DIRECTIONAL DRILLING AND SUBSURFACE TRESPASS

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DIRECTIONAL DRILLING AND SUBSURFACE TRESPASS,

Or how far can you really go in putting your straw into someone else's milkshake?

I. INTRODUCTION

Seldom is the subject for an Annual Institute paper grist for a Hollywood blockbuster. Even more luckily, although trespass can certainly lead to raised tempers and large claims, I am not aware of any messy conclusions on a bowling alley. While the ever increasing tempo of technology pervades the whole field of subsurface activities, including directional and horizontal drilling and ever more sophisticated seismic processing, there has been little definitive development in the substantive law concerning when subsurface activities breach the bounds of legality and become trespass. Nonetheless, while we await what might become the significant bellwether of legal development, a ruling by the Texas Supreme Court in *Garza*, the explosion of technologies like sophisticated directional and horizontal drilling bring focus on the regulatory agencies that permit them. It may also be time to focus on the here-and-now challenges posed by subsurface activities from a legal standpoint, and to see how the developing technologies can be either a blessing or a curse – or both at once – for handling these challenges.

II. LEGAL DEVELOPMENT OF SUBSURFACE TRESPASS

A. Definition and elements

The law of subsurface trespass developed from the traditional concepts of surface trespass. Subsurface trespass is an unlawful *physical* entry onto the mineral estate of another. Subsurface trespasses typically occur when a test hole or wellbore is drilled into a mineral estate on which the operator does not have a lease, or when secondary recovery substances migrate from the mineral estate into which they were injected to adjacent off-lease mineral estate.

See, e.g., Hartman v. Texaco, Inc., 937 P.2d 979, 123 N.M. 220, 224 (N.M. App. 1997) ("We recognize that in New Mexico an action for common law trespass does provide relief for trespass beneath the surface of the land.").

Railroad Comm'n of Tex. v. Manziel, 361 S.W.2d 560, 567 (Tex. 1962) ("To constitute trespass there must be some physical entry upon the land by some 'thing'...") (citing Gregg v. Delhi-Taylor Oil Corp., 344 S.W.2d 411 (Tex. 1961)).

B. Standing to sue for subsurface trespass

1. Adjoining operators

2. Adjoining mineral estate owners

HECI Exploration Co. v. Neel, 982 S.W.2d 881 (Tex. 1998) concluded that a royalty owner has a cause of action against an adjoining operator for overproduction in violation of Railroad Commission rules. The court also held that there is no implied covenant in a mineral lease that obliges an oil and gas lessee to notify the lessor (royalty owner) of its intention to sue an adjoining operator, *even if* the lawsuit will preclude the lessor from bringing future claims against the adjoining operator.

III. TYPES OF SUBSURFACE TRESPASS

A. Early development: surface trespass to access minerals

The earliest trespass cases relating to mineral estate involved unauthorized invasion of the surface estate by the owner of the underlying mineral estate beneath it (or the owner's oil and gas lessee) for the purpose of accessing the mineral estate. Bender v. Brooks, 127 S.W. 168, 170 (Tex. 1910); Williamson v. Jones, 27 S.E. 411, 423-424 (W. Va. 1897). These cases concern property rights as between a surface owner and a mineral owner, and they are not true examples of subsurface trespass. They are cited most frequently for the premise that the mineral estate is dominant over the surface estate.

B. Off-lease bottoming, slant wells, and directional drilling

The earliest cases establishing the law of subsurface trespass arose from intentional or inadvertent "slant wells" (wells that do not have a perfectly vertical wellbore). Slant wells can result from bottoming on another party's mineral estate. Off-lease bottoming is the most basic type of subsurface trespass. Hastings Oil Co. v. Texas Co., 234 S.W.2d 389, 398 (Tex. 1950) (bottoming a directionally drilled well upon the land of a neighbor is an enjoinable trespass); Alphonzo E. Bell Corp. v. Bell View Oil Syndicate, 76 P.2d 167 (Cal.App. 1938) (bottoming a well on an adjoining mineral estate without consent is a trespass).

1. Directional drilling and the increased potential for off-lease bottoming

When the law of subsurface trespass was first developing, the technology for purposefully directing slant wells was rudimentary.

Modern directional drilling technology is so precise that it is frequently employed to avoid surface or subsurface obstructions such as bodies of water, powerlines, pipelines, and developments. Directional drilling is also used to drill multiple wells from one pad. This allows the achievement of economies of scale in drilling operations by reducing the overall infrastructure costs of supporting multiple wells. In Colorado in 2007, 57% of the total number of APDs filed with the COGCC were for directional wells from common well pads. So far in 2008, over 60% of the APDs filed have been for directional wells.

The precision of modern directional drilling reduces the potential for accidental off-lease bottoming, but it increases the ability of unscrupulous operators to intentionally target off-lease portions of reservoirs.

C. Perforating

Perforation of the casing or liner of an oil well at a point that is not within the operator's oil and gas lease is a form of subsurface trespass. Frequently, operators with deeper oil and gas leases will have to drill through the shallower mineral interests of others in order to access the reservoirs to which they are entitled. When an operator has a right of access allowing drilling through the mineral interest of another, the operator must not produce from section of the wellbore that is not located within its lease. Off-lease "perfing" is an easy to implement yet difficult to detect method of draining a vertically neighboring mineral estate.

D. Secondary recovery operations and the negative rule of capture

The term "secondary recovery operations" refers to operations designed to maintain or increase production once a reservoir's primary drive mechanism has decreased. In Railroad Comm'n of Tex. v. Manziel, 361 S.W.2d 560, 568 (Tex. 1962), the Supreme Court of Texas discussed the primacy of public policy concerns with respect to subsurface trespass issues in secondary recovery operations:

> "Secondary recovery operations are carried on to increase the ultimate recovery of oil and gas, and it is established that pressure maintenance projects will result in more recovery than was obtained by primary methods. It cannot be disputed that such operations should be encouraged for as the pressure behind the primary production dissipates, the greater is the public necessity for applying secondary recovery forces. It is obvious that secondary recovery programs could not and would not be conducted if any adjoining operator could stop the project on the ground of subsurface trespass."

Pressure maintenance programs involve the injection of water, polymers and surfactants, carbon dioxide and other gases, as well as the reinjection of natural gas back into the reservoir. Secondary recovery operations often result in the migration of the injected substances from the mineral lease of the operator to adjoining estates.

Migration is distinct from an actual physical trespass by an operator. Courts have traditionally balanced the public policy interest in maximizing overall production through secondary recovery operations, with the mineral owner's private interest in preventing inundation with secondary recovery substances.

In Manziel, the Supreme Court of Texas made invasions of secondary recovery substances a regulatory issue rather than a legal one:

> "We conclude that if, in the valid exercise of its authority to prevent waste, protect correlative rights, or in the exercise of other powers within its jurisdiction, the Commission authorizes secondary recovery projects, a trespass does not occur when the injected, secondary recovery forces move across lease lines....The technical rules of trespass have no place in the consideration of the validity of the orders of the Commission." 361 S.W.2d at 568-69.

The court also applied a "negative rule of capture", holding that the owner of a mineral estate may inject substances into a formation even if the substances might migrate through the structure to the estates of others and displace valuable minerals. Manziel placed secondary recovery disputes squarely within the jurisdiction of state regulatory agencies and closed the courts to plaintiff's seeking tort damages for invasion of secondary recovery substances. Subsequent cases took Manziel one step further by ruling that landowners who decline to participate in field-wide unitization for secondary recovery are also precluded from bringing trespass claims arising from the migration of substances lawfully injected into the unit. See Baumgartner v. Gulf Oil Corp, 168 N.W.2d 510 (Neb. 1969) (waterflooding); Phillips Petroleum Co. v. Stryker, 723 So. 2d 585 (Ala. 1998) (per curiam) (fire flooding).

The strict rule of Manziel and its progeny is tempered by courts' recognition that state authorized secondary recovery projects can potentially cause an interference with property rights that rises to the level of a compensable taking. Tidewater Oil Co. v. Jackson, 320 F.2d 157, 163 (10th Cir. 1963) ("though a water flood project in Kansas be carried on under color of public law, as a legalized nuisance or trespass, the water flooder may not conduct operations in a manner to cause substantial injury to the property of a non-assenting lessee-producer in the common reservoir without incurring the risk of liability therefore" because the state cannot authorize the flooder to take the property of the non-assenting producer to serve the public's interest in overall conservation without the payment of just compensation).

For the alternative view that secondary recovery operations can cause a trespass, see Hartman v. Texaco, Inc., 937 P.2d 979, 123 N.M. 220, 221-22 (N.M. App. 1997) (affirming a trial court judgment holding Texaco liable for a blowout that occurred in a neighboring operator's well that was caused by migration of injected water).

E. Exploratory trespass

Geologic exploration is the physical evaluation of a prospect through techniques such as physical examination and test drilling. Geophysical exploration evaluates passive characteristics of the underlying mineral prospect such as radioactivity and gravity readings, as well as non-passive interpretation of seismic data from shock waves projected from the surface. Both geological and geophysical exploration of a mineral interest without the consent of the owner has been recognized as a form of subsurface trespass. The courts have drawn a sharp distinction between the different types of exploration activities based upon the concept of a physical invasion.

1. Physical invasion (geologic trespass)

The most basic form of exploratory subsurface trespass is the unauthorized drilling of a test hole. Drilling into another party's mineral interest, whether for the purpose of production or exploration, clearly involves a physical entry. For example, in Grynberg v. City of Northglenn, 739 P.2d 230 (Colo. 1987), the Colorado Supreme Court held that exploratory drilling without the permission of the owner of the mineral leasehold interest or the owner of the mineral estate was a trespass. Similarly, the non-consensual placement of geophysical devices on the surface and subsurface estates involves both a physical entry to place the devices, as well as a continuing physical invasion by the devices themselves.

2. Non-physical invasion (geophysical trespass)

Courts have recognized that unlawfully obtaining geophysical information is a form of subsurface trespass. See, e.g., Phillips Petrol. Co. v. Cowden, 241 F.2d 586, 590 (5th Cir. 1957) ("It appears well established that in Texas the mineral owner may sue the geophysical trespasser only in trespass and not for conversion of either the information or the right to obtain it."). But courts do not allow recovery unless there has been an unlawful physical entry onto the plaintiff's property by some "thing." Seismic devices allow subsurface exploration without physical entry onto the mineral interest, so courts have had to decide whether vibrations and sound waves are "things" capable of supporting a trespass claim.

Kennedy v. General Geophysical Co., 213 S.W. 2d 707 (Tex. Civ. App. [Galveston] 1948), remains the seminal case. In Kennedy, the plaintiff claimed that vibrations caused by geophysical blasting operations conducted on an adjacent surface estate for the purpose of exploring the directly underlying mineral estate entered his property and amounted to a subsurface trespass. The court concluded that there was no trespass because no straight line drawn on the surface connecting a shot-point to a receiving set crossed any part of the plaintiff's property. Id at 713. The court in Kennedy did not explicitly state that vibrations could not be "things" capable of a physical invasion. Instead, the court determined that no trespass had occurred because the entry of the vibrations onto the plaintiff's property did not cause any physical damage nor did they provide any information about the subsurface structure of the property to the defendant. Id. at 709.

Similarly, overflight and aerial photography and viewing do not constitute a physical entry upon the surface estate. Ratliff v. Beard, 416 So. 2d. 307 (La. App. 1982).

F. Hydraulic Fracturing

Hydraulic fracturing is the high pressure injection of fracturing fluids and proppants into wells for the purpose of setting cracks into the producing formation that increase permeability and stimulate production. The question of whether fractures that cross lease lines constitute a physical invasion capable of supporting a subsurface trespass claim has not been definitively settled.

The public policy concern of maximizing overall production may or may not properly bear on how courts should address cross-lease fractures. Operators who want to fracture wells have argued that fracturing is analogous to secondary recovery because both types of operations maximize overall production. Mineral estate holders who want to protect the portions of reservoirs located on their property have argued that there is no evidence that fracturing increases overall production. See Gregg v. Delhi-Taylor Oil Corp., 344 S.W.2d 411, 418 (Tex. 1961) ("There is nothing...to show that sand fracturing will either cause or prevent waste. While the process may increase production from an individual well, there is nothing...to show that the process is necessary from the public's standpoint to increase the total recovery from the common source.").

If courts are ultimately persuaded that public policy favors fracturing, then they are likely to follow the example of the secondary recovery cases by holding that subsurface trespass principles don't apply and leaving regulation to state agencies.

1. Texas takes the lead:the history leading to *Coastal Oil & Gas Corp. v. Garza Energy Trust*

The most significant cases addressing fracturing have come from Texas. The Texas Supreme Court has twice obliquely addressed whether fracturing can constitute an actionable subsurface trespass, and it is currently confronting the issue head on in Coastal Oil & Gas Corp. v. Garza Energy Trust, No. 05-0466 (Tex. review granted Apr. 21, 2006). Prior to the pending Garza case, the Texas courts have dealt with fracturing in Gregg v. Delhi-Taylor Oil Corp., 344 S.W.2d 411 (Tex. 1961), and Geo Viking v. Tex-Lee Operating Co., 817 S.W. 2d 357 (Tex. App. [Texarkana] 1991).

In Gregg, the Texas Supreme Court decided the question of whether a state trial court or the Railroad Commission properly had primary jurisdiction to grant injunctive relief to preserve the status quo when the plaintiff's neighbor was preparing to fracture a well close to the property line. 344 S.W. 2d at 412. The plaintiff sought relief in court under the theory that the fracture job would constitute a subsurface trespass. Id. The court had no evidence as to the extent of the fractures, but it held that the plaintiff had at least alleged a subsurface trespass:

> "The invasion alleged is direct and the action taken is intentional. [Defendant]'s well would be, for practical purposes, extended to and partially completed in [plaintiff]'s land...While the drilling bit is not alleged to have extended into [plaintiff]'s land, the same result is reached if in fact the cracks or veins extend into its land and oil and gas is produced therefrom by [defendant]." Id. at 415.

The court concluded that fracturing was distinct from the water injection program in Manziel because the Railroad Commission was not specifically authorized by the legislature to regulate it or to decide whether it could ever constitute a subsurface trespass. Id. at 415-16.

In Geo Viking, the Texarkana Court of Appeals applied the rule of capture to reject the argument that an operator had no right to recover oil from fractures extending beyond lease lines. 817 S.W.2d at 363-64. The court did not appear to conceptualize fractures outside of the operator's unit as partial completion of the well on the property of another. Id. Instead, the court simply stated that a landowner is permitted to drill as many wells on his land as the Railroad Commission will allow, and that there is no liability for draining the land of others. Id. at 364.

Gregg and Geo Viking appear to conflict, but neither decision was directly aimed at whether fracturing could be a subsurface trespass. In Gregg the primary dispute was jurisdictional and in Geo Viking the appeal was about properly assessing damages. In Mission Res. v. Garza Energy Trust, 166 S.W.3d 301, 310-11 (Tex. App. [13th Dist.] 2005), a Texas court finally explicitly held that fracing can create a subsurface trespass if the invasion of the fracture lines is "direct" and "intentional." The court declined to resolve the apparent conflict between Gregg and Geo Viking and instead simply followed its interpretation of the Gregg holding. Id. at 311.

The Texas Supreme Court granted review of the Court of Appeals decision in April 2006, and oil and gas attorneys and operators are holding their breath.

2. Proving trespass by fracture: the problem of measurement

Even if fractures that cross lease lines are conceptually recognized as a form of subsurface trespass, proving the length and direction of a fracture is a major practical problem. Courts may struggle to develop an effective evidentiary standard for proving the extent of fractures out from a wellbore because there are "at least four different ways to measure the distance." Mission Res. v. Garza Energy Trust, 166 S.W.3d 301, 314 n.3 (Tex. App. [13th Dist.] 2005). The extent of one fracture wing (an individual crack) can be thought of as (1) the length of the crack from wellbore to tip, the "half length"; (2) the length of the crack that is occupied by the liquid initially used to create the fracture, the "hydraulic length"; (3) the length of the crack that contains proppant, the "propped length"; or (4) the length of the crack that actually contributes to the flow of oil and gas, the "effective length." Id.

Until recently, the extent of the fractures out from a wellbore using any of the four measures could be estimated only with theoretical calculations. New microseismic technology allows for a much more accurate picture. Courts that were originally reluctant to recognize that fracing could cause a subsurface trespass because they feared opening a technical "can of worms" may now embrace microseismic imaging as a reliable method of proof.

IV. DAMAGES

A. General assessment of damages for trespass and conversion

Damages are established by measuring the loss in market value of the mineral interest caused by the unlawful act. Damages can be proven using expert testimony. There is no reduction in the trespasser's liability for costs of any kind, unless the trespass was "in good faith."

Interest is generally allowed on the net amount of oil and gas produced by the trespasser.

1. Punitive damages

Punitive damages are available to plaintiffs with successful subsurface trespass claims whenever the plaintiff is able to recover compensatory damages. Typically, punitive damages for trespass are governed by general state statues. See, e.g., Mission Res. v. Garza Energy Trust, 166 S.W. 3d 301, 315-16 (Tex. App. [13th Dist.] 2005).

Tidewater Oil Co. v. Jackson Oil Co. v. Jackson, 320 F.2d 157, 165 (10th Cir. 1963) ("Kansas follows the general rule, which permits an award of damages in addition to compensatory or nominal damages, by way of punishing the wrongdoer for 'willful and wanton invasion of the injured party's rights'....").

See Fed. Express Corp. v. Dutschmann, 846 S.W.2d 282, 284 (Tex. 1993) (punitive damages cannot be recovered without a finding of an independent tort and an award of actual tort damages).

2. Statutory damage multipliers

In most states, actions for subsurface trespass arise under the common law. Trespass and property damage statutes generally do not explicitly extend to cover subsurface trespass, but they do frequently provide for a damage multiplier (for example, "double damages"). See, e.g., Hartman v. Texaco, Inc., 123 N.M. 220, 222-25 (N.M. App. 1997). Subsurface trespass plaintiffs cannot expect to prevail on their common law cause of action and then receive damages calculated under statutory rules associated with statutory causes of action.

B. Calculating damages in cases of good faith trespass

A good faith trespasser may deduct drilling and operating costs from his damages for trespass. Bender v. Brooks, 127 S.W.2d 168 (Tex. 1910).

1. Proving "good faith"

There are many different judicial articulations of "good faith." A trespasser claiming good faith must always be able to show ***reasonable reliance*** upon some adequate support for his belief that his actions were not wrongful. What constitutes

adequate support varies by jurisdiction, but generally reliance upon advice of counsel is enough. Some cases have required that a trespasser be claiming a right under color of title in order for his actions to be considered in good faith, but this rule is not widely adopted.

Swiss Oil Corp. v. Hupp, 69 S.W.2d 1037 (Ky.App. 1934) ("The test to be applied is that of intent, but being a state of mind, it can seldom be proved by direct evidence. The conditions and behavior are usually such that the court can determine whether the trespass was perpetrated with a spirit of wrongdoing, with a knowledge it was wrong, or whether it was done under a bona fide mistake, where the circumstances were calculated to induce or justify the reasonably prudent man, acting with a proper sense of the rights of others, to go in and continue along the way. And in judging the trespasser's acts, regard must be had for conditions as they then appeared rather than as disclosed in the light cast backwards by the future.").

Miller v. Tidal Oil Co., 17 P.2d 967 (Okl. 1932) (good faith exists when the trespasser "is without culpable negligence or willful disregard of the rights of others and in the honest and reasonable belief that it was rightful").

Sapulpa Petrol. Co. v. McCray, 277 P. 589, 590 (Okl. 1929) ("Good faith consists in an honest intention to abstain from taking any unconscientious advantage of another...").

LeBow v. Cameron 394 S.W.2d 773 (Ky. 1965) (holding that good faith requires that there be some reasonable doubt about the true owner's exclusive or dominant right).

Dethloff v. Ziegler Coal Co., 412 N.E.2d 526 (Ill. 1980), *cert. denied*, 451 U.S. 910 (1980) (holding that a trespass is not in good faith when it occurred in pursuit of a wholly speculative claim on the mineral estate).

2. The rule of cost recovery

When a trespasser invades a mineral interest inadvertently while acting in good faith, he is entitled to reduce his liability in the amount of the costs of production. When the trespasser's costs of production are higher than the value of gross production, no damages are awarded to the plaintiff.

Swiss Oil Corp. v. Hupp, 69 S.W.2d 1037, 1038 (Ky.App. 1934) (holding that "those who invade the property of another inadvertently or under a bona fide belief or claim of right and extract minerals are allowed credit for proper expenditures in obtaining or producing them").

Lawrence Oil Corp. v. Metcalfe, 100 S.W.2d 217 (Ky.App. 1936) (holding that credit for costs is limited to those that were incurred to *actually enhance* the property of the owner).

Miller v. Tidal Oil Co., 17 P.2d 967 (Okl. 1932) (holding that the credit to good faith trespassers takes the form of a right to reimbursement of costs from production revenues).

C. Assessment of damages for loss of speculative value

1. Physical trespass resulting in no production

When a trespasser drills into the mineral interest and the result is a dry hole (no production), the owner of the mineral interest should be entitled to recover damages from the trespasser as compensation for the elimination of the speculative value of the mineral interest.

Matheson v. Placid Oil Co., 33 So.2d 527, 819 (La. 1947) (allowing recovery for a trespass resulting in a dry hole in the amount of the ex ante market value of a lease on the mineral interest).

Humble Oil & Refining Co. v. Kishi, 276 S.W. 190 (Tex. Comm'n App. 1925) (assigning damages for a trespass resulting in a dry hole equal to the leasing value of the mineral interest); restricted to its facts in Byrom v. Pendley, 717 S.W.2d 602 (Tex. 1986). The case also applies a rule that no showing of a loss of a *specific* sale is required in order to establish a loss of speculative value.

The theory of compensation is rejected in Martel v. Hall Oil Co., 253 P. 862 (Wyo. 1927) (denying recovery for a trespass resulting in a dry hole on the theory that a damage award would effectively give the owner of the mineral interest "something for nothing" because the mineral interest is valueless).

2. Geophysical trespass

Modern geophysical technology has allowed trespassers to gain information about the mineral estates of others without actually conducting exploratory drilling. Courts have recognized that exploratory geophysical information is a valuable property interest and that the owner of a mineral estate is entitled to recover compensatory damages when it is unlawfully obtained by others. Grynberg v. City of Northglenn, 739 P.2d 230, 237 (Colo. 1987); Phillips Petrol. Co. v. Cowden, 241 F.2d 586, 590 (5th Cir. 1957).

When a geophysical trespasser is able to make a determination that no producible minerals are present, the speculative value of the property has been destroyed and the plaintiff is entitled to the same damages as if the trespasser had unlawfully drilled a dry test hole.

When no valuable information is obtained by the geophysical trespasser, a plaintiff is only entitled to nominal trespass damages because no decrease in market value proximately resulted from the trespass. See Phillips Petrol. Co. v. Cowden, 241 F.2d at 589, 592 (when a trespasser's seismograms are "so poor in quality that they were unreliable and essentially worthless" the plaintiff has not suffered any harm). However, a plaintiff might be able to recover damages under an assumpsit theory. See id. at 592.

D. Assessment of damages for assumpsit

Assumpsit is an equitable remedy for subsurface trespass claims that can be used when the plaintiff cannot establish traditional tort damages. For example, in Phillips Petrol. Co. v. Cowden, the plaintiff suffered no reduction in property value when a geophysical trespasser took poor seismograms of his property. 241 F.2d at 592. The plaintiff was still able to recover from the trespasser because Texas belongs to the minority of states that permit a landowner to waive the trespass and sue in assumpsit for the reasonable value of the use and occupation of the land. Id. The court assigned damages by estimating the amount for which the plaintiff could have sold exploration rights on the open market. Id. at 593 ("it is necessary to establish the reasonable market value of the use [the trespasser] made of the [plaintiff]'s property, and this value is independent of the benefit that [the trespasser] actually received from that use.").

Assumpsit damages are only awarded when no seismic agreement, surface use agreement, or lease was entered into prior to the alleged trespass. When assigning assumpsit damages, courts attempt to approximate the ex ante bargain that would have been negotiated between the trespasser and the plaintiff. Assumpsit damages can take the form of a lease bonus or

exploration rights. Because assumpsit damages are a proxy for a hypothetical agreement and the predicted consequences of that agreement, courts often struggle to establish a causal relationship between the predicted consequences and actual ex post values.

E. The practical problems of proof and defenses: commingling

Most jurisdictions hold that a commingler of properly possessed or obtained goods with improperly possessed or obtained goods bears liability for the full value unless he or she is able to carry the burden of segregating the two. See, e.g., Humble Oil & Refining Co. v. West, 508 S.W.2d 812, 818 (Tex. 1974) ("the burden is on the one commingling the goods to properly identify the aliquot share of each owner; thus, if goods are so confused as to render the mixture incapable of proper division according to the pre-existing rights of the parties, the loss must fall on the one who occasioned the mixture"). Therefore, as a practical matter of proof, the good faith trespasser bears the burden of separating lawfully obtained production from unlawfully obtained production.

A prototypical situation of this difficulty is when perforations straddle both sides of the division between estates, one of which the producer has rights to produce from but is in trespass as to the other. Operational plans are seldom made in anticipation of the need to separately monitor such commingled production to allow demonstrable segregation. See, e.g., Texaco, Inc. v. Shouse, 877 S.W.2d 8 (Tex. App. [El Paso] 1994).

Under Texas law, a co-mineral owner does not commit a trespass by producing from the mineral interest without the consent of the other co-mineral owners, but merely owes an accounting for the others' share less costs of bringing to the surface. See Burnham v. Hardy Oil Co., 195 S.W. 1139, 108 Tex. 555 (Tex. 1917).

V. DIRECTIONAL AND HORIZONTAL DRILLING

A. Directional vs. Horizontal drilling

The classic conception of directional drilling is conventional vertical drilling done at a straight angle from the vertical. The most familiar uses of directional drilling are onshore wells drilled directionally into offshore reservoirs, and multiple wells drilled directionally from one pad in order to meet surface use restrictions.

The classic conception of horizontal drilling is a curvature of the drill string from the vertical surface well resulting in a the eventual horizontal completion though the target formation, with multiple perforations and completions throughout the horizontal section of the well. The most familiar uses of horizontal drilling are in unique shale formations such as the Barnett Shale in

Texas, the Bakken Formation shales in Montana, North Dakota and southern Saskatchewan, and in unique vertical fractures such as the Austin Chalk Trend in Texas. The more general definition of a horizontal well is any well in which the bottom part of the wellbore parallels the pay zone—the producing portion of the pipe does not have to be at an angle of 90 degrees or less to the rest of the wellbore.

Horizontal wells are by their nature more costly and difficult to drill and complete. The story of horizontal well development has been driven by the ability of the technology to exploit reservoir characteristics that were previously uneconomical, as well as utilizing new technologies such as fracing to enhance permeability in reservoirs that were previously uneconomical using more conventional drilling technologies.

B. Horizontal drilling technology

The horizontal well consists of the vertical build, the build section and the lateral section. The vertical build extends from the surface to the top, or kickoff point, of the build section, where the well begins its gradual deviation from the vertical section of the well, eventually reaching up to ninety degrees deviation from the vertical well. The lateral section begins at the point the desired degree of deviation has been reached.

See Continental Resources v. Farrar Oil Co., 599 N.W.2d 841, 843 n. 1 (N.D. 1997) ("Operators have discovered that drilling a wellbore horizontally along the plane of an oil and gas-bearing formation provides the opportunity to expose more of the productive zone for more efficient capture of this elusive natural resource. What truly seems phenomenal is that this technology is reviving areas that were once thought to be nearly depleted of oil and gas. Its most effective utilization to date has been in reservoirs that are highly fractured. Here, the drilling of vertical wells has always been extremely risky, being dependent upon the chance of actually drilling into such an oil-bearing fracture or gaining access to a nearby fracture through various completion techniques...It is a known fact that a horizontal well recovers hydrocarbons from the reservoir much more efficiently and effectively than does a conventional [vertical] hole. It also takes fewer of them. . . It promotes the drilling of fewer wells (preventing waste) and it realizes the more efficient and economical recoveries of this nation's reserves.")

C. Unique subsurface trespass issues arising from horizontal and directional drilling

1. Surface estate issues

Directional and horizontal drilling allow for the possibility of a drill site located on a surface estate that has no correlation to the target mineral estate. With conventional vertical drilling, the principle of mineral estate dominance controls the mineral estate owner's right to enter and make use of the overlying surface estate. When the drill site is located on a surface estate with no correlation to the target mineral estate, permission of the surface owner is required before drilling operations can commence.

When an operator does not own or hold a lease on the underlying dominant mineral estate, the operator must acquire surface rights that are broad enough to encompass all surface activities attendant to production operations for a time period that is coterminous with the operations.

Robinson v. Robbins Petroleum Corp., 501 S.W. 2d 865, 867 (Tex. 1973) (an operator must obtain consent from the surface owner in order to use salt water from the tract for secondary recovery operations that serve a unit that is larger than the dominant mineral estate that underlies the tract).

2. Mineral estate issues

Directional and horizontal wells may pass through non-participating mineral estates that lie between the surface well site and the target mineral estate. Courts have generally held that permission of the non-participating mineral estate is not required, absent a showing that operations would interfere with the non-participating mineral estate's rights. Humble Oil & Refining Co. v. L&G Oil Company, 259 S.W. 2d 933 (Tex. Civ. App. (Austin) 1953; Atlantic Refining Company v. Bright and Schiff, 321 S.W.2d 167 (Tex. Civ. App. (San Antonio) 1959 (holding). Chevron Co. v. Howell, 407 S.W. 2d 525 (Tex. Civ. App. (Dallas) 1966 (drilling operations successfully enjoined by demonstration of "inevitable" damage to subsurface).

VI. POOLING ISSUES RELATED TO SUBSURFACE TRESPASS

The power to pool must be expressly granted and any grant is strictly interpreted. See Jones v. Killingsworth, 403 S.W.2d 325 (Tex. 1965).

Continental Resources, Inc. v. Farrar Oil Co., 559 N.W.2d 841, 844 (N.D. 1997) (holding that a forced pooling order of the North Dakota Industrial Commission superseded the common law of trespass and precluded a subsurface trespass claim by one operator in a unit against another operator in the same unit whose horizontally drilled hole transected the plaintiff's lease).

In Zinke & Trumbo, Ltd v. Kansas Corp. Comm'n, 749 P.2d 21, 242 Kan. 470 (Kan. 1988), the court held that a Basic Proration Order (BPO) issued by the Kansas Corp. Comm'n (KCC) to establish each operator's allowable production from a common gas reservoir was unlawful because the KCC did not properly consider the effects of one operator's fracture treatment on the reservoir's production dynamics. The frac job at issue "obviously penetrated [the plaintiff]'s lease." Id. at 477. Instead of applying subsurface trespass principles, the Kansas court remanded the issue of allowables to the regulatory agency with instructions to reasonably consider the increase in the "open flow" of the fraced well that resulted from fracture wings that extended onto the plaintiff's lease. Id. at 478-79.

VII. NEW TECHNOLOGIES

A. Technological developments

1. Micro-seismic technology, permanent geophones, and the increasing ability to frac with precision

B. How these technologies apply

1. Greater operational control in both bottom hole location and fracing
2. Greater knowledge as to both
3. Application to disputes: Demonstrate lack or presence of physical trespass
4. Application to disputes: Reduce speculative nature of damages calculation, including segregation to avoid commingling?

VIII. CONCLUSIONS

Until the Texas Supreme Court hands down a ruling in *Garza*, there will be little to report as to seismic changes (pun intended) in the legal environment surrounding directional drilling, horizontal wells, and subsurface trespass. Nonetheless, the current legal environment still leaves a large role for the administrative regulatory agencies. And, the current development of technologies appears to simultaneously provide unparalleled tools in determining what downhole activities have taken place, whether they have strayed into inappropriate and actionable trespass, and what can be done if it has.