MAKING THE EARTH MOVE: LIABILITY FOR EARTHQUAKE DAMAGE ASSOCIATED WITH OIL & GAS PRODUCTION ACTIVITIES

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I. INTRODUCTION

At 3:06 PM on June 2, 2009, the earth moved in Cleburne, Texas. Only a little – but it was the first time in history that this North Texas town, located fifty miles southwest of Dallas-Fort Worth, had experienced an earthquake.[1] By July 24, 2009, a total of seven small tremors had gently shaken the community, the strongest registering 2.8 on the Richter Scale, and at least one major insurance company had notified its policyholders that they could (and probably should) add earthquake coverage to their homeowners policies.[2] No damage resulted from any of these events, but they were exceptionally noteworthy since the area is shown on the USGS Seismic Hazard Map as being in the lowest category of earthquake risk.[3]

Cleburne is located within the Barnett Shale formation in central and north Texas, an area that has recently seen an extraordinary amount of new natural gas production. Not only had the region around Cleburne never experienced earthquakes, it had seen relatively little oil and gas activity until exploitation of the Barnett Shale began in earnest. Naturally, speculation

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[1] Sherry Jacobsen, *Earthquakes fuel questions over drilling in Cleburne*, DALLAS MORNING NEWS, June 14, 2009, *available at* http://www.dallasnews.com/sharedcontent/dws/news/healthscience/stories/061409dnmetdrilling.459ab21.html.; *Cleburne hires geologist after earthquakes*, CBS TV CH 11 (June 10, 2009), http://cbs11tv.com/local/Cleburne.to.get.2.1039543.html.

[2] *7th earthquake since June rattles Cleburne*, DALLAS MORNING NEWS, July 10, 2009, *available at* http://www.dallasnews.com/sharedcontent/dws/news/texassouthwest/stories/071109dnmetcleburne.287b5338.thml.

[3] USGS, *Texas Seismic Hazard Map*, http://earthquake.USGS.gov/earthquakes/states/texas/hazards.php (1ast visited Jan. 10, 2010).

arose that the production activities and tremors were related. Although rumors flew, there was little explanation for the shocks until, in August of 2009, Chesapeake Energy announced it was shutting down an injection well in the immediate vicinity of Cleburne.[4] Production wells extract oil and gas from the ground, while injection wells are used to dispose of contaminated drilling fluids by, as the name suggests, injecting them into the ground in places where the driller's geological studies indicate they are unlikely to pollute water sources.[5] It seemed to follow that pumping huge amounts of uncompressible fluid deep into the ground had to displace *something* – especially when the seismic activity ended with the capping of the injection well.

Some research shows that injection wells may, in fact, be the source of these seismic events. This view is supported by a study of the Paradox Valley in California that showed a causative link between injection wells and over 4,000 tremors of magnitude similar to the Cleburne events.[6] The Environmental Protection Agency (EPA) recognizes the possibility of induced seismicity from injection wells, calling for monitoring, but has not yet issued definitive regulations.[7] While no damage has yet been reported from human-induced seismicity, one has to ask what would happen if it were?

An intriguing speculation is thus presented by the potential for more serious human-caused earth movements: if damage actually does occur, where does (or should) liability lie? Naturally occurring seismic events clearly do not raise liability issues. If, however, it is true that earth tremors can be caused by oil and gas producers, it is reasonable to ask whether there is a rule or theory which may either provide or deny recovery to adjacent landowners should damage result, or whether one should be articulated.

In view of the relatively recent development of injection well technology and its uncertain causative relationship to induced seismicity, it should not be surprising that there does not appear to be a current legal rule establishing the relative rights of these parties. As a property law concern, the question of liability for human-caused earthquakes does, however, bear

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[4] Bloomberg News, *Chesapeake Energy shuts wells linked to Dallas-Fort Worth earthquakes*, DALLAS MORNING NEWS, August 14, 2009, http://www.dallasnews.com/sharedcontent/dws/bus/stories/081509dnbuschesapeakewells.1a1b63d.html.

[5] At least, this is the intent. The EPA requires regulation and monitoring to assure this goal is reached. *See* EPA, *Underground Injection Control Program*, http://www.epa.gov/safewater/uic/index.html (1ast visited April 5, 2010).

[6] Seismological Society of America, *Deep-Injection and Closely Monitored Induced Seismicity at Paradox Valley, California*, 95 BULL. SEISMOLOGICAL SOC'Y AM. 664 (April 2005).

[7] *See supra* note 5.

some resemblance to well-understood common law doctrines regarding subsidence (especially surface damage resulting from mining and mineral extraction) as well as more typical nuisance theories involving interference with use and enjoyment of property as a result of such relatively intangible intrusions as noise or odor. Another analogy worth exploring would be strict liability involving blasting, given the primary source of damage would also be due to shock or vibration.

The candidates for a rule to resolve this issue (assuming a general standard can, or should, be propounded) appear to fall on a continuum from strict tort liability on the operator to the denial of any recovery for affected landowners. While the latter is unlikely, strict liability such as that traditionally placed upon users of explosives also appears to be dubious given the importance of both energy production and environmental protection. Accordingly, we look briefly at traditional nuisance and trespass theories, as well as, strict liability. Our proposed solution, however, will be directed toward an economic analysis technique that would seek the most efficient outcome given the societal, as well as private, costs and benefits. Our conclusion, for the reasons stated below, is that the most efficient rule would be to place liability on the operators under a theory of negligence.

Of course, since no measurable damage was reported from the incidents in question and since even the EPA does not appear to be satisfied that induced seismicity is a real threat, it may reasonably be concluded that this problem is moot, or perhaps trivial; that formulation of a rule can easily be deferred until a real casualty occurs. Although mere intellectual curiosity alone might sustain this inquiry anyway, we believe there is a better line of reasoning to support our effort.

Contemporary debates over the possible depletion of energy resources and fears of irreparable injury to the environment call for serious consideration of any issue that may affect oil and gas production activities, even where actual negative consequences are far less than certain. Established property rights theories and modern notions of cost-benefit analysis, also, seem to clash in this area, perhaps calling for the application of some standard other than traditional property rights to settle the fears of those in the vicinity of the drilling, fears stoked by recent devastation in Haiti and Chile. Rather than arguing whether such concerns are justified, we enter into this exercise primarily to demonstrate a decision-making approach of potentially considerable merit. This approach, an application of economic as opposed to purely legal reasoning, supports *ex ante* determination of issues, if not outcomes, on the basis that such foreseeability is more efficient and is preferable to waiting for a dispute to determine the rule.

II. THE LAW OF NUISANCE: SIC UTERE TUO UT ALIENUM NON LAEDAS

One of the first principles of property that comes to mind in this area is the concept of private nuisance – the admonishment to "use your property so as not to harm that of another" (as the title to this section translates). The notions of nuisance, both public and private, underlie much of the legal dogma ordinarily believed applicable to questions such as the one before us.[8] Under this legal theory a landowner, using his or her own property lawfully, may still become responsible for interference with the use of nearby property of another.[9] Such would appear to be the case where local or limited seismic activity results from the operation of a single well site.

The Anglo-American legal system appears to favor property-based rights and interests above most other classes of right, in some cases without regard to whether any actual damages are measured. Accordingly, a finding of interference with property rights often results in the imposition of remedies by way of the injunctive power of the court, ordering cessation of such interference under threat of penalties based on the authority of the court to punish contempt. If, however, the conduct claimed to be interference is itself a result of the exercise of a property right of equal stature, the potential for a standoff is obvious.

Traditionally, for an otherwise lawful use of property to be considered actionable because of its impact on another's property, there must be an element of intent or knowing disregard of the other's right. Accordingly, the Restatement (Second) of Torts provides that interference with the use of land will be actionable only if the interference is intentional or if the acting party knows that it is reasonably certain to result in harm.[10] For this purpose, considerations for the determination of "reasonably" are outlined in the Restatement.[11] Moreover, the Restatement requires an analysis of the seriousness of the harm or financial burden on the aggrieved party, together with a determination of the utility of the conduct that causes the harm, to determine whether it is, in fact, unreasonable.[12]

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[8] Creating noxious odors, producing smoke or other such annoying or harmful activities, if they directly affect no more than those in reasonable proximity, are generally classified as "private nuisances" and the affected property owners must pursue their own courses of action without the explicit help of government. On the other hand, if a widespread health or safety hazard is created, the notion of "public nuisance" will apply allowing – or even requiring – abatement by the appropriate governmental authority. This discussion will be restricted to private nuisance in the interests of time and space.

[9] For a concise review of the history and current state of the law of nuisance, see Stephen Harlan Butler, *Headwinds to a Clean Energy Future: Nuisance Suits Against Wind Energy Projects in the United States*, 97 CALIF. L. REV. 1337, 1342 (2009).

[10] RESTATEMENT (SECOND) OF TORTS §§ 822, 824.

[11] *Id.* at § 826.

[12] *Id.* at §§ 827, 828.

The application of this relatively ancient line of common law principles to the question of induced seismicity, however, does not produce a satisfying "bright-line" rule. Currently, the lack of measurable harm and the significant benefit of engaging in the extraction of oil and gas and ancillary activities would support a finding of no nuisance. This result, of course, would not be as easy to reach if the tremors caused serious property damage or personal injury. In view of this possibility a general finding of no liability would be unsatisfying, to say the least.

III. STRICT LIABILITY

At the other end of the liability spectrum lies "strict liability." Under this doctrine (sometimes referred to as "no-fault" liability), a plaintiff need only demonstrate damage and show causation to obtain recompense. Since one of the most venerable notions of tort law – the requirement of actual or implied intent on the part of the tortfeasor to either do harm or to ignore the likelihood of harm – is vitiated by this doctrine, it is severely limited in application. The theory shows up most clearly in cases involving damage from inherently dangerous activities such as blasting[13], or the use of firearms. Where strict liability applies, the question of accountability is easy to determine. However, the amount of damages is not. As suggested below, planning and financial forecasting by energy producers faced with strict liability for the results of induced seismicity could be stifled by such uncertainty. Since there would be no "due diligence" or standard of care that could be pursued to eliminate the possibility of having to pay unknown future claimants, producers would be unable to identify the most appropriate course of action. Such a result is "inefficient" in the economic sense – it fails to minimize costs and maximize benefits.

Also, since the incidence of seismic activity resulting from production activities is not common and is in any case quite unpredictable, there is no "common-sense" expectation of damage from the activity. Thus, the base concept of strict liability (a clear, inherent threat of harm) is inapplicable. In any event, scholars have recognized for quite some time that the great majority of strict liability cases would be resolved the same way, whether a strict liability or negligence rule were applied.[14] In view of the judicial reluctance to apply strict liability rules, it appears that this extreme is not a viable choice. Since foreseeability is low, also, the ability to make *ex ante* determinations of probable liability in the face of a strict liability rule would

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[13] Jeremiah Smith, *Liability for Substantial Damage to Land by Blasting Part I, 33 HARV. L. REV. 542* (1920); Jeremiah Smith, *Liability for Substantial Damage to Land by Blasting – the Rule of the Future Part II,* 34 HARV. L. REV 667 (1921).

[14] 33 HARV. L. REV. at 672.

be nearly impossible. It would therefore be equally impossible to adopt strategies to avoid activities that can create loss, and the ability to provide for the compensation of loss by insurance or other means would be greatly hampered as well.

IV. NO LIABILITY

The other extreme, one which is also not likely to be acceptable to many, would be a determination that the operators of injection wells are free to conduct their activities in any way they see fit without regard to potential losses to neighbors. While it may be argued in favor of this position that one is entitled to use property in any lawful manner and, since (at least at this time) the incidence of damage or injury from induced seismicity is nonexistent, the elements of intent or foreknowledge called for by the Restatement are lacking. Such a holding, however, would be essentially a license to perform an activity that not only has an arguable potential for harm, but which also can do damage in other ways, such as contamination of groundwater.

There are few examples in American legal doctrine of an actor being absolved of *any* liability for actions undertaken intentionally, and there would appear to be no justification for creating such an immunity in this case. Just because no one has been hurt does not mean no one will be, and as recent experience in Haiti and Chile show, the harm of earthquakes can be horrendous. Moreover, the EPA has adduced at least some evidence of groundwater pollution from injection wells, and a "pass" on induced seismicity could very well obfuscate legitimate claims of contamination. It is regularly recognized by the courts that businesses, more so than their private-citizen victims, have or should have the foresight and capital necessary to provide insurance for foreseeable damages (or take actions to prevent them) and should therefore be expected to do so.

V. THE COASE THEOREM AND THE MARKET SOLUTION

In economics, an "externality" is a cost imposed upon or otherwise borne by a third party who does not share the benefit of the transaction creating it.[15] Clearly, then, the question of induced seismicity is one of economic externalities. The existence of such externalities is one of the principal economic justifications for governmental regulation of business, with an obvious example being the EPA. Solutions to the externality problem, however, can exist outside direct government action.

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[15] N. GREGORY MANKIW, PRINCIPLES OF ECONOMICS 204 (5th ed. 2008).

One of the most influential analyses of the externality problem in a legal context was made by Nobel laureate Ronald Coase, who proposed that in the absence of transaction costs, the market may be relied upon to achieve an efficient outcome (assuming freedom to negotiate and enter into exchanges).[16] In the case at hand, this would mean that if the producers were exempted from liability, property owners would have an incentive to negotiate with them and offer payments to reduce the incidence of induced seismicity. If, however, the property owners had the right to compensation for any damages, an equivalent incentive would motivate the producer to, in essence, purchase easements allowing then to expose the property owners to the potential damage.

If the Coase Theorem were applicable, then, it would be best (i.e., most economically efficient) to impose no rule at all and allow the respective parties to negotiate a mutually satisfactory solution. This outcome however, relies on the lack of transaction costs,[17] and such is clearly and unfortunately not the case here. This inapplicability of the Coase Theorem arises, in no small part, from the fact that the property owners suffering from the shocks of induced earthquakes would represent a collective, comprising a potentially large number of persons with differing aims or interests. Organizing a group of such claimants has special problems, including extremely high transaction costs, which make the process of seeking and obtaining recompense inefficient (and which prevent Coase's market mechanism from working). Holdouts, for example, can significantly raise the cost of reaching an agreement, consuming resources such as attorney fees, experts' studies, and the like without any compensating benefit to the class of claimants. A similar problem is that of the "free rider" who joins in for a share of the ultimate distribution but who fails or refuses to participate in the cost of getting there. These are, of course, examples of the transaction costs that would prevent the market from efficiently resolving this issue.

Framing the question as we have done so far, however, ignores an important economic goal of the legal system, that being to ensure the most efficient resolution of disputes both on a societal as well as a private basis. That is, measuring the desirability of an outcome should include not just the recognition of precedent and satisfaction of logical analysis, but must also balance the costs, both explicit and implicit, that the outcome (or the process of resolving it) may impose both privately and publicly. In a 2008 article in the Michigan Law Review, Prof. Stuart E. Sterk of the Benjamin N. Cardozo

[16] *Id.* at 217.
[17] *Id.* at 218.

School of Law proposed a framework for resolving questions of this sort which has intriguing possibilities for the problem at hand.[18]

VI. CHOOSING BETWEEN PROPERTY RULES AND LIABILITY RULES.

Recognizing that the law has long known distinctions between "rules of law" that apply without regard to the intent of the parties and more flexible rules that involve intent, negligence or some other basis of culpability, Sterk proposes to openly consider the explicit and implicit costs of complying with each particular type of rule as well as the incentives regarding conduct which may be produced by the rule to be chosen.[19]

Rules of law, unaffected by the intent of the parties, are well known in the field of property law. From the almost incomprehensible (the "Rule against Perpetuities," a traditional nightmare for law students) to the half understood ("finders keepers, losers weepers," which denotes a far more complex relationship in the law than in conventional wisdom) these rules guide conduct and provide foreseeability in the resolution of conflicts. Property rules are most often characterized by relatively absolute applications, giving little or no regard to the impact on the "losing party" of providing a preferential remedy to the owner of the property right, and thus are rules of law.

Where property rules are to be applied, the scope of available remedies is greatly limited, since the court often has no option but to grant injunctive relief even where the burden on the owner of the property right is slight and the cost to the other party is great. Thus, in both economics and law, the existence of such property rights entitles the owner to absolutely exclude all others from the use of or access to the property without regard to the extremity of their need.[20] An economic consideration not often raised in this context is the cost incurred by the parties in identifying the existence and extent of property rights and whether, as discussed at length by Sterk, the expense of engaging in such searches is justified.

Liability rules, on the other hand, provide greater flexibility in fashioning outcomes. That is, where rights are relative, neither party is able to claim or rely on an absolute and thus would have an incentive to negotiate. This result, in fact, is the most intriguing consequence of Stark's analysis. Furthermore, property rules are effective only where transaction costs are

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[18] Stuart E. Sterk, *Property Rules, Liability Rules, and Uncertainty About Property Rights*, 106 MICH. L. REV. 1285 (2008).

[19] *Id.* at 1287.

[20] This of course, is a legal, as opposed to a moral, question. Many examples of the moral attributes of such a rule (such as the traditional argument over whether imminent starvation is a defense to theft) exist but are hardly helpful in resolving these questions in the legal system.

low or where issues of causation are readily determined.[21] Where transaction costs are truly high or where causation is doubtful, or at least unclear, liability rules are likely to produce more efficient results. This would appear to be the case at hand.

It is interesting to note that the literature and focus of the courts on the selection of property versus liability rules has in the past been concentrated almost exclusively on situations where a specific dispute has arisen and requires resolution. Simple common sense suggests that allowing a dispute to arise before considering the consequences must be more expensive than prevention. This is consistent with the fact that once a dispute has arisen, expensive interests not previously existing become established and must be satisfied – paid for – which, of course, are costs that might otherwise be avoidable. Sterk identifies many of these as "research costs", but they would also include expenditures aimed at preserving the status quo or creating a new one, such as attorney fees. In many cases, the adoption of a liability rule, as opposed to a property rule, will encourage the parties (or even make it possible for them) to attempt to discern *ex ante* what outcomes are likely and what extent of liability may be involved. That is, liability rules support prior contemplation and prevention, while property rules are more suited for resolution of existing claims.[22]

This last point is of importance in determining the costs to the various parties, especially the cost of investigating and establishing their own rights. Individual property owners would not have the expertise (or perhaps even the capital to acquire such expertise) to determine the technical basis of any injury or even its actual causation. Nor would they have access to the technical details of a particular well, its depth, the geologic strata it extends into or through and so forth. The operator, on the other hand, would have a much easier time of marshaling the appropriate technical proficiencies and experience (probably already present on staff) to determine whether particular claims of damage may reasonably have resulted from their activities. They would be equally well equipped to forecast for themselves the potential occurrence and scope of such damages. Also, a single operator would be much more likely to be able to plan and execute a program for compensation than a group of disparate property owners would be able to organize and press a collective claim.

Finally, it is important to note that liability rules, as opposed to property rules, provide a greater diversity of options for resolution. The broader spectrum of potential outcomes available under a liability theory (i.e., the parties are not limited to injunctive relief or money damages alone) encourages negotiation. Not hard knock bargaining, but rather principled,

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[21] *See supra* note 15.
[22] *Id.*

interest-based negotiation which recognizes the existence of rights and interests on both sides of a controversy and thus leads more often to a satisfactory resolution, or even a resolution at all. If the liability were settled even before the earth stopped moving, leaving only the size of the check to be determined, that's all the parties would have to talk about.

VII. CONCLUSION

Although the science is clearly unsettled, the strong possibility that injection wells and other activities involved with oil and gas production might cause seismic events is potentially alarming and problematic. Traditional approaches to the resolution of property damage matters are probably sufficient to handle such a problem if it ever arises, but it appears that better, more proactive, solutions may exist.

Choosing between property or liability-type rules appears to be the question, and the choice seems to favor liability rules that are imposed upon the operators. While it may be argued that taking away the protection of a property rule would harm the expectations or interests of the landowners, substantial support exists for a balancing test pitting the property rights of injured landowners against the society's need for energy and environmental protection.

Not only would the creation of liability rules foster negotiation and planning to assure protection of the drillers' interests, the resulting solutions would be *ex ante* rather than merely reactive to existing losses. Property owners' interests would be protected, but at the same time, the essential activity involved with production and environmental protection would be encouraged since the total cost could be determined beforehand and worked into the cost-benefit analysis of the particular project. Since it would be unlikely that such a rule could be judicially developed in a consistent manner, however, appropriate legislation probably should be considered.