

EMERGING CENTRIFUGAL TECHNOLOGY IN SHALE PLAY DRILLING WASTE MANAGEMENT

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Introduction

- As the United States' energy demands continue to increase, natural gas, specifically shale gas, will play an integral role in meeting those demands.
- Newly discovered shale plays have increased the United States' already abundant source of natural gas and will play a vital role in satisfying future demand. As a result, production from shale formations is one of the most rapidly expanding trends in domestic oil and gas exploration and production.
- Government and citizens alike, have serious concerns about the environmental impact of shale gas exploration and production and how it will affect the surrounding landscape and water supply.



Importance of Water

- Water is needed to produce energy and energy is necessary to make water available for use.
- During the extraction of oil, gas and other minerals, water is used for a variety of purposes:
 - Drilling Mud
 - Hydraulic Fracturing
- Water is also a central component of the waste products generated by oil and gas activities, known as flowback and produced water, which may be treated, recycled or disposed.




Legal Overview

- The development and production of oil and gas in the U.S., including shale gas, are regulated under a complex set of federal, state, and local laws that address every aspect of exploration and operation
- Federal
 - EPA administers majority of federal laws
 - FWS, BLM, etc.
- State/Local
 - Each state has one or more regulatory agencies that:
 - permit wells, including their design, location, spacing, operation, and abandonment, as well as environmental activities and discharges, including water management and disposal and waste management and disposal



Waste Management

- A key component during exploration and production of shale gas is drilling waste management.
- Managing drilling wastes is an extremely critical aspect of a shale gas project and is vital to the success or failure of complying with environmental laws and regulations.
- Successfully managing drilling waste is a key factor in minimizing impacts to water resources which has become a major area of concern in today's society.



Current Drill Site Waste Management Technologies

- Separation of Mud from Cuttings
 - Drilling mud is used to control subsurface pressures, lubricate the drill bit, stabilize the well bore, and carry the cuttings to the surface, among other functions
 - Mud is pumped from the surface through the hollow drill string, exists through nozzles in the drill bit, and returns to the surface through the annular space between the drill string and the walls of the hole
 - As the drill bit grinds rocks into drill cuttings, these cuttings become entrained in the mud flow and are carried to the surface





Current Drill Site Waste Management Technologies

- How are cuttings and Mud separated?
 - Circulate Mud over vibrating screens called shale shakers
 - The liquid mud passes through the screens and is recirculated back to the mud tanks from which mud is withdrawn for pumping downhole
 - The drill cuttings remain on top of the shale shaker screens; the vibratory action of the shakers moves the cuttings down the screen and off the end of the shakers to a point where they can be collected and stored in a tank or pit for further treatment or management





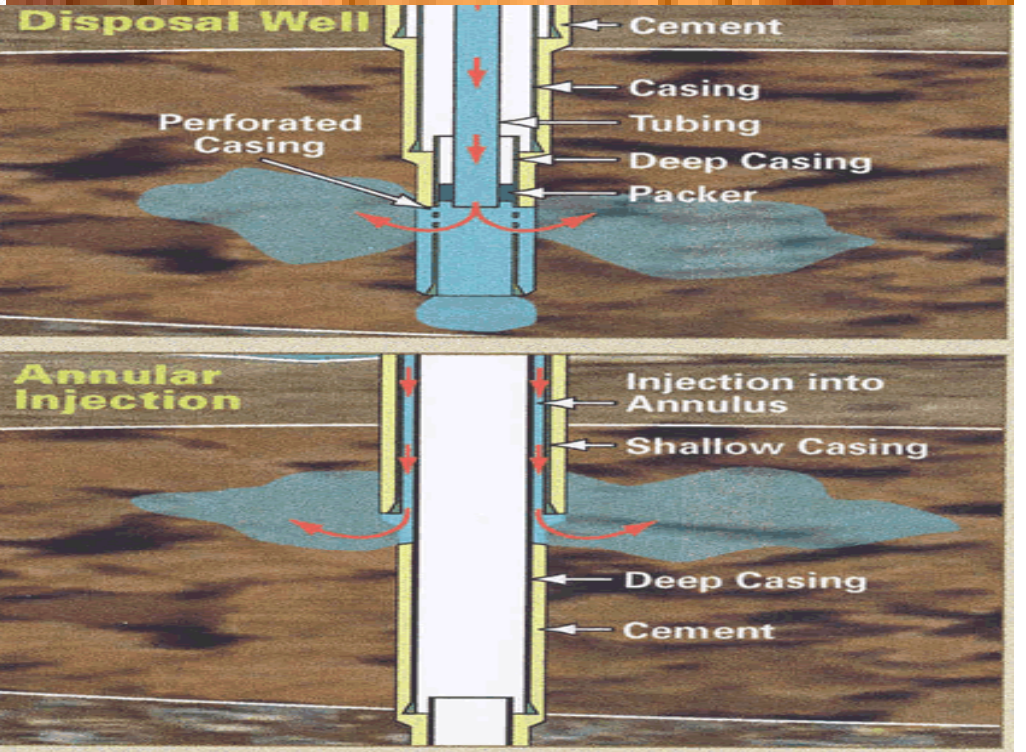
So What Are We Left With?





What Do We Do With This Stuff?

- Solidification & Stabilization
 - What if matrix breaks down?
- Onsite Burial
 - Leaching into groundwater?
- Bioremediation
 - High maintenance costs, large land requirements
- Commercial Disposal Facilities
 - PA ban on sending drilling waste to municipal facilities
- Slurry Injection
 - Unanticipated leakage to the environment





Emerging Centrifugal Technology

- While the use of centrifugal technology in the oil and gas business is an emerging technology, centrifuges and related technology have existed for many years
- In its simplest form, a centrifuge is comprised of a fixed base or frame and a rotating part in which a mixture is placed and then spun at a high speed.
- Capitalizing on forces such as gravity and inertia, this process separates materials of different densities, and can be an extremely efficient process in respect to drill site waste management



How It Works

- Waste material is placed in centrifuge and spun, creating centrifugal forces well beyond 3000 times greater than gravity
- When subject to such forces, the solid particles are pressed outwards against the rotating bowl wall, while the less dense liquid phase forms a concentric inner layer
- Solids/Liquid are removed and stored separately





Typical Applications

- Cleaning tank bottoms
 - During drilling, swirl tanks accumulate sedimented solids as a function of gravity and this fine silt can be vacuumed directly off of the tank bottom via pump, into the centrifugal rig for processing and disposal
- Waste water management
 - Typically takes place on a very large scale and are typically carried out at large static facilities
 - Centrifugal technology allows for efficient on-site management
- Sludge dewatering
 - Typically revolve around remediation of older standing reserve tanks whose contents have settled or whose accumulated sediments have been previously covered or buried



Clean Water Act

- Under the CWA, EPA has implemented pollution control programs such as setting wastewater standards for industry
- Shale gas production sites or commercial facilities that handle the disposal or treatment of shale gas produced water must obtain NPDES permits if they intend to discharge directly into surface waters
- NPDES effluent limits are typically based on available treatment technologies, while allowing the discharger to use any available control technique to meet the limits



Clean Water Act

- Centrifugal technology allows shale gas producers to comply with the CWA by bringing them into compliance with NPDES permits
- Lag time exists between emerging technology and laws regulating these technologies. Thus, the limits contained in current NPDES permits are typically based on older, less efficient technologies available to the discharger
- As a result, implementing highly efficient centrifugal technology will allow shale gas producers to comply not only with the current limits, but future more stringent limits as well



RCRA

- Subtitle C established a federal program to manage hazardous wastes to ensure that hazardous waste is handled in a manner that protects human health and the environment
- Although EPA has made the determination that wastes from oil and gas exploration and production should be exempted from Subtitle C of RCRA, , the same does not apply to backflow waste generated during the fracing process of natural gas well shale play sites



RCRA

- Centrifugal technology can be used to facilitate the recovery of the drilling fluids while in preproduction and later as a remediation source post production
- Centrifuge equipment can be used to “desand” the material for reuse downhole, and by recycling these fluids, reduce the exposure of the operator as a function of mathematical volume reductions
- Although the drilling cuttings are specifically exempted under RCRA, they tend to be extremely heavy, especially when an operator leaves fluids in them
- Centrifugal technology allows operators to remove the fluids from the cuttings, thus allowing them to avoid hauling a heavier and ultimately costlier material, to be disposed of



Endangered Species Act

- Sections 7 and 9 are central to regulating oil and gas activities
- Section 9 makes it unlawful for anyone to "take" a listed animal, and this includes significantly modifying its habitat
- A Section 9 (incidental take) permit must include a habitat conservation plan (HCP) consisting of: an assessment of impacts; measures that will be undertaken to monitor, minimize and mitigate any impacts; alternative actions considered and an explanation of why they were not taken; and any additional measures that the Fish and Wildlife Service may require



Endangered Species Act

- Centrifugal technology may play a vital role in operators who must prepare HCPs when applying for a Section 9 permit, specifically to show how the operators will minimize and mitigate any impacts to a listed species that may exist in or around the drill site.
- The biggest risks to both animals (and humans), involve the older reserve pits utilized over the last forty years in the US.
 - They represent a clear danger as they are attractive, appearing to be a stock tank to animals (or worse, a “swimming” hole for young children)



Questions?