

APPRAISING OIL & GAS PROPERTIES

A Newsletter for Appraisal Professionals

Richard J. Miller & Associates, Inc.

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Appraisal and The Cost of Regulation or "Why Don't We Simply Require....."

There is a rather humorous little story on the last page (read it later, not now) about the misplacement of the erstwhile well intentioned, but nonetheless heavy, hand of government regulation on the otherwise pastoral activities of your basic dam-building beaver. The story chronicles what transpires when regulations are created for a purpose but are then enforced with no particular regard for, or knowledge of, the circumstances. The beaver episode ends well but that is not always the case. Regulation is a growth industry that is self-sustaining. In the last newsletter we saw that Reserves are defined, in part, based on existing government regulations. If Reserves are affected by Regulation then so is value. In this issue we will examine the effects of Regulation and compliance therewith on the appraised value of oil properties and will give particular attention to an increasingly important issues: Abandonment and Remediation.

Regulation, particularly as it affects the business in which you work, is a difficult subject to treat objectively and fairly; avoiding the political aspects while concentrating on the practical and economic consequences. Politics and economics are not readily separable. All regulatory efforts have an economic cost to someone and they are often instigated for the political purpose of extracting that price from one group for the benefit of others. Some regulatory efforts restrict business activities while others require the creation and institution of entirely new activities and industries. Compliance with regulations may exact a cost in time and aggravation, but the costs may not be specifically quantifiable. Some regulatory costs are easily quantifiable because they are taxes. Careful examination might reveal that the realized purpose of many proposed or existing regulations is tax revenue not the supposed benefits. It is also not uncommon for regulatory zeal to outrun whatever rational or scientific foundation may exist for the rules, resulting in legislative overkill and greatly expanded possibilities for litigation. A rather lengthy list of such occurrences could be assembled in a short time. However, a current issue, Global Warming, encompasses all of this in a fairly tidy capsule. While the science has been long forgotten and/or ignored, proposed treaties and laws are being written whose primary purpose is government revenue enhancement. Global Warming is a personal favorite because it is so closely related to another timely topic - Junk Science. So, I thought, why not start our tour of the effect of regulation on oil property appraisal with the Mother of all Regulatory Opportunities: Global Warming.

But first, a historical perspective. "In Fourteen Hundred and Ninety Two, Columbus sailed the ocean blue"... in the Niña, the Pinta, and the Santa Maria. That little ditty is a reminder that Columbus is generally given credit for "discovering America". When I was a kid (4-5th grade), I knew Columbus was important not only because he was the first stop in our history book but also

because our school had some Italians (we were considered culturally diverse) who made a big deal out of Columbus - there was Columbus Day and a lot of ethnic pride in a fellow who was, for all intents and purposes, lost. He thought he had reached India but it was really the Bahamas. Then he reported back to Spain that he had discovered new lands when of course he didn't find anything - it had been there all the time as any of the locals could have told him. "India?? Nope, sorry guy, you should have hung a left at the Canary Islands."

To make matters worse - he didn't even get there first. Norwegians had beaten him to it by about 500 years. Now, these guys were some travelers. Around 800-1000 AD, stalwart souls named Olaf and Hågar were sailing all over the world. And with good reason. What with the weather and welfare-state taxes, Norway and Sweden were good places to be from. So many Swedes used the Dnieper river route to the Black Sea that the area came to be known as Rus ("Red"), later Russia. Having acquired a reputation for being as rowdy as sophomores on spring break, they scared the bejesus out of everyone in Europe living close to salt water. Norsemen thought Ireland was so nice they stayed and built Dublin (I can hear the Irish now; "Oh, great, there goes the neighborhood - next it will be the d___ English".) Vikings pioneered the winter Mediterranean cruise; colonized Iceland; and took over parts of England and France. But by far, Björne and Thor's most excellent adventure was to settle in Greenland. The Greenland colony lasted for about 400 years, supported several agricultural villages, and was on the regular trade route back to Norway. Denmark claims Greenland today based on this old Norse colony. Around 1000 AD, adventurers from Greenland even attempted to establish a colony in America. It seems that Olaf and Hågar were out on a cruise and landed on northern Newfoundland. After a short walk-about, Olaf was heard to say, "So, well, Jeez, looks OK to me, whatcha think?", to which Hågar replied, "Oh yeah, you betcha. Let's go back and get the fellas". Unfortunately the colony didn't last long, Olaf and friends ended up as bachelor farmers in Minnesota.

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What is Regulation?

Before discussing the economic impact of regulation on oil properties, perhaps we should reach agreement regarding the nature of Regulation, Here is My Opinion: Regulation is the price we pay for a being part of a civilized society. We can debate the level of civilization in our society today but without regulation it would be infinitely worse and, in its absence, society would be impossible. The issue is not whether regulation is necessary but the form and extent that it takes. Regulation in any form is an abridgement of individual freedom by other individuals acting as a group - ergo society. Whether in the form of unspoken group behavioral norms, the Ten Commandments, or local public ordinance, each and every regulation that is accepted (operative term) infringes on individual freedom. Regulation is ancient, it effects everyone differently, and it is good or bad depending on whose ox is gored (not a pun). To the extent that people go along with these restrictions, the result should be a peaceful, civilized society. Of course, regulation can be so complex as to be dysfunctional. The Constitution was hand-written on a single sheet of parchment. The "reformed" Federal tax code is a foot thick.

Regulation and Property Value

So how does this fit into oil property appraisal? A basic component of individual freedom and the foundation of every successful society is the right to own and dispose of property land, cattle, gold, mineral rights, intellectual property. Ever since the first Neolithic farmer said, "That there's yours, this'n mine", property has been the basis of individual freedom and attainment. And therein, at last, is the connection.

Appraisers, are concerned with the value of property and the rights thereto. Every law and regulation that restricts property disposition amounts to a "taking" of the property for the benefit of others. It may be inconsequential or of great universal benefit but it is a Taking nonetheless. The effect on value of such Regulatory Takings are often difficult to quantify. The utility of regulatory expropriation is that, unlike eminent domain, which requires compensation, it steals your property bit by bit.

The Cost of Regulation

Regulation can often be overlooked in estimating property value because the costs of regulation are difficult to define let alone apply. Regulation which effects property rights, positively or adversely, directly or indirectly, has an effect on value. Good appraisal practice requires the ability to fairly define and then to measure the monetary impact.

The Direct effects of Regulation on value are measured by the difference in value before and after implementation of the Regulation. For example:

- Case A. Your business site has a parking lot. The city wants part of the lot for a bike path but you remain responsible for the lot. The cost is loss of business (fewer parking spaces) and a smaller usable property.

- Case B. The land you have farmed for 30 years is found to be home to a species of endangered rodent and is declared rat pasture by USDA fiat. All or a large part of the property is now worthless.

- Case C. Part of the 400 acres you planned to develop into homes is declared a duck pond and another part must be set aside as "green-belt". Fewer houses; less value.

- Case D. Development of your billion barrel oil project is delayed for several years by obtuse and redundant permitting processes during which time oil prices drop and construction costs escalate.

Each of these cases can be debated as to the relative impact of the imposed regulation on value but there can be no doubt that value is affected. The parking lot issue (Case A) was debated up to the Supreme Court and, Surprise!, the property owner won. (see *Dolan v. City of Tigard*).

Indirect costs are more commonly encountered in oil appraisal because they tend to impact the income stream as (1) charges against income and/or (2) reduction in the time value of money due to delays in construction, startup, or full scale operation. Charges against income result from increased personnel and contract services such as the archaeologist that must be hired to survey the site; landscapers to maintain the greenbelt and trees masking the property; air and water emissions test services; and the cost of hauling waste-water to approved sites when the local percolation ponds are shut-down.

"Why Don't We Simply Require...."

First words of testimony by a representative of the Sierra Club in a geothermal EIR hearing.

In 1993 a study was done for the California Division of Oil and Gas (DOG) to examine the regulatory compliance ("RC") costs imposed on the California oil and gas producing industry. The study compiled a list of environmental and other laws and regulations that affect oil and gas production, estimated the costs of compliance, and identified those regulations which have a high ratio of cost to benefit.

According to the study..... the single most salient finding.. is that local, state, and federal agencies have imposed complex regulatory controls on the petroleum industry (cost over \$375 million in 1991) with little or no requirement to demonstrate that the regulations provide incremental benefits to society to match the costs. " Editor's Note: This statement should be writ large and firmly nailed to the door of every government office.

Of the \$375 million, almost \$180 million or 55.4% was for air quality compliance. Another \$45 million was for produced water management with the balance going for a laundry list of regulatory categories including \$44 million in local land use. This doesn't sound like much when compared to an estimated market value of production of about \$4.5-5.0 Billion, but the study also compared the RC costs to total costs of production and to crude price. It was found that RC cost an average \$0.55 per barrel in the San Joaquin valley but cost \$2.39 per barrel in the Long Beach area. As a percentage of lifting costs, RC was 9% in San Joaquin and 27% in the Long Beach area. A producer in Long Beach paid 20% of the wellhead price of \$12.00 (1991) to comply with regulations.

One weakness of the study was that the costs were not normalized for economies of scale. San Joaquin produces far more oil than Long Beach so the costs are distributed over more barrels. However, actual dollar costs were much higher in other areas when compared to San Joaquin. Other areas of California had higher or lower expenses in terms of lifting costs or crude price. While the composition of the costs varied considerably from area to area there was no question that, in those regions that were most heavily regulated, the associated expenses were the highest and had a significant impact on costs of production. And these costs are on top of "ordinary" lifting costs. There are a lot of other numbers to play with but the point is made.

Charges against Income

A cost that can be measured is a cost that an appraiser can account for in estimating value. Even if the property is not in the LA Basin, the compliance and other regulatory costs must be considered. What are these costs? First, the easy ones. There are the fees that must be paid - fees for filing for approvals, disposal fees, inspection fees, licenses, permits, payments for air quality offsets, plus the fines and other payments if you forget. Then there are the harder ones. How much of the Labor and Benefits budget (staff time, pumper time, engineer's time), is devoted to the requirements of RC such as filling out and filing paperwork, inspecting facilities, and installing new equipment because the regulation says so. What about the cost of reduced productivity whilst paper-pounding? Where RC is a political tool, how much Public Relations expertise is wasted to trying to convince the locals that you are a "good corporate citizen"?

An argument can be made that RC costs get absorbed into operating costs, (which they generally do) and that there is not much point in trying to dig them out. I disagree. As seen above, RC costs are local, varying geographically, and have been known to change as the political environment changes. A knowledge of the RC component of operating costs may help in understanding the subject property and its relation to any properties that you might think are comparable.

Compliance costs usually impact the income stream through four categories; Disposal, Labor, Overhead, and Capital Investment. Disposal can be a major cost. Dumping produced water into sumps or creeks is no longer acceptable. An approved disposal well or other site is usually required which may mean trucking. In some urban areas, water can still go into the sewers but there are substantial fees for the privilege. And water isn't the only thing. I recently appraised a very small field where produced sand was considered to be toxic and had to be trucked 500 miles to an "approved site". Sand and water disposal was the second largest field expense.

Labor is something else. The 1993 DOG Study described RC costs in terms of barrels of production and as a percent of total costs but that was for effect. Labor costs related to RC do not vary with production or well count. They are fixed. It takes just as long to provide reporting to the AQMD when production is down as it does when production is up. The Water Resources guy doesn't give you the day off just because oil price is down. You have to do it or pay the fines. So these costs should go into the appraisal as so many dollars per month.

RC costs are also an increasing part of Overhead. The staff environmental specialist and the PR guy are Overhead. There is a tendency in appraising properties to overlook or minimize Overhead but that is a mistake. It is a commonly held belief that a small operator can operate cheaply due to lower Overhead. I am not sure that is necessarily true as a whole but in regard to RC the opposite may be more correct. Big Oil can manage compliance problems by setting up an RC group that is separate from production operations. MometPop Oil Company may well have to chose - pump oil or fill out forms.

Finally, there is Capital Investment. How much investment is required for a project in excess of that indicated by engineering design criteria in order to comply with regulation? How many

screening trees, site redesigns, new roads and schools, flora and fauna inventories, or butterfly pastures must be included in the budget in order to achieve RC?

Again, they may all be well-intended requirements but there are costs and they must be accounted for and considered in any determination of value.

With enough data, an appraiser can determine the costs associated with compliance, apply them against the income stream, and estimate the reserves and value of a property based on the prevailing and expected regulatory environment.

Time Value of Money

There are other parts of RC to consider ranging from the myriad of permits and licenses necessary to drill and operate a well to the multiple phonebook-sized EIR's that must be filed and even Congressional action needed to resolve a problem. They can all be gathered up under two valuation issues likelihood of completion/production and time value of money.

Regulatory issues reduce the value of oil properties when development is impeded by those issues. If a reliable estimate of completion of permitting approval for a new gas plant is 2-3 years, that time has to be built into the appraisal. If a new drilling project to access an hitherto unproducible oil accumulation requires not just an EIR but public approval, then the project cannot be valued as if it were starting up today. Depending upon local attitude, some uncertainty maybe prudent. In appraising these properties there must be allowance for both time delay and the uncertainty of a positive result. Pop Quiz Questions: What is the value of a fully constructed facility for which start-up permits are denied for four years? And my favorite - If a property is, in all respects, a candidate for a steamflood but local law prohibits steam generation equipment, then can there be any value to the potential steam flood recovery?

Abandonment and Remediation

An increasingly important subset of RC is Abandonment, Restoration, and Remediation ("AR&W"). When oil production comes to an economic and/or physical demise most leases and applicable Federal, State and local laws require that the well(s) be abandoned and the land surface restored to its original condition. Unlike the old days, Abandonment now requires more than an old tree stump and a sack of cement and Restoration has come to mean more than just running a bulldozer over the well site and scattering some grass seed. And as the end of economic life approaches - more rapidly in some places than others - operators and appraisers have to plan for the big day. At the current oil price in California, that is today. While the operator calls Halliburton, the appraiser has to estimate the costs and decide how to include those costs in the appraisal.

Estimating AR&R Costs

The cost of abandonment of wells and facilities can be estimated with reasonable accuracy based on the existing and foreseeable requirements of state and local agencies. The cost is generally a function of age and depth of the well and the complexity of the completion interval. Old wells

with casing cement of questionable reliability are particularly troublesome where ground water communication is an issue. It is not unusual, in areas that have been developed over decades, for an operator to have to dig up and re-abandon oil wells to prevent leakage and other mishaps. Service companies are usually pleased to help - and give discounts for bulk jobs. So many wells times X dollars per well.

Restoration of the surface may be a bit more difficult depending on local requirements, the nature of the land, and the intended future use. Barring major unforeseen events, a good estimate should be possible with the help of qualified engineers and, if necessary, local environmental specialists. There is always the unknown flowline or forgotten well that has to be dug up but the total cost of abandonment plus restoration should not be too difficult to ascertain.

Remediation is another story. Soil remediation maybe necessary when it is found that tanks, flowlines, and well heads have been leaking or where there have been unlined sumps in use. In old oil fields with tanks and sumps on every lease it would be prudent to count on some soil remediation. These costs can be significant. Once you start digging there is no stopping until you are done. If you are lucky the contamination will not have spread far and is all on your property but it can get out of hand. There is a small town here in CA that will essentially be demolished in order to correct soil contamination. Groundwater contamination due to leakage or spills generally goes far beyond the costs of remediation and gets into lawsuits and related expenses.

There may be a legitimate debate about the amount of the costs and who is responsible, but there can be no doubt that potential remediation costs do impact the value of oil properties. In recent years purchase and sale agreements for oil property acquisitions contain some especially and imaginative language and procedures for (a) side-stepping, (b) disclaiming, and (c) ensuring financial responsibility for future abandonment and remediation. A buyer is not likely to pay full price for a property if there is the potential for substantial remediation expense during the remaining life of the property. Similarly, a seller may be willing to accept a lower price for a property if he can shift responsibly for future clean up to the seller.

The real problem with estimating remediation costs are that (a) no one wants to talk about potential remediation because that may suggest that it is necessary and (b), partly because of (a), the costs are difficult to estimate because if you do the necessary tests you may have to report the results which could trigger a requirement to do the work. Also, while a fair amount of experience with remediation costs has been accumulated by individual companies, a generally available database is nonexistent. Our firm has been on a minor crusade to persuade companies to pool remediation cost data, even if only on service stations, so that some data would be available. I have no sage advice on how to handle the remediation issue except to say that, if there is reason to think there will be a need for remediation, some kind of estimate should be made and included in the appraisal. The real estate appraisal business has made some progress on this issue which may be applicable (see References). We have had some success in property tax hearings with the scientific approach: "Aw Shucks, I don't know. How about double the Abandonment Costs"?

Remediation is site specific as to the regulations in effect, the extent of the problem(s), and the potential use of the site. Where the only use for the next 100 years is cow pasture, soil

remediation may not be as great a concern as it would be in an urban area where homes and schools are planned. Nonetheless, for each property being evaluated the appraiser must consider and include the costs for abandonment, restoration, and potential remediation.

Salvage

The AR&R costs may be partially offset by anticipated salvage of well equipment and facilities. In ancient times abandonment costs were assumed to be offset by the salvage value of recoverable tubing, rods, pumping units, and other stuff. That was a reasonable approach 10-20 years ago, but today the oil business is not a growth industry in many areas and there is not much market for old tubing and gas meters. Out our way old pumping units have little or no value and salvage companies have to be paid to haul away tanks and other equipment. So salvage value should not be considered an automatic offset. If there is any salvage value, consider it a gift.

Applying AR&R Costs

Estimating the potential cost is only half the job. The appraiser still has to determine how to account for the AR&R cost in the value of the property. As noted, in the old days, little thought was given to abandonment costs let alone remediation; the general attitude was that whenever it became necessary salvage would cover it, but it was so far away - why bother. So some number was stuck out at the end of the cashflow where it had no impact. Times have changed. In many areas it has become eminently clear that abandonment is imminent. (Don't you just love plays on words?) And besides, good appraisal practice requires that we no longer slough this off.

There are a couple of ways to handle these costs depending, to some extent, on the purpose of the appraisal. For an SEC or company internal evaluation, it may proper to say that abandonment costs will be paid by funds accumulated at the corporate level out of general revenues. In this case the costs show up on the balance sheet and are reported in the financial notes. Where the company does so, (and according to annual reports and 10-K's, many do), this approach may be acceptable as long as the appraiser is satisfied that the estimated costs are reasonable and that there is adequate provision for accumulation. It is interesting that in many companies this accumulation of funds has reached down to the operating level where it is shown as a budget line item.

On the other hand, where the appraisal of a specific property is at issue, such as for ad valorem and other taxes or for acquisition, the AR&R funds should be accumulated out of the cashflow of the property. An external source should not be assumed. The reasoning here is pretty simple. If I own an oil property that produces for 10 years to economic limit and I then have to pay \$100,000 in AR&R costs there has to be a source for those funds. In valuing that property today I have to recognize that in 10 years I have to come up with \$100K from somewhere. Simply deducting \$100,000 as an expense in Year 10 and present worthing it back doesn't solve the problem because in year 10 the cost will be \$100,000 in current dollars not PW dollars and, by definition, the property is uneconomic. The way to do it is to deduct a certain amount from cashflow every year that will add up to the AR&R cost. This is a common practice in real estate appraisal known as a "replacement allowance". Using a replacement allowance, the appraiser recognizes funds are set aside for predictable major expenditures - a new roof on an apartment building or replacement of

the HVAC system in an office building. In our homeowners association, half the monthly assessment is budgeted for eventual replacement of the clay tile roofs - something I need to chat with them about.

If anything is predictable in oil property appraisal it is that the property will eventually have to be abandoned and that at that point someone will have to pony up the money to pay for it. That being the case, the appraiser should make an estimate of the costs and then devise a process for accumulating those funds. With regard to the replacement allowance the Appraisal of Real Estate (10th Edition, pg. 449) states, "The... allowance for each component (of replacement) is usually estimated as the anticipated cost of its replacement prorated over its anticipated remaining economic life..... Assume a property with an income stream from declining production which reaches economic limit in 10-years. The "AR&R allowance" could be accumulated in a number of ways: (1) a fixed amount as \$/month, (2) a variable amount based on percentage of revenue or units of production, or (3) a combination. The longer the life and the smaller the estimated cost, the less the impact on value; but the approach is both logical and good appraisal practice and is starting to show up in acquisition appraisals and internal company planning evaluations.

The next issue is a proper treatment of the accumulating funds. It would seem that, for appraisal purposes, a form of sinking fund would be most useful. In this approach, the current dollar estimate of AR&R cost is escalated at the rate of inflation to obtain an estimate of the costs 10 years hence. The funds deducted from cashflow are assumed to be placed in an interest bearing account which compounds over the period of accumulation. If the interest rate exceeds the cost escalation rate (it should) then the amount to be deducted from cashflow can be reduced. (See Appraisers Workshop).

References

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- "Measuring the Effects of Hazardous Materials Contamination on Real Estate Values: Techniques and Applications," a Technical Report of the Appraisal Institute, Chicago, IL, 1992.
- "Environmental Site Assessments and Their Impact on Property Value: The Appraisers Role," Colangelo, Robert V. and Miller, Ronald D., Appraisal Institute, Chicago, IL. 1995.

Now Back to Global Warming (continued from Pg.2)

So where were we - oh yeah, Greenland. How, you might well ask, could anyone live in Greenland for 400 hundred years let alone farm? To be sure, the settled area was only a strip along the southwest coast and life was not easy given the almost total lack of resources. It was possible for one reason "Global Warming". Al (Mr. Charity) Gore and your local treehugger want you to

believe that Global Warming ("GW") is a recent event caused, as usual, by humans in general and industry in particular. In fact, GW, along with its sibling "global cooling," (the environmental catastrophe-in-waiting in the 1970's), have been around for a long time.

As, every geologist knows, the earth goes through cycles of heating and cooling and was doing so long before the Industrial Revolution. Remember the so-called "Dark Ages"? In school, we were taught that the period following the fall of Rome was culturally depressed because of all the Barbarians who showed up uninvited and stayed. Maybe so. But it was also a global cooling period and it was just too cold to go out and invent things with the neighbors. But starting in the 800's or so, a warm-up began. Shivering Europeans poked their heads out and before long they were busy building cathedrals; going on Middle East excursions; and farming in Greenland. There was a 200-year cold snap in the 1600-1700's that slowed things a bit but not for long. The "Little Ice Age" resulted in the expansion of glaciers in the Alps and elsewhere, which expansion became a point of reference for latter years. Since then the Earth has been gradually warming up. A recent study suggests that we are still below the average temperature for the last 3,000 year period (See Reading). The cycles are apparently a function of solar not human activity. Global Warming may well be occurring as part of a long-term trend but there is not necessarily any relation to industrial development or energy use. We are returning to the climatic conditions that allowed farming in Greenland 1000 years ago.

To hear the Great Evader tell it, all the world's scientists agree that global warming is occurring and that it can only be stopped by government regulation to reduce emissions of carbon dioxide and other so-called "greenhouse" gases. In fact, the only agreement among scientists who have actually studied the matter is that there is such a thing as a 'Greenhouse Effect' but there is no consensus as to whether warming is occurring, the degree of warming, or the cause.

Global Warming is the 1990's vehicle for further government intrusion, on a global scale, into industrial development in general and the energy industry in particular. The last effort, during the Energy Crisis of the Carter administration, brought us the "Windfall Profits" tax, subsidies for windmills and garbage dump methane, 55 MPH speed limits, and CAFÉ standards for automobiles.

According to current theory, the burning of hydrocarbon fuels produces excess carbon dioxide which results in a "greenhouse effect" leading to increasing atmospheric temperatures which will cause untold human hardship and the end of the world as we know it. Apparently the only way to stop this cataclysm is to reduce the burning of oil, gas, and coal or stop breathing. Some incentives will be needed such as increasing the cost of energy so everyone will cut back (sound familiar). The current talk in DC is about raising the tax on cigarettes \$1.50 a pack or about 35%. If the same % is applied to crude oil (at normal prices) WTI would be about \$27.00/Bbl. If CO₂ levels do not go down, then obviously the incentives are not strong enough so more taxes will be needed. Bad news for compost lovers methane is also a greenhouse gas. Rumor has it that Methane emission prevention and amelioration systems for cows are currently being designed with your tax dollars.

Reading

"Environmental Effects of Increased Atmospheric Carbon Dioxide," Robinson, Arthur B.; Babuinas, Sallie L.; Soon, Willie; and Robinson, Zachary.; George C. Marshall Institute and Oregon Institute of Science and Medicine, January, 1998. (www.oism.org/project)

"Abstract - A review of the research literature concerning the environmental consequences of increased levels of atmospheric carbon dioxide leads to the conclusion that increase during the 20th Century have produced no deleterious effects upon global weather, climate, or temperature. Increased carbon dioxide has, however, markedly increased plant growth rates. Predictions of harmful climate effects due to future increases in minor greenhouse gases like CO₂ are in error and do not conform to current experimental knowledge".

"Nonstandard Reserves Estimates lead to Resource Underestimation," Ross, James G., Oil and Gas Journal, pg. 39, March 2, 1998.

Appraisers Workshop by Ellwood

Accounting for future abandonment and remediation costs in an income approach appraisal is done through the use of a sinking fund or similar approach. As an example, assume a fully developed oil property with 100 wells, drilled in the 1930's, a modest tank battery and necessary flowlines, a small gas separation facility, and several old sumps which have been buried. Let us further assume that a reliable estimate of the current cost has been obtained which totals \$1 million of abandonment of the wells, restoration the site, and remediation of contaminated soil about the sumps and tank battery. Further assume that remaining reserves are 500,000 Bbls to an economic limit in 10 years. If inflation is assumed to be 3% for all components of the estimate, then the future cost of AR&R work, when undertaken in 10 years, would be \$1,344,000 using an inflation multiplier of 1.3439 and rounding off. The appraiser should consider not only dollar inflation of materials and labor but also regulatory and litigation inflation particularly if remediation costs are being considered. This form of inflation results from the expansion and increased complexity of regulation over time. This effect is part of the natural law of government covered by Ellwood's Second and Third Theorems which are as follows:

- Second - A Regulation, once placed in motion, will remain in motion forever.
- Third - A Regulation, once introduced into an area of human endeavor, will expand to fill that area until all activity, except that resulting from the regulation, ceases.

The necessary amount can be accumulated in several ways within the structure of the appraisal cashflow. The simplest approach is by a uniform periodic deduction from future cashflow of \$134,400 per year (\$11,200 per month); however, while simple it ignores the uncertainty of the cashflow in later years and, in a declining cashflow, fails to take advantage of greater income in early years. Another approach would be to deduct a certain amount per unit of production to accumulated the required amount. In our example, this would be \$2.69 per barrel. Still another method would be to deduct a certain percentage of cashflow each month. A note of caution: AR&R

is deducted from cashflow not from net revenue; these costs do not influence the economic limit.

The use of a sinking fund approach requires that accumulating funds be "deposited" in a safe, interest bearing "account". Treasury notes at 7% (inflation at 30/o) are a good example of such an account. When this is done the interest earned is income which can be used to partially reduce the amount that must be deducted from cashflow. The appraiser must determine the amount of the periodic deduction which when compounded at 7% per year accumulates to \$1,344,000. There are standard formulas to calculate this amount for fixed monthly deductions (see Appraisal of Real Estate, 10th Edition, pg. 720). The calculation is more complicated if a \$/Bbl or % of cashflow deduction is used and may require some trial and error analysis using a spreadsheet program. When completed, Us calculation allows the appraiser to estimate a value for a specific property which accounts for all the assets (future income) and liabilities (cost, investment, and AR&R) - attributable to that property.

Appraising Oil and Gas Properties is a publication of the Petroleum Engineering and Appraisal consulting firm of Richard J. Miller & Associates, Inc. For further information, letters and continents, and/or additional copies, please write, call, fax or E-mail:

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Ode to a Primitive Device

*I think that there will never be
A computer to match my K&E
A primitive device made from a tree
I think mine was mahogany*

*It could multiply or divide
Then do logs on the other side
It worked in daylight and in gloom,
In the field and in my room*

*It gave me answers without sound
And never told me "Files not Found"
PC's are fast and sometimes svelte
But I still can't hang one on my belt.*

*The add-on was a leather case
And I had no need to interface
With Mcrosoft, Corel, and Norton
They weren't around, they weren't important*

*Service was easy, to make it move,
Talcum powder in the grooves,
The manual for my old slip-stick
Was a pamphlet just one-eighth inch thick!*

*Slide rules aren't fast, nor are they cool.
Engineers now have a quicker tool
But as I watch my TV screen
A slide-rule brings home Apollo 13.*

From the Wall Street Journal editorial page:

The Spring Pond Beavers

Now that the Academy Awards have been handed out, we are proud to present the Award for Environmental Lunacy to the obscure Michigan bureaucrat who sent the following (abridged) letter to a landowner last December:

"It has come to the attention of the Department of Environmental Quality that there has been recent unauthorized activity on the above referenced parcel of property. You have been certified

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as the legal landowner and/or contractor who did the following unauthorized activity: Construction and maintenance of two wood debris dams across the outlet stream of Spring Pond. A permit must be issued prior to the start of this type of activity.... The Department has been informed that one or both of the dams partially failed during a recent rain event, causing debris dams and flooding at downstream locations. We find that dams of this nature are inherently hazardous and cannot be permitted.... Failure to comply with this request, or any further unauthorized activity on the site, may result in this case being referred for elevated enforcement action.....

The landowner's response (also abridged) just about says it all:

"[A] couple of beavers are in the (State unauthorized) process of constructing and maintaining two wood "debris" dams across the outlet stream of my "Spring Pond. While I did not pay for, nor authorize their dam project, I think they would be highly offended that you call their skillful use of natural building materials "debris"... As to your dam request the beavers first must fill out a dam permit prior to the start of this type of dam activity, my first dam question to you is: are you trying to discriminate against my Spring Pond Beavers or do you require all dam beavers throughout this State to conform to said dam request? If you are not discriminating against these particular beavers, please send me completed copies of all those other applicable beaver dam permits.... I seriously hope you are not selectively enforcing this dam policy-or once again both I and the Spring Pond Beavers will scream prejudice!" The Michigan Department of environmental Quality informs us that the case has been closed.

Big government did not come in to existence all at once. It grew because particular crises - real or orchestrated - were utilized to create enduring institutions that would outlive the events to which they owed their existence and expand thereafter whenever the opportunity presented itself or could be created. Dr. Thomas Sowell, Forbes, April 20, 1998