

Health, Safety, and Environment



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Health, safety, and environment (HSE) considerations continue to be integral parts of all sectors of the oil and gas industry. The health and safety of the industry workforce as well as of residents in producing regions are of paramount importance to the continued viability of the industry. In a recent example of an international health issue, the April 2009 emergence of a rapidly disseminated strain of swine flu created great concern around the world. Oil and gas industry personnel travel frequently between countries and can contribute to spreading of diseases.

Last year I commented on the safety challenges of keeping up with the strong drilling demands resulting from high oil prices. This year offers a new set of challenges. With lower oil prices, companies may have cut back on some activities and programs. Hopefully, safety and environmental programs will remain as important and central elements of everyday work.

Industry performance in traditional air- and water-quality and waste-management programs remains very important. Overlain on these are highly visible global issues such as climate change and carbon capture and sequestration. Projects for injecting carbon dioxide into underground formations will need to draw on the decades of expertise in the oil and gas industry.

Previously, I have written about the challenges of selecting a small number of top papers to represent three separate disciplines (health, safety, and environment). My own work focuses only on environmental issues. This year, I enlisted the assistance of Tom Knode of Halliburton to help identify the top papers in health, safety, and social responsibility, which are areas within his scope of responsibility. **JPT**

Health, Safety, and Environment additional reading available at OnePetro: www.onepetro.org

SPE 121065 • “The Use of Risk Analysis in Design: Safety Aspects Related to the Design and Operation of an FPSO” by Lars Tronstad, SPE, StatoilHydro.

SPE 118176 • “Health-Reporting System in the Oil and Gas Business” by Claudio Zappador, Eni, et al.

SPE 120973 • “Integrating Social Responsibility Into the Health, Environment, and Safety Management System” by Carolina Ortega Barrales, SPE, Occidental Oil and Gas, et al.

SPE 121104 • “Breakthrough Mobile-Water Treatment Converts 75% of Fracturing Flowback Fluid to Fresh Water and Lowers CO₂ Emissions” by Aaron D. Horn, SPE, Newfield Exploration.

SPE 121050 • “Time To Protect: Layout Methodology for Safe SimOps in High-Pressure, High-Percent-H₂S Facilities” by A. Blyth, Shell International.

Restoring Sagebrush Habitat in the Pinedale Anticline Natural-Gas Field in Wyoming

Disturbed areas in the Pinedale Anticline natural-gas field are being restored with native plant species that are beneficial in the sage grouse and ungulate habitat. A new seed mixture was developed to re-establish native plant species in reclaimed areas, replacing the grass-dominated seed mixes used in the past, thus returning these areas to productive habitat in a timelier manner.

Introduction

The Pinedale Anticline field is in the Upper Green River basin of southwestern Wyoming, near the town of Pinedale. The gas field was discovered in the mid-1930s and has estimated ultimate gas reserves of more than 25 Tcf. Land ownership in the field is more than 90% federal, and all aspects of the gas development are managed by the US Bureau of Land Management (BLM). New hydraulic-fracture-stimulation technology enabled further development of this resource, which accelerated after 2000. In an effort to limit the amount of overall land and habitat disturbance, the field is being developed with multiple-well drilling pads, with up to 32 wells drilled, completed, and produced from each pad location. Total land disturbance to date is estimated at more than 700 acres for Shell's operations on the Pinedale

Anticline. Once the drilling on a pad is completed, pad size can be reduced by up to 70%. Full development of the field will have 12,885 acres of initial disturbance and 4,012 acres of disturbance remaining after interim reclamation activities are completed. The ecosystem in the area is considered a sagebrush-dominated steppe with mixed grasses and forbs. Elevation ranges from 7,200 to 7,400 ft above sea level, and annual rainfall averages less than 9 in./yr. Native soils range from sands and gravels to clayey loams. The native plants are a main source of forage, especially in the winter months, for large ungulate populations that include pronghorn antelope and mule deer. This sage-steppe habitat also is critical for populations of the greater sage grouse, a species that may soon be listed as endangered.

Project Approach and Objectives

The overall goal of this project was to restore native sage grouse habitat in as timely a manner as possible, to reduce the surface environmental effects of natural-gas development. Native-plant survival in harsh arid environments such as the Pinedale Anticline depends on interaction between soil microbial communities and the native shrub, forb, and grass species. Specifically, soil microbes, referred to as mycorrhizal fungi, are known to aid native plants in nutrient and water absorption, leading to improved plant growth and reproduction. Re-establishing microbial communities and healthy soils on disturbed sites is important in restoring native-plant habitats, particularly for the germination stage and first-year growth of the native shrubs, forbs, and grasses.

A "habitat" seed mix with more native components and compatible with sage grouse and ungulate

life-cycle needs was developed. The final seed mix in any given year is influenced by annual fluctuations in native-seed availability. Shrubs, forbs, and grasses chosen for the seed mix mainly reflect species native to the local area, use by sage grouse or ungulates (e.g., antelope, deer, and elk) during various life stages and seasons of year, and ability to withstand periodic drought conditions.

Restoring native habitat that will sustain itself requires seedlings that are hardy enough to withstand the uncertain precipitation and drought, as well as the harsh winters in this environment. Providing irrigation during early plant growth could reduce the plants' ability to establish critical microbial associations needed for survival.

Project Implementation

The initial pilot test of the project variables was carried out in the fall of 2004 as a cooperative venture between Shell and the Pinedale, Wyoming, BLM field office. A total of 14 locations were seeded with the new habitat seed mix—three were hydroseeded with organic soil amendments; four were drill seeded, two with organic soil amendments, two without; seven previously seeded grass locations were overseeded with the range drill, three of which received organic soil amendments. The locations ranged in size from 2 to 7 acres. Fencing was installed on all three hydroseeded locations, two of the drill-seeded locations, and three of the overseed locations. In addition, 26 topsoil stockpiles were seeded with slender wheatgrass. These stockpiles ranged in age from 0 to 3 years.

Each seeded location has been mapped and documented carefully. Reseeding was done only where necessary to supplement weak plant germination, mainly because of drought

This article, written by Senior Technology Editor Dennis Denney, contains highlights of paper SPE 120980, "Restoring Sagebrush Habitat in the Pinedale Anticline Natural-Gas Field in Wyoming," by H. James Sewell, Shell E&P, and Richard S. Carr, C-M Environmental Group, prepared for the 2009 SPE Americas E&P Environmental & Safety Conference, San Antonio, Texas, 23-25 March. The paper has not been peer reviewed.

For a limited time, the full-length paper is available free to SPE members at www.spe.org/jpt.

conditions during the 18 months following the fall 2005 seeding. Follow-up monitoring, including vegetation line and belt transects, was carried out each spring/summer season from 2005 to 2008.

Results

The timing of the initial 2004 pilot project was fortuitous: The winter/spring season of 2005 was a good-precipitation year, with nearly twice as much precipitation received as in each of the next 3 years. As a result, sagebrush stands were established on all the primary seeded locations in 2004, with the exception of one drill-seeded location. In 2008, a rigorous monitoring program of on-site/off-site vegetation transect pairs was carried out for all locations seeded in 2004 and 2006.

Hydroseeding vs. Drill Seeding.

Successful sagebrush stands were established on all three hydroseeded locations seeded in the initial pilot test in 2004, although grass and forb production appeared to lag relative to the drill-seeded sites. Sagebrush-shrub densities on two of the three hydroseeded locations exceed those of their respective adjacent native offsite reference areas. However, attempts to hydroseed in 2005 were not as successful because of drought conditions during the first growing season following seeding. Drill seeding also was successful in establishing sagebrush stands on the initial (2004) pilot sites, as well as on several sites seeded in the fall of 2005. The 2006 growing season was poor for most seed projects in western Wyoming. Since 2006, drill seeding with a range drill has been the preferred method. The focus is on determining the best, most consistent way to deliver the native seeds to the soil bed by modifying drop-tube configurations on the drill itself.

Habitat Seed Mix. The initial habitat seed mix was successful on the pilot-test sites and has been retained, with minor modifications as suggested by field experience. Since 2004, the grass component in the habitat mix has been increased slightly, mainly by adding thickspike wheatgrass to the mix as well as slender wheatgrass, which acts as a fast-growing but short-lived nurse

crop. Some forbs have been slow to appear, and poor forb performance was more obvious during the drier years. Two forbs, globemallow and penstemon, were under consideration to be replaced during 2007 seeding. However, favorable conditions in the spring of 2008 brought numerous penstemons and globemallows up for the first time in 3 to 4 years. Now, changes in the seed mix are more site-specific, based on the local native species adjacent to reclaims.

Soil Testing and Soil Amendments.

The effectiveness of the organic and mineral soil amendments applied to selected locations is difficult to quantify, and is still uncertain. The one location seeded in 2004 that was split into amendment and no-amendment sections was, unfortunately, severely degraded by cattle in 2005, and again in 2008. Positive evidence of amendment effectiveness was seen early in the project when all three hydroseeded locations produced healthy stands of sage shrubs and other native plants, including a location with high-sodium soils. Problematic levels of sodium, sulfur, and soluble salts have been reduced, and the general level of organic matter has been increased.

Overseeding. The Rainbow 7-31 location was seeded in 2003 with the BLM seed mix, and was overseeded in 2004 with the habitat mix. Transect data collected in the fourth growing season after the 2004 seeding showed only marginal improvement in shrubs and forbs in the overseeded location compared with the baseline grass site (New Fork 7-3). Rainbow 7-31 had the highest number of shrubs and forbs of all the overseeded locations. However, included in the shrub counts at this location are older fourwing saltbush shrubs that were seeded with the older BLM seed mix. These older locations are still dominated by grasses and likely will remain so for decades.

Fencing. Two grass-dominated overseeded locations in relatively close proximity were compared. The Pinedale 13-19 location was not fenced and is excessively grazed regularly. The New Fork 11-24 location was fenced only in part, leaving the outer area open to

grazing. Data reflect heavy livestock use of the Pinedale 13-19 site, which has lower sage-shrub density along with short shrub height. Significantly more shrubs exist on the lesser-used New Fork 11-24 location, with slightly more shrubs found inside the fenced area than outside (indicated by the shrub-density data).

Topsoil-Stockpile Seeding. Seeding the topsoil stockpiles in the first season following construction proved successful in reducing the weed population. Older stockpiles that already contained a heavy weed-seed load showed some reduction, but the introduced grasses were not able to eliminate the weed infestation. Future efforts will concentrate on farming the topsoil stockpiles as soon after construction as possible.

Conclusions

The success of this reclamation depends heavily on the abundance of precipitation as well as the timing of the precipitation events in relationship to seed distribution.

The habitat seed mix was successful in re-establishing native sagebrush, integral shrubs, some forbs, and a better-balanced component of grasses. The native-seed mix will be monitored continuously and adjusted, subject to new data and seed availability. Native-plant diversity and plant density on reclaimed locations more closely match that of the surrounding undisturbed sagebrush habitat with the use of the habitat seed mix compared with the previously required, grass-dominated seed mix.

Temporary fencing of newly reclaimed locations appears to be an obvious best-management practice. It allows young native-plant seedlings to become better established in the first 2 to 3 years of growth and avoids the pressures of cattle grazing on reclaimed locations.

Conclusive, quantitative evidence supporting the decision to use soil amendments and biostimulants to improve soil viability and to improve native-plant emergence is lacking at this stage in the project. However, circumstantial evidence indicates that these tools have a positive influence on sites with difficult soils. **JPT**

Evaluating Implications of Hydraulic Fracturing in Shale-Gas Reservoirs

Exploration, drilling, and production of shale-gas plays such as the Barnett, Fayetteville, and Haynesville have changed the unconventional-gas industry. Two technologies that enhanced shale-gas development are horizontal drilling and hydraulic fracturing. Hydraulic fracturing of horizontal wells completed in shale reservoirs often requires larger volumes of fracturing fluid than conventional vertical-well stimulations. Rapid development of shale gas across the country has created concerns about the use of infrastructure and about environmental effects.

Introduction

The Barnett-shale play began in the Fort Worth, Texas, area in the 1980s. Continued improvements in hydraulic-fracturing techniques and technology enhanced development of the Barnett shale. Development uses horizontal drilling and sequenced multistage hydraulic-fracturing technologies.

Another source of technological advances in horizontal drilling and hydraulic fracturing is the Bakken shale of the Williston basin in Montana and North Dakota, which produces more oil than gas. Each shale-gas basin has a unique set of exploration criteria and operational challenges. However, the combination of horizontal-well completions and sequenced hydraulic-fracture treatments has been crucial in

facilitating the expansion of modern shale-gas development to other shale plays. The low natural permeability of shale has been the limiting factor to production.

Shale-Gas Geology

Shale gas is natural gas produced from shale formations, and these shales function as both source rock and reservoir for the natural gas. Typically, shale gas is dry gas composed primarily of methane (90% or more). However, some shale-gas formations do produce water.

Gas shales are organic-rich formations traditionally viewed as source rocks and seals for stratigraphic gas accumulations. The thin layers, as shown in **Fig. 1**, that make up shale result in a rock with limited horizontal permeability and minimal vertical permeability. Unfractured shales typically have permeabilities on the order of 0.01 to 0.00001 md, limiting production.

The natural matrix permeability of shale sometimes is overcome by natural-fracture networks that developed when overburden pressure was reduced as a result of erosion of overlying rock formations. Other tectonic activity also can cause a change in the pressure, creating additional fractures. Often, fractures are key sources of permeability, facilitating the migration of fluids through fine-grained rocks such as shales.

Fracture Stimulation

Hydraulic-fracture treatments are designed formation stimulations in which specific characteristics of the target formation (e.g., shale thickness, rock-fracturing characteristics, and stress regimes) are used to develop a network of fractures. The design process for a hydraulic-fracture treatment starts with prestimulation reservoir evaluation, which involves collecting field data and understanding the character

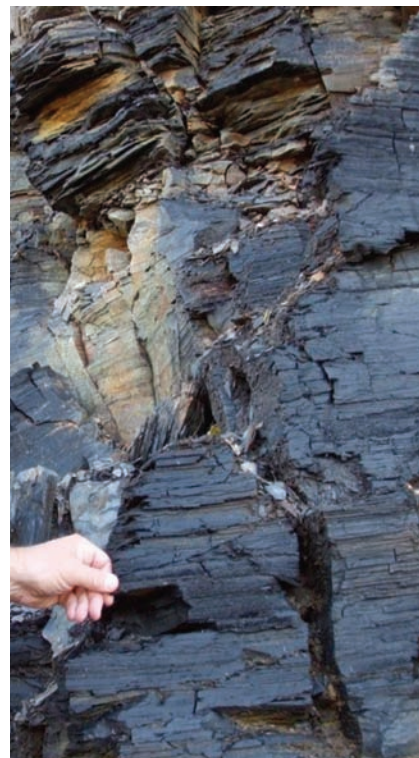


Fig. 1—Thinly layered Appalachian Marcellus-shale outcrop.

of the reservoir and the dynamics of existing stress relationships. Collected data include porosity, permeability, and lithology of the producing formation; fluid-saturation data; natural-fracture character; and current stress regimes that identify the maximum and least principal horizontal stresses.

Computer simulations allow engineers to evaluate treatment design in a controlled setting and assess the resultant fractures. When designing treatments, operators take into consideration formation stresses to predict probable fracture propagation. Use of a single fracture event and microseismic monitoring on a vertical well in the formation of interest before drilling horizontal laterals from that well can

This article, written by Senior Technology Editor Dennis Denney, contains highlights of paper SPE 121038, "Evaluating Implications of Hydraulic Fracturing in Shale-Gas Reservoirs," by J. Daniel Arthur, SPE, Brian Bohm, Bobbi Jo Coughlin, and Mark Layne, SPE, ALL Consulting, prepared for the 2009 SPE Americas E&P Environmental and Safety Conference, San Antonio, Texas, 23–25 March. The paper has not been peer reviewed.

For a limited time, the full-length paper is available free to SPE members at www.spe.org/jpt.

assist in designing lateral orientation to the preferred direction.

For gas shales, individual fracture-treatment stages typically include multiple substages during which different fluids and concentrations of proppants are pumped into the well. Initial substages typically are performed as a flush and often may include simply pumping fresh water into the wellbore. Next, an acid flush cleans cement from the perforations and the near-wellbore region to facilitate the flow of fluids during the fracturing process.

Following the acid flush, a spacer pushes the acid into the formation and begins fracture propagation. After the spacer is pumped, the next substage is to shut the well in during which time the fracture gradient for the formation is calculated. When the well is opened again, a clean fracture-fluid pad is injected to lubricate well tubing and formation fractures, aiding in the delivery of the proppant substages. The next substages are a series in which proppant is used to create and maintain fractures.

The number of substages is determined by the volumes of proppant and fracture fluid required for the fracture-treatment design. Once the prescribed volume of fluids and proppant has been pumped, a final flush is performed to clean the wellbore and tubing of proppant.

Water is the primary component for the fracturing treatments. Availability of water is a distinguishing factor between various shale-gas plays across the country. With fracture treatments requiring large volumes of water, operators must identify unique ways of acquiring fresh water. For example, at the Dallas/Fort Worth Airport project in the Barnett shale-gas play, the operator tapped into the airport's freshwater system. Water is pumped into lined storage impoundments and stored until it is transported by temporary above-ground piping to the well-pad locations for a fracture treatment. Locations were chosen relative to the location of the newly constructed water vaults and well clusters to provide optimal access and reuse.

The urban nature of the Barnett play has enabled operators developing other areas to tap city fire hydrants and use local surface reservoirs on golf courses to store and supply water. In the rural area of the Fayetteville-shale development, the Little Red River Reservoir is under construction. The 500-acre-ft reservoir will be supplied by water

diverted from the Little Red River during periods of high flow. The current permit allows up to 1,550 acre-ft of water to be collected annually and stored for future use in fracturing and drilling. Water is transported from the reservoir through above-ground temporary pipelines and by water-hauling trucks to the well-pad locations.

Water Transport and Disposal

Water production associated with shale gas varies between the shale-gas plays and varies significantly within regions of each of the plays. For example, in the Barnett play, water production is high in the western portion of the play and decreases to near zero in the eastern portion. The Fayetteville play has very little associated-water production. Most of the concerns of water transport and disposal arise from flowback water (partial recovery of the fracture-stimulation fluids used in a well).

Water disposal creates additional challenges. Land application facilities, both commercial and single-use applications, are the main disposal method in the Fayetteville play. These activities are regulated by the Arkansas Department of Environmental Quality. In the Barnett area, disposal in Class-II injection wells is the primary disposal method. Methods for Class-II injection and for municipal and industrial water-treatment facilities in the Marcellus-shale play are being explored. However, to make injection an acceptable disposal method for the long term in all of the shale-gas plays, additional research on the receiving formations will be necessary to accommodate the number of wells that will be necessary. As more wells are brought onto production, operators will need new technologies for managing the water.

Another option for managing the large volumes of flowback water is recycling. Although still in the early phases, operators have applied for pilot projects in the Barnett shale with varying results. One company uses a recycling process that allows reuse of approximately 80% of the recovered fracture fluid used in the Barnett-shale play. Distilling units are used on location to treat the water. The treated water then is used in future fracturing treatments, reducing the stress on water availability and the burden of water disposal. As of 26 April 2008, more than 5.7 million bbl of flowback water has been processed to recover more than 4.5 million bbl

of water for reuse in additional fracture stimulations. As additional operators conduct successful pilot projects and prove available technologies, recycling may become a more prominent disposal method, and more operators will be encouraged to use the new techniques.

Natural Radiation

Naturally occurring radioactive material (NORM) refers to low-level radiation from natural sources found in soils, water, air, and food. Everyone is exposed to radiation in everyday life from sources including sun exposure, X-rays, porcelain dental work, books, and wristwatches. In terms of shale-gas development, NORM may be found in drill cuttings, natural gas, and produced water associated with the production of natural gas from shale formations.

In natural-gas development, NORM concentrations are noticeable in areas where sediments tend to accumulate inside tanks and process vessels or where precipitates accumulate as scale on pipes, storage tanks, and other surface equipment. Because of where NORM accumulates in natural-gas operations, exposure typically occurs only when repair work is performed. The dense steel used in gas-production equipment tends to block alpha and beta radiation and reduces the amount of gamma radiation that is transmitted. Typically, exposure occurs only when equipment is opened and exposed to the atmosphere, and as such, it is unlikely that an oilfield worker would be exposed to a dosage exceeding 1 rem/yr, and the general population would be exposed to even less. The risk to the general population is reduced because distance reduces exposure to radioactivity, and radioactivity is reduced by a compounding factor. Exposure is reduced by a factor of four, 2 ft from the source and by a factor of 16, 4 ft away, compared to 1 ft away.

Although methods for managing NORM in oilfield operations vary, several states have enacted regulations specific to NORM, while others handle this issue through standard oilfield-waste rules and through permit stipulations in some cases. Standards for cleanup typically require average concentrations of less than 5 pCi/g in the upper 15 cm of soil and an average of less than 15 pCi/g in deeper soils. However, management and cleanup practices vary based on very low perceived risks to human health and the environment. **JPT**

Behavioral Safety, Success Factors

Unsafe acts account for approximately 88% of accidents, followed by unsafe conditions (10%) and acts of providence (2%). Unsafe acts result from unsafe behavior. In an analysis of management-system faults that trigger accidents, unsafe behavior is the most common. Although it is important to track injury-related incidents, the incidents themselves most likely are the result of actions taken by one or more people.

Introduction

To eliminate injuries, proactive monitoring is recommended. Although tracking incidents is important, measuring the potential for incidents to occur also is important. This approach allows the worksite to make adjustments before personnel injury occurs or property is damaged.

A proactive approach measures safety in terms of ongoing behaviors and measures how often employees perform “safe” vs. “at-risk” behaviors on a daily basis. This approach is most effective when behaviors that relate to previously incurred incidents are studied.

RasGas Example

A review of injury records showed a high occurrence of hand-related injuries. Knowing that appropriate use of gloves should prevent those injuries, RasGas used a behavior-based safety

process to measure how often employees wore gloves in situations warranting their use. By observing occurrences of this safe behavior (i.e., use of gloves during critical times), RasGas found a remarkable reduction in hand-related injuries. With the appropriate use of gloves, the company has experienced no hand-related injuries.

Behavioral Safety

RasGas is a leading supplier of liquefied natural gas and has developed a safety process in which the workforce participates. This systematic behavioral-safety process can be implemented and monitored such that both management and the workforce receive feedback. The intention is to focus workers’ attention and action on safe behavior to avoid injury. Interventions are aimed at observable interactions between safe behavior and the working environment.

Behavior-based safety was a major safety initiative introduced in 2006. This initiative focused on improving performance by targeting people’s behavior. Unsafe behavior triggers most workplace incidents. People often behave in an unsafe manner because they perceive that “cutting corners” makes their job easier, yet will not result in injury or incident. However, these “shortcuts” can result in serious incidents and/or severe injuries. Eliminating all incidents by means of engineering solutions and management procedures appears ideal. However, these strategies do not always work as intended, simply because it is the individual who chooses whether to adhere to safety or not. Behavioral safety targets these types of behavior to reduce the number of incidents, with the aim of achieving a zero accident rate.

Behavioral safety attempts to identify unsafe behaviors that are impli-

cated in the majority of injuries. These behaviors and/or proxies (e.g., hoses left lying across walkways) are developed into specific behavioral checklists. Trained observers are assigned to monitor and record people’s work behavior on a regular (even daily) basis. Scores provide feedback to enable tracking of improvement goals. Feedback mechanisms include verbal feedback at the point of observation, graphical charts, and/or written performance summaries with corrective actions to be taken. Results indicate that significant reductions in injury rate are possible within a relatively short time, with the effect lasting for many years.

People take action on the basis of events that come before behavior (antecedents that direct) and events that come after behavior (consequences that motivate). The active part is the consequence, and people will behave either to avoid unpleasant consequences or to receive pleasant consequences.

The full-length paper summarizes key achievements and lessons learned from implementing a behavior-based safety process at RasGas. The process was implemented in the company’s Arabian Gulf region, with an organization having more than 35,000 staff and contractors across all disciplines. The behavioral-safety process was implemented in 2006 and has provided tangible benefits from safety indicators, including a reduction in total-recordable-incident rate and lost-time-incident rate.

Effective communication is key to successful implementation of the behavioral-safety process and creation of new, more-rewarding behavioral-safety experience. Behavioral safety focuses on proactive monitoring. However, incidents themselves most likely are the results of actions taken by

For a limited time, the full-length paper is available free to SPE members at www.spe.org/jpt.

one or more persons, and the outcome and behavior are lagging indicators of safety. Building a confident attitude requires becoming aware of the principles that build positive attitude, promoting a desire to be positive, and cultivating the discipline and dedication to practice those principles.

Management Commitment

Managerial commitment includes engaging in and maintaining behaviors that help others achieve a goal. Measurement can be taken in two ways: direct questions asked of managers or monitoring their commitment behaviors. Few managers admit they are uncommitted to safety when asked, whereas behavior provided the ultimate proof of commitment. The greatest effect of managerial commitment is directly proportional employee safe behavior.

Senior-management commitments played a crucial role in shaping employee behaviors. They also shaped lower-management behavior that, in turn, affected employee behavior. Upon completion of each phase of a process, all participants receive operations behavioral-safety awards.

Procedures taken by senior management are as follows:

1. Meet with the head of operations/asset manager to ensure closeout of remedial actions including all safety-restoration action items.
2. Discuss safety with employees, one-to-one.
3. Review permit-to-work deviations.
4. Discuss safety as first item on meeting agenda.
5. Review the number of incidents per asset.
6. Undertake plant-safety walkabout.
7. Actively support closeout of identified concern areas.
8. Conduct follow-up tracking and ensure timely closeout of process-related root-cause-of-failure analysis.
9. Review safety-device-bypass log book.
10. Conduct and promote safety-related coaching.
11. Review weekly progress status of the behavioral-safety process for all assets and departments.
12. Attend weekly behavioral-safety-feedback meeting.
13. Remind observers to make their daily behavioral-safety observations.

Enhancing Behavioral Safety During Maintenance Shutdown

RasGas periodically undertakes maintenance shutdowns. During shutdowns in 2006, 2007, and 2008, behavioral-safety procedures were put into effect. During a 33-month period, the 35,000-member workforce completed 11 shutdowns, of which seven shutdowns were incident-free, which was attributed to adherence to behavioral-safety practices. RasGas behavioral safety is a successful work practice. Behavioral-safety success does not mean the absence of failure, but the attainment of ultimate objectives. People are our greatest asset or liability (i.e., behavioral safety is a holistic approach). The concept constantly emphasizes the behavioral change toward safety, rather than rules and regulations.

Behavioral-Safety Success

A positive attitude leads to safe behavior by all. Each phase has achievable targets with effective levels of observations. Observers are the nerve centers of the behavioral-safety process. Also essential are strong management commitment, support, and dedicated coordination.

A dedicated coordinator guides the organization to implement the program. Behavioral safety always focuses on the situation (issue and behavior only), treats people with respect, and provides constructive feedback to all personnel. Observation is the crucial element in achieving 100% safety.

Motivation is most important for promoting positive culture. A new method of motivation will not work until the demotivating factors are removed. Many times, simply removing demotivating factors can start motivation. Through feedback meetings, demotivating factors are eliminated, which is appreciated by all employees daily.

Positive-focused consequence management was learned—a promise (antecedent) of recognition (consequence) for good behavior (i.e., the desired repeated behavior). When the application of the positive consequence results in an increase in the behavior that produces it, the process is called positive reinforcement and the consequence is a reinforcer. Reinforcers can be either social (e.g., a “thank you”) or material, such as tangible rewards.

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The Arab Republic of Egypt
Ministry of Petroleum
The Egyptian General Petroleum Corporation (EGPC)
Ganoub El Wadi Petroleum Holding Company (Ganope)
Announcement



The International Bid Round-1/2009

The Egyptian General Petroleum Corporation (EGPC) and Ganoub El Wadi Petroleum Holding Company (Ganope) invite specialized companies in Oil and Gas exploration and exploitation for the First International Bid Round-1/2009 including eleven (11) blocks in the Gulf of Suez (GOS) and the Eastern Desert (E. Desert), as shown in the following table and in accordance with the production sharing agreements model applied in the Arab Republic of Egypt.

Block No.	Block Name	Area Km ²	Province
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EGPC blocks

1	West Darag Offshore	254.4+178.7	GOS
2	South Darag	259.3	GOS
3	Northwest Abu Zenima	276.3	GOS
4	East Ras Budran Offshore	45.56	GOS
5	Northeast Issran	343	GOS
6	Northeast Morgan	63.114	GOS
7	Northeast Amal	27.92	GOS
8	North Ras El Ush	164.5	GOS

Ganope blocks

9	West Wadi Dib	506	E. Desert
10	Wadi Abu Had	258	E. Desert
11	West Tawila	88	S. GOS

Data required for blocks (1 to 8) are available at the Information Center, Nasr City
1A Ahmed El Zomor St., Nasr City, Cairo – Egypt

Data required for blocks (9 to 11) are available at Ganoub El Wadi Petroleum Holding Company Headquarter.

19 Mostafa Refaat St., Sheraton residence – Heliopolis - Cairo – Egypt.

Purchasing the data package for each block is a pre requisite to bid for the block.

The basic data, coordinates, procedures and conditions for participation in this Bid Round can be obtained through The Egyptian General Petroleum Corporation website www.egpc.com.eg and through Ganoub El Wadi Petroleum Holding Company website www.Ganope.com

The closing date will be on Sunday, Nov. 1st, 2009 before 12:00 noon.

For more information, please contact:

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