ensure contamination does not occur ○ Reduce water usage <ul style="list-style-type: none"> ▪ 1 point: develop and implement a water use efficiency program ▪ 1 point: develop and implement a process to reduce the use of hazardous materials that could increase water treatment requirements ○ Reuse of water/fluids <ul style="list-style-type: none"> ▪ 1 point: develop and implement a plan to use water/fluids from nonpotable sources that are located within 50 miles of the sites

<p>Site</p>	<ul style="list-style-type: none"> • Prerequisites <ul style="list-style-type: none"> ○ Regulatory compliance ○ Erosion and sedimentation control • Credits <ul style="list-style-type: none"> ○ Pre-existing site <ul style="list-style-type: none"> ▪ 2 points: fully evaluate the possibility of the reuse of an existing drill site, determine the financial impact on the drilling budget, and select/use a pre-existing drill site ○ Pad drilling <ul style="list-style-type: none"> ▪ 1 point: employ pad drilling to more than a single well from the drill site ▪ 1 point: have a minimum of eight wells on the drill site ○ Protect and restore habitat <ul style="list-style-type: none"> ▪ 1 point: perform a site survey to identify site elements and adopting a plan concerning use and restoration of the site ▪ 1 point: use a spill control system and mats to limit surface disturbance ○ Contractor guidelines <ul style="list-style-type: none"> ▪ 1 point: publish an illustrated document that provides contractors with information on how to reduce their environmental footprint related to the drill site ▪ 1 point: hold training sessions with all contractors to review the document and the strategies listed in the document. Provide supervision on-site to ensure implementation ○ Site restoration <ul style="list-style-type: none"> ▪ 1 point: reclaim the site to its original elevations using the stockpiled topsoil and replanting the entire area with native grasses or other vegetation as directed ▪ 1 point: use topography to hide structure locations and using low profile structures ○ Well design considerations <ul style="list-style-type: none"> ▪ 1 point: document how the environmental sensitivities were taken into consideration when developing the well design ▪ 1 point: review the reservoir development plan to maximize production from each well and minimize the number of wells that need to be drilled ○ Living quarters and people <ul style="list-style-type: none"> ▪ 2 points: develop and implement a recycling program to minimize household waste ○ Organic materials <ul style="list-style-type: none"> ▪ 1 point: harvest organic materials during site preparation, mulch organic materials to be used on-site during site restoration, and bury remaining organic materials ○ Preplan and production <ul style="list-style-type: none"> ▪ 2 points: pre-plan for production by including the layout of flowlines, planning for stock tanks and other production equipment during the well site preparation ○ Match site/access to topography <ul style="list-style-type: none"> ▪ 1 point: use, whenever possible, previously impacted terrain for access routes and build irregularly shaped drill pads to conform to natural topography ○ Logistics plan—offsite storage <ul style="list-style-type: none"> ▪ 1 point: develop and implement a logistics plan that considers a centralized location for storage of equipment and supplies for various frill pads ○ Planting of native vegetation <ul style="list-style-type: none"> ▪ 1 point: develop and implement a plan that includes planting of native vegetation at the appropriate time of year for the plants to become established
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<p>Waste management</p>	<ul style="list-style-type: none"> • Prerequisites <ul style="list-style-type: none"> ○ Waste management plan ○ Pit design pre-site assessment • Credits <ul style="list-style-type: none"> ○ Drilling fluid handling system <ul style="list-style-type: none"> ▪ 2 points: use cuttings management plan ▪ 2 points: use environmentally friendly drilling fluids ▪ 1 point: use a modified closed loop system by using additional drilling fluids handling equipment in addition to what is supplied by the rig ▪ 1 point: use a full closed loop system in addition to rig system that includes a cuttings dryer ○ Handling of rig wastes <ul style="list-style-type: none"> ▪ 2 points: use biodegradable lubricants and including a recycle/salvage plan for disposal ▪ 1 point: use environmentally friendly pipe dope for both drill pipe and casing ▪ 1 point: use an electric top drive system to minimize use of hydraulic fluids ▪ 1 point: maximize the use of bulk materials ○ Spill prevention system <ul style="list-style-type: none"> ▪ 1 point: to minimize the risk of any spillage, including drilling fluids, oil/fuel, lubricants, drip pans and other devices/systems should be used ▪ 1 point: ensure that all equipment installed on the site is designed so that any effluent is caught and not discharged directly into the environment ▪ 1 point: develop and implement plan for bioremediation of spills and use of landfarming ○ Cuttings reuse <ul style="list-style-type: none"> ▪ 3 points: develop and implement a drill cutting recovery and reuse plan ○ Cuttings reinjection <ul style="list-style-type: none"> ▪ 3 points: develop and implement a cuttings reinjection plan
<p>Biodiversity/habitat</p>	<ul style="list-style-type: none"> • Prerequisites <ul style="list-style-type: none"> ○ Species protection ○ Habitat protection/enhancement ○ Regulatory requirements • Credits <ul style="list-style-type: none"> ○ Restoration/interim reclamation <ul style="list-style-type: none"> ▪ 4 points: develop a well abandonment plan before the well is drilled to ensure that the plan is updated during the well's life whenever the well's configuration is changed ○ Reduction of surface disturbance <ul style="list-style-type: none"> ▪ 1 point: during construction and drilling, shuttle workers to site ▪ 1 point: establish centralized location for hydraulic fracturing and water delivery ▪ 1 point: install systems to enable remote monitoring ○ Erosion prevention <ul style="list-style-type: none"> ▪ 1 point: plan and install access roads to avoid erosion ▪ 1 point: armor roadway ditches and leadoff ditches with rock riprap ○ Voluntary offsite mitigation <ul style="list-style-type: none"> ▪ 1 point: establish and implement a plan that includes passive techniques that encourage biodiversity and ecosystem health ○ Invasive species prevention <ul style="list-style-type: none"> ▪ 1 point: perform three (3) of the following: site restoration, identify and establish no impact zones, clean equipment that is moved between sites to prevent transport of invasive species, ensure that materials (soils, mulch, etc.) brought in to site are certified to be invasive free, identify and remove invasive species on site ○ Reintroduction of species, habitat <ul style="list-style-type: none"> ▪ 1 point: ensure that a botanical expert is on-site when clearing vegetation occurs. The expert should develop a pre-disturbance species composition list. Then, a restoration/revegetation plan should be developed and implemented based on the pre-disturbance species composition list. Also, ensure that a wildlife expert is consulted and on-site, if necessary, when site construction activities occur. The expert should document various topographical and other features that are conducive to wildlife habitat(s). Then, a restoration plan should be developed and implemented that would encourage the return of native wildlife ○ Avoidance of high value areas <ul style="list-style-type: none"> ▪ 1 point: include input from on-site land manager(s) to preserve agricultural land when selecting locations for facilities ○ Wildlife and habitat: <ul style="list-style-type: none"> ▪ 1 point: Scout the sensitive areas and plan routes likely to cause least disruption, stay clear of wildlife areas marked on the planning map to avoid sensitive areas, ban hunting and fishing at all times, instruct crews not to intentionally harass or feed wildlife, ban pets on all crew facilities, report incidents and any significant problems with wildlife, train crews to identify wildlife ▪ 1 point: develop and implement a habitat mitigation plan that includes enhancements to the area that encourages biodiversity and improves wildlife mortality rates

Societal

- Prerequisites
 - Regulatory compliance
 - Communication plan (an agreement in writing from land managers and landowners concerning plans to construct new facilities. Also develop and implement a transparent process concerning making decisions about)
- Credits
 - Public outreach
 - 1 point: engage community early and often in discussions concerning energy development, reach a consensus with community leaders concerning location of facilities that may potentially be visible from public places, work with local law enforcement to develop and implement measures to reduce traffic safety hazards, engage local and regional officials to advise on health and safety concerns associated with operations
 - 1 point: develop and implement a logistics plan to transport all consumables for the project to and from the location in the least disruptive way and how to store and use them on location in the safest possible manner
 - 1 point: develop and implement a public interaction plan, including a communication process that keeps the public informed of planned activities and progress
 - Noise and lighting control
 - 1 point: work with community leaders to identify noise management guidelines
 - 1 point: minimize residual lighting effects
 - Training of local first responders
 - 1 point: develop and implement a plan to train local emergency medical service personnel on issues that may arise during operations
 - 1 point: provide support to local public health service providers that could address key public health issues
 - Air quality monitors
 - 1 point: install air quality monitors to ensure the following values are not exceeded: VOCs (including benzene): 20 milligrams per normal cubic meter, hydrogen sulfide: 30 milligrams per normal cubic meter, odor: not offensive at the receptor end
 - 1 point: provide website that has links to data from sensors
 - Emergency response plan
 - 2 points: develop and implement an Emergency Response Plan that goes beyond requirements and engages the community. The plan should be a set of scenario-based procedures to assist emergency responders during real life emergencies as well as training exercises. The plan should include an assessment of local support capabilities
 - Dispute resolution plan
 - 1 point: develop a dispute resolution plan that is agreed to with landowners. Include in the plan a process that would handle any dispute and agree on how the costs would be split among the affected parties
 - Surface use plan
 - 1 point: develop and implement a Surface Use Plan that ensures environmental expectations exceed regulatory requirements concerning exploration and production activities
 - 1 point: (1) organize and hold a workshop to inform all landowners and the surrounding community about the operational commitment to environmental stewardship and (2) routinely (suggested weekly, but at least monthly) inform landowners and community about environmental stewardship related to surface use. This may be done through a website, electronic newsletters, mailings, or other means
 - Unintended consequences program
 - 1 point: develop and implement a company policy that addresses unintended consequences that may arise during development. Communicate the company policy to all stakeholders. In addition, ensure that all stakeholders are aware of whom to contact if/when an issue arises

Summary

1. The Environmentally Friendly Drilling Systems (EFD) Program
 - Brings all stakeholders together
 - Broad program that takes a systems approach to issues
 - Strong, worldwide program

2. Complementary Programs
 - Coastal Impacts Technology Program
 - Ukraine efforts

3. The EFD Scorecard
 - Comprehensive review of operations
 - Consensus of stakeholders developed scorecard
 - Currently testing 'alpha prototype'



It's not so hard to be green



Questions?

www.efdsystems.org

www.facebook.com/EFDSystems

Thank you

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