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Geological Carbon Dioxide Sequestration

Insurance and Legal Perspectives on Liability

September 2004

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Executive Summary

The large-scale geological sequestration of carbon dioxide is a potential mechanism to slow the accumulation of atmospheric greenhouse gas (GHG) emissions in the earth's atmosphere. Policy initiatives need to develop a consistent set of regulations and incentives to manage what is becoming a new class of assets. When regulations allow for transactions of emission rights among various parties, issues regarding liability for underperformance become significant. If these potential liabilities are viewed as debilitating by potential project developers or buyers of the subsequent emission credits produced, then it is highly unlikely that the potential of large-scale geological sequestration will be fully realized.

Traditionally, insurance helps organizations deal with different kinds of uncertainties, by spreading risks of underperformance among a wide pool of similar assets. Conventional insurance products, however, have difficulties dealing with new asset classes, where actuarial data regarding risk occurrence is not fully understood. This means that there is a role for industry driven risk mitigation strategies, because third party products may not be available. First generation products that may have significant financial liability implications upon the participants may also require some form of externally provided support. There will likely be the need for government to assume some of the early stage risk especially if domestic and international policy is driving carbon dioxide mitigation strategies.

This report reviews the following:

- ▷ Emerging domestic and international policy tools to address GHG emissions.
- ▷ The role of geological sequestration in overall GHG emission policy.
- ▷ Potential risks and liabilities associated with geological sequestration.
- ▷ Risk mitigation and insurance strategies for sequestration activities.

This report assumes that positive performance from emission mitigation activities will have an economic value at some point in the future for those companies that engage in it. Exactly how such performance translates into financial value on the balance sheet remains to be determined. While there are fairly well established transactional models available for renewable energy and energy efficiency projects, sequestration activities are relatively scarce in recent global emission trades related to Kyoto's potential implementation. Sequestration transactions that have occurred have been principally biological in nature. Biologically based sequestration has mainly included tree planting and forestry maintenance. This general lack of experience has created a general knowledge gap for all types of sequestration. Sequestration initiatives, and specifically the geological sequestration of carbon dioxide, are evolving in a dynamic environment where technology, domestic policy, and international regulations intersect to influence decision making. A great deal of uncertainty exists under which all types of GHG mitigation strategies will operate and it is this uncertainty that makes risks and the associated liability of paramount concern.

Emission Market

Developing geological sequestration as part of the emerging greenhouse gas (GHG) emission market, public policy must determine the accepted methods of transactions, how risk is allocated among parties, and what the consequences should be for underperformance. This is true particularly if the performance projected by the sequestration is being used by an entity to meet policy driven emission goals. While biological sequestration provides some guidance, geological sequestration has its own unique characteristics that need to be fully analyzed. More importantly, before policy can set guidance for liability issues, it must establish the appropriate standard for achieving full performance and the accepted metric for measuring relative underperformance. Sequestration is a particular challenge in this, because its performance is strongly dependent on a significant passage of time. The time variable typically does not have an equivalent significance in alternatives involving direct emission reduction measures.

It is not the purpose of this report to evaluate the particular statistical likelihood that geologically sequestered carbon dioxide will be accidentally released. Geological sequestration involves a wide range of engineering techniques, each with their own performance and risk profiles. This report is solely focused on the secondary financial aspects regarding sequestration and how risks and subsequent liability can be addressed from a public policy compliance perspective. Although this report is primarily concerned with sequestration performance under GHG emission strategies, public health and environmental protection is discussed in the next section. If there were a catastrophic failure of geologically sequestered carbon dioxide and the ensuing carbon dioxide caused significant damage to a local population or ecosystem, the financial ramifications would fall within the bounds of conventional casualty insurance.

The scope of this report does not cover how geologically sequestered carbon dioxide will be monitored. Credible monitoring and verification is a key component of any type of emission transaction and is especially important in sequestration transactions where long-term performance is important. These will be crucial if geological sequestration becomes a more significant part of public policy and the financial transactions supporting that policy. Environmental advocates who have continually challenged biological sequestration will similarly challenge the ideas supporting geological sequestration. The technology for geological sequestration and the data it provides must be relatively transparent, if geological sequestration is going to be used as a potential compliance tool. For the purposes of this report, it is assumed that credible monitoring and verification methods are possible and that these would support various accounting and risk mitigation mechanisms.

Some of the mechanisms discussed within this report may ultimately represent an overestimation of what is otherwise a reasonably manageable risk. Evidence from several of the largest geological sequestration pilot studies such as undertaken by Statoil in the North Sea have indicated that the risk profile of geological sequestration

may indeed be quite low. Even if the actual risk is quite low, however, using geological sequestration in a compliance context will always have some level of identifiable risk and contingent liability from potential underperformance that companies will look to diminish.

Emission Regulations

Although still a topic of intense scientific and even more dramatic political debate, it is generally believed that the aggregate accumulation of GHG emissions in the atmosphere will at some point cause a negative dislocation to the global climate system. Because of this potential, a range of policies and voluntary initiatives has been promoted over the past decade and a half. The most notable of these, the Kyoto Protocol to the United Nations Framework Convention on Climate Change, currently influence the policy activities of Europe, Japan, Canada, and New Zealand. In these countries, formal "caps" on GHG emissions are an accepted public policy parameter for the foreseeable future.

The United States has rejected Kyoto for several reasons. Most notable is the potential impact on the US economy and the fact that Kyoto places only incentives, rather than restrictions, on the emissions performance of large developing economies like China, India, and Brazil. Despite this stance against Kyoto, there continues to be a variety of policy initiatives for managing GHG emissions in the US. These are occurring at both the Federal and State level, as well as in the private sector. Many US corporations expect that they will eventually come under some form of GHG restrictions on their domestic as well as international activities. As a result of this perception, most major US multinational corporations already have GHG management plans for their overseas operations.

Fundamental aspects of the GHG debate help to define which public policy options are available to policymakers. GHG emissions, and potential future emission reductions, in the global economy come from tens of millions of disparate sources across many sectors: energy, chemical, agriculture, forestry, urban development, and waste management. The climate change issue is inherently global in scope. Damages from climate change can not be ascribed in any particular source and atmospheric systems mix all carbon dioxide emissions uniformly around the globe. The implication of this is that GHG emissions can be mitigated at any location using a variety of interventions and have in the end an equivalent global effect. The most efficient policy would create incentives for the highest possible participation of entities who can provide GHG mitigation at the lowest possible cost. Assuming that policy allows emission rights to be freely traded, the average price of emission reductions is brought to a natural clearing price in the open market.

There are two principal frameworks under which emissions can be regulated. These are through command and control or through market mechanisms. It is generally

recognized that command and control, implementing technology interventions or restricting operations by government mandate, would be ineffective in controlling GHG emissions. Due to this perception command and control options have been largely dismissed. Market incentives for pollution issues break down to either the implementation of a tax on emissions or the use of emissions trading or some combination of the two. Taxation alone is a blunt instrument for regulating GHG emissions. Even Europe has almost completely rejected taxes for meeting its Kyoto commitment, instead relying on the European Union Emissions Trading Scheme. GHG taxes are economically inefficient because there is an enormous range in the marginal abatement costs for reducing GHG emissions across different sectors and across different economies. Taxes on core energy products generally need to be set enormously high in order to impact behavior. This approach is subsequently not efficient in achieving the desired environmental goal.

Emission Trading

Transferability of emission rights or credits is almost certainly the key to any efficient GHG regime. Trading mechanisms can even work within a taxation scheme as long as impacted companies can purchase emission credits external to their operations in order to lower their net liability to the tax. A general principal of trading is that the wider the potential pool of suppliers of emissions performance, the lower the aggregate cost will be. The greater the number of participants, however, the higher the overall operating costs of the system. Over the past fifteen years, the international debate has centered on exactly how wide these markets should be. This has included a discussion on which sectors and which countries should be allowed to participate and under what conditions participation should be granted.

The concept of emission trading, either as a principal policy instrument or as a means to broaden a tax-based emissions scheme is assumed to be the most likely methodology for reducing GHG emissions. Emissions markets are designed to be cap and trade, baseline and credit, or some synthesis of the two. In general, impacted entities are endowed with a particular allowance of emissions over a specified period of time. If an entity emits less than these allowances, the remainder can either be sold on the market or banked for future use. If an entity emits more than these allowances it is obligated to purchase emission rights on the market or pay a significant fine. The breadth of options from where a non-compliant entity can potentially purchase its credits is a function of market design.

In a pure cap and trade system, where the best example is the US sulfur dioxide market, emission allowances distributed by the government constitute the entire market. Pure cap and trade works best in pollution markets where the vast majority of the targeted pollutant comes from a very small number of industries. In the case of the US sulfur dioxide market just the electric power industry is involved. Markets such as this are defined by entities who presumably have a fairly similar cost basis for

both production and emission mitigation. In a pure cap and trade system the aggregate "balloon" of allowed emissions is fixed, but the shape of the balloon, which is the ultimate distribution of those allowances among participants, has infinite permutations depending on market and technology trends.

Baseline and credit systems are somewhat more complex, in that the value for emissions performance is based upon improvements against a hypothetical performance trend line, rather than an absolute number. Baseline and credit systems tend to be rate based systems, where value is given for creating economic output at lower GHG emissions per unit of output. While baseline and credit systems are sometimes used within industries, their real value to GHG trading would be derived by having unregulated entities provide more liquidity into cap and trade schemes. Under Kyoto, the baseline and credit system is the driving force under both Joint Implementation (JI), emission reduction projects between industrial countries, and the Clean Development Mechanism (CDM), emission reduction projects sponsored in developing countries. Credits are important because assets that might not be negatively impacted by GHG policy can still earn credits. This creates a broad based incentive for participation, widening markets, increasing competition, lowering overall compliance costs, and enhancing market liquidity.

Creating GHG Credits

According to current emission trading policy there are two fundamental ways impact overall GHG concentrations in the earth's atmosphere. These then become the primary means to create emission credits.

- ▷ Slow the rate of GHG emissions into the atmosphere.
- ▷ Physically remove and sequester GHG emissions already in the atmosphere.

In sequestration, atmospheric carbon removed from the atmosphere is stored, either in living biomass as pure carbon or as carbon dioxide in various geological strata such as former petroleum reservoirs, unmineable coal seams, or saline formations. Numerically, the vast majority of sequestration projects have been biological in nature. As companies and policymakers first began to recognize the potential long-term impacts of climate change in the early 1990s, a high number of biological sequestration projects were launched, particularly in Latin America, the US, and Australia. Over the years, biological sequestration projects have included forest conservation, forest restoration, plantation forestry, reduced impact logging in tropical and temperate forests, and farming strategies that preserve soil-based carbon.

Despite some very strong early support and a host of co-benefits associated with biological sequestration, terrestrial sequestration projects involving land use became highly controversial. This was true even among environmental groups that would presumably support the many positive attributes such projects can bring. Because of

this, their use in the Kyoto context is currently extremely limited. While there are a number of components to this controversy, one of the key areas of disagreement among advocates and Non-Government Organizations (NGOs) concerned the need for a clear definition of “permanence”.

Mitigation Versus Sequestration

Avoiding GHG emissions into the atmosphere through efficiency, fuel switches, renewable energy, or mitigated methane, is considered to be permanent. Whatever unit of production that has occurred (MWhr of electricity, ton of steel, or other industrial output) the associated emissions were either zero or at least lower than an agreed upon benchmark average. This benchmark average is commonly referred to as the “baseline”. Since the production of the relevant unit has been completed, there is no way to reverse the positive performance that has occurred at that time. Since reversal is structurally impossible, the credit or earned emission allowance is by definition permanent.

Sequestration, however, is not necessarily permanent. The classic example in this consideration is the planted forest that burns down, “re-releasing” all of the carbon that was stored in the biomass. If carbon is removed from the atmosphere for several years and then re-released suddenly back into the atmosphere, it is fair to say that a genuine environmental benefit does not continue to exist. After the time of the re-release, atmospheric concentrations are exactly what they would have been at the outset, even including the intervening sequestration performance. Saying that absolutely no environmental benefit was achieved during the period of time that the carbon was sequestered, however, is not fully credible either. This carbon was, for at least a time, not increasing the heat trapping effect of the atmosphere. The current debate centers on how performance should ultimately be measured.

These are highly controversial considerations that have elicited tremendous emotion in international negotiations. Skeptics of sequestration as a viable public policy tool made extensive efforts to discredit biological sequestration as an option, favoring more aggressive use of renewable energy and efficiency improvements. These skeptics were largely successful in influencing policy. Biological sequestration has gone from being a major force in emission transactions ten years ago to being a marginal consideration. This is particularly true in countries operating under Kyoto. Biological sequestration, however, is still viable and its supporters have put together risk mitigation mechanisms in an attempt to address the concerns of skeptics. This is reflected in the fact that there are several major funds devoted to developing the biological sequestration market. Ideas that have been proposed for biological sequestration, but have been temporarily shelved may still have relevance to geological sequestration. In particular, the discussion about time discounting and the ton-year approach should be recognized as important within the policy and risk management context.

Time Element

The fundamental question about sequestration becomes one based on the total amount of time that the sequestered carbon or carbon dioxide must be physically removed from the atmosphere to be considered equivalently “permanent”. While simplistically, some observers would simply say “forever”, such a restriction would create intolerable risks for any transacting party or direct claimant that was using sequestration in a public policy compliance process. There is a need to agree on what timeframe should be used as the basis for quantifying the GHG benefits of any sequestration project. The policy debates over forestry again provide some guidance for different timeframe approaches that have been proposed to define the duration of projects.

Time preference relates to the relative measure of a social desire for benefits that accrue at an earlier rather than a later stage. In the context of climate change time preference is used to introduce a sense of urgency in relation to GHG emission mitigation measures, as opposed to sequestration, where full benefits can only be claimed after a significant time has passed. Not using discounting implies an endorsement of the assumption that a GHG mitigation activity can be postponed indefinitely without any effect on the overall objective of reducing the impacts of GHG concentrations in the atmosphere. To account for the value of time and include the concept of time preference, the discounting method has been proposed. It consists of using a discount rate to calculate the present value of the total amount of carbon stored over the lifetime of a project, according to the following equation:

$$\text{Present Value of Carbon Storage (tons C)} = \sum_{t=0}^{t=n} \frac{\text{Carbon Stored by a Project (tons C)}}{(1+i)^t}$$

note: i is the discount rate and n is the project's timeframe (usually in years)

One problem of using discounting, however, relates to the selection of an appropriate discount rate to reflect financial, economic, or social measures of time attached to the carbon mitigation benefits of a project. High rates favor short-term projects and discourage long-term sustainability, while low rates discourage approaches that promote more rapid results. Some observers have indeed suggested that perpetuity is the appropriate timeframe for sequestration projects. This argument is based on the assumption that the "reversal" of GHG benefits of a project at any point in time would totally invalidate a project and that only maintenance of carbon stocks in perpetuity could counter the environmental effects of GHG emissions from fossil fuel use. This approach suffers from difficulties that are both structural and technical in nature.

From a structural perspective, it is difficult if not impossible to guarantee that a project

will be run in perpetuity and the assignment of a long-term contingent liability on the basis of potential reversal would undercut any market effects that the project would have. More importantly, from a technical basis, the perpetuity argument is flawed. While GHG emissions do have a very significant residence time in the earth's atmosphere, because the period that they will continue to exert heat trapping effects is relatively long, there is a definite decay pattern of GHG emissions in the atmosphere. This means that even the "permanent" avoided emission of a clean energy project only impacts that cycle for a certain period of time. The GHG benefits of sequestration projects have to be maintained until they counteract the effect of an equivalent amount of GHG emissions into the atmosphere. This is based on the cumulative radiative forcing effect of emitted carbon dioxide during its residence in the atmosphere. Current estimations have proposed a minimum timeframe of between fifty-five to one hundred years.

The adoption of a standard definition for the minimum required project duration would greatly facilitate consistency in accounting for GHG benefits of different projects. This would allow sequestration projects to be assessed on the same metric as emission reduction projects. The overall GHG market would be stimulated by this reduction in investment uncertainty and alternatives such as geological sequestration would become more attractive.

Policy Defines Underperformance

Once requisite project duration has been defined, it is important to decide how to treat projects that have a shorter duration than the minimum required timeframe. That duration can be either part of the project design such as is the case with certain types of forestry projects or due to actual underperformance. Underperformance for a geological sequestration project would involve any unplanned release of carbon dioxide. The options for dealing with not meeting a set time duration can be divided into two main approaches: full liability and proportional liability.

In the event of a "reversal" of GHG benefits under full liability projects must return an amount of credits equal to the total amount of GHG released. This approach is consistent with the stock exchange method, which consists of giving credits to projects as carbon dioxide is sequestered, and removing credits if stocks of carbon dioxide diminish. If the project has transacted those carbon values to another party, who in turn has presumably used them for compliance instruments in a policy context, it would be incumbent on one or the other party to supply replacement credits back into the relevant regulatory regime. Whether that replacement liability was on the buyer or on the seller would be determined by contract. The default position, however, would almost certainly be on the buyer unless a side agreement had been previously struck. The buyer of GHG credits would not be inclined to bare that responsibility, unless the sequestration credits had been supplied at a highly advantageous price as compensation for the risk. This full liability approach does not recognize the temporal

value of carbon storage, but this is the only method possible if it is decided that projects have to be run in perpetuity. Under proportional liability projects that did not fully perform would be debited an amount of credits proportional to the difference between the required timeframe and the actual duration that had occurred. This method is only applicable if a finite minimum project duration is agreed. If, for example, a minimum timeframe of one hundred years is adopted as a standard duration, a plantation project which had a significant carbon dioxide release after only fifty years would be liable for not maintaining that volume of carbon stock for the last fifty years of the required timeframe.

Financial Transactions

Environmental benefits of sequestration begin accruing when a unit of carbon is removed from or not released into the atmosphere. These benefits then continue accruing throughout the duration of carbon storage. Financial transactions based on these benefits can occur at any point in time, before, during, or even after the project lifetime. In order to maintain the environmental integrity of the system, however, it must be ensured that only after carbon has been fully sequestered for the requisite period of time can the full value of the credits actually be used. This would be especially important for the purposes of compensating for emissions taking place elsewhere. If financial transactions occur before the full environmental benefit of the carbon credits are fulfilled, there must be contractual obligations to ensure that storage will take place or responsibility must be determined for the liability associated with storage periods shorter than contracted.

Two primary regulatory models are available to ensure compliance:

1) Regulatory bodies would only authorize credits to be sold after a corresponding amount of carbon is fixed and stored for a minimum project duration as determined by policy. While safe from an environmental point of view, considering that the timeframe proposed for minimum project duration currently varies from fifty-five years to perpetuity, this requirement would greatly discourage developers.

2) Regulatory bodies would only authorize credits to be sold after a corresponding amount of carbon is fixed in vegetation, but before storage for the minimum timeframe. In this case, there must be an associated contractual arrangement establishing an obligation to store this amount of carbon for an agreed amount of time. This would also involve allocating a liability for the emissions associated with its release before the end of the established project duration.

Addressing Liability

If underperformance does occur within a sequestration project, unplanned amounts of

carbon dioxide are released into the atmosphere. The standard presumption is that some party along the value chain is ultimately liable for that underperformance. As previously discussed, the level of penalty is most likely to be dependent on time passage. If the release occurs in sixty years, public policy should recognize the significant benefit that has occurred. The penalty imposed should not be as severe as in the case of a sudden, unintended release after only one year. There are several means public policy can penalize this kind of underperformance, but in all scenarios, the ultimate result is a negative financial impact upon the liable party.

The liability can be either a seller liability or a buyer liability. Under a seller liability structure the seller guarantees a certain level of performance for a certain number of years and is obligated to compensate the buyer by either providing replacement credits or a cash equivalent. Under a buyer liability structure the credit buyer simply takes the risk of the project. GHG transactions to date have offered both forms of liability assignment. Dividing buyers and sellers ignores the fact that there are certain participants who will have both GHG liabilities and sequestration opportunities. These include large-scale oil extraction and refining concerns. In these cases the same firm using the sequestration mechanism retains the full contingent liability for performance and must maintain the appropriate risk mitigation structure.

Normally, few serious transactions invoke pure buyer liability. Those that do would likely occur at very significant discounts to current market price. This would be particularly true in long-term sequestration projects, where the buyer would need to carry a contingent liability for many years as the sequestration value accrues over time. Few companies with long-term GHG management issues would accept those kinds of highly non-quantifiable risks against their balance sheets, unless they were highly confident about the technology and the implementing organization. Buyer liability also forces purchasing firms to get into substantial due diligence about business and technology risks of the selling counterparty, which is counterintuitive to efficient commodity transactions

Forestry sequestration projects again offer a degree of guidance to the mechanisms that may be available for risk mitigation against underperformance. As forestry carbon projects have already been through several stages of evolution, it is worthwhile to observe several of the models that have been undertaken in that realm. Key issues include the different risk profiles for small-scale underperformance and large-scale catastrophic risk and whether risk mitigation provides the covered party with an in-kind product such as equivalent emission credits or cash.

An important consideration for parties taking on an amount of performance liability is to define exactly what they are promising to provide in the event of underperformance. This would be credits or the cash equivalent or an option of one or the other. Under a cash liability prices for replacement can be set either at the time of contracting or can be based upon a downstream market indicator for the value. Generally, providers of traditional insurance mechanisms are uncomfortable with

market instruments that do not give them a sense of their exposure. As noted, the actuarial tables for underperformance in geological sequestration are currently unknown. This means that both the frequency and the amplitude of the risks are not clearly understood. Compounding this with an unknown magnitude of the per unit cost makes it quite unlikely that conventional insurance will be able to fully address the emerging needs of geological sequestration liability without some form of government guarantee. This is especially true for covering the highest risk positions.

Risk Management

Insurance is a risk management tool that allows the pooling of risks between various assets with similar risk profiles. Essentially, insurance allows for compensation costs to be spread among the pool of participants who could theoretically be impacted by certain losses. This assumes that these participants are all willing to enter into the pool through the payment of premiums. There are a variety of criteria for assessing the insurability of any type of risk.

- The existence of many independent entities.
- Losses occur with a high degree of randomness.
- The maximum loss is very limited.
- The average loss per occurrence is relatively small.
- The average time between losses is relatively short.

Traditional insurance products in well-understood market segments are typically provided by a third party risk management firm such as multi-national insurance companies. Insurance companies, however, have a great deal of difficulty offering products in which actuarial understanding is poor. When insurance companies do not know the market, they risk pricing their products either too low and losing money or too high and not having customers. In this context, “pricing” encompasses both the up front premium and the downstream provision of compensation involving the structural requirements of the deductible and claim.

In the early stage of any new market or technology there will almost certainly not be many independent entities. It is quite unlikely that any series of assets in a new field will share a standard protocol. It is far more likely that projects will be highly heterogeneous, as new technologies and theories are tested in the field. Until there is a reasonable amount of experience, it will be difficult for any third party to have comfort in understanding either the frequency distribution of losses or what the maximum loss may actually be. There is a definite need for external intervention to seed the market with enough projects to achieve critical mass and encourage the private sector to ultimately take on the risks. As the market evolves there are four basic means to address liabilities arising from underperformance.

- Single project self-insurance through internal buffers.
- Multi-project risk pooling.
- Government intervention.
- Traditional third party insurance.

Refer to Appendix I for additional discussion of the insurance business and Appendix II for a glossary of related terms.

Internal Buffers

The most common form of risk mitigation in existing sequestration projects has been the use of internal buffers, which limits claims to a significant percentage less than the actual sequestration performance of the asset. For example, if the transaction or internally claimed benefit is only fifty percent of the quantified and monitored performance, then the claimant builds up a reserve of credits that can be used to compensate for later underperformance. This allows for time to pass and data to be analyzed, which enables the claiming firm to better understand its own performance.

Buffering programs are most vulnerable in their initial years before a sufficient reserve account has been built up. This is similar to the challenges most projects face, because the highest risk is usually found during the early period of performance. In many projects this is often reflected in the role of mezzanine finance and completion bonds. These are specific financial instruments provided by experts in the field having risk capital at their disposal. If the internal buffer option is put in place, it is questionable whether any financial firm would feel comfortable “backing up” the performance during the first several years. Traditional insurance products could be sought, however, after a track record had been established and the buffer effectively became the deductible provided by the insured.

Simply buffering the performance of a single large-scale project does not do anything to address the potential for catastrophic risk in the event of a total loss of carbon dioxide from a geological reservoir. Catastrophic loss would release both the claimed carbon and the buffered carbon. While the time value of the buffered carbon would potentially be applicable to the remaining sequestration time horizon of the claimed carbon, it becomes fairly apparent that there could potentially be a large shortfall. For example, if there is a fifty to sixty year maintenance requirement and there is catastrophic loss after only five years, those ton-years of the buffer can only cover a very small percentage of the total liability.

Internal buffers are a far from perfect solution, but they are often the only solution when technologies are just entering the commercial stage and when performance profiles of the new technology have yet to be established. Not only are the risks themselves non-quantified, but the financial implications of those risks are similarly

obscure. Given that a variety of shifts on policy and markets could mean extremely high or extremely low pricing for emission credits, it is highly unlikely at this point that any third party agency would be willing to insure these positions on a cash basis.

Internal Pooling of Projects

If the underlying technology is deemed sound, then a serial catastrophic underperformance across multiple assets is highly unlikely. Under this scenario the potential risk could be shared within the industry itself. A second risk mitigation mechanism generally undertaken with minimal involvement of third party institutions is the creation of a risk sharing pool among similar parties. This is a captive insurance, because the insured parties own the insurance pool as well as the potential financial benefit that may accrue from ownership. This benefit would result if performance exceeded actuarial predictions of risk. It will be comparatively difficult, however, for anyone, either inside or outside the industry, to come up with bankable actuarial tables. This would in turn lead to a relatively conservative structure for this type of insurance pool.

There is a strong advantage to the pool approach. By pooling credits rather than capital, the collective pool builds up the necessary credit reserve to cover one or two cases of underperformance faster than a single project can do on its own. Pooling would also dramatically reduce the need for using capital to insure performance. Each project would simply reserve a portion of its emission position as a “premium” to be tapped by other parties once certain conditions were met. Once insured, however, firms may have significantly less incentive to practice appropriate management under a direct pooling approach. An internal pooling approach requires that there be sufficient disincentive to being willfully negligent to responsibilities. The most effective means of undertaking this is through a cost-sharing program that involves a deductible. First dollar risk would not fall upon the insurance pool, but upon the specific participant involved. As long as the deductible is significant, there exists a strong incentive to conduct operations with a great deal of care.

External Pooling of Projects

The use of third party insurance is useful when all of the major conditions outlined above can be met. This is a situation that does not exist today. Third party insurance typically operates on a cash basis, where premiums and claims are both monetary, rather than through in-kind products. This is because insurance companies operate across the entire economy and are effectively cross-collateralizing various sector risks against each other.

Cash basis will likely not be attractive in the carbon market for the foreseeable future, unless the contract length is very short. Neither the insurer nor the insured are going

to want to risk being on the wrong side of the carbon market if and when claims need to be paid. For example, if a contract were written to pay back the insured a market based cash amount when the claim was made, the insurance company would potentially have a fairly non-quantifiable contingent liability on its books. Alternatively, if the downstream payout is set at the outset of the contract, then the counterparties to the contract run the risk of that cash compensation being insufficient to cover the market position that they need to establish to get back into compliance. These risks are somewhat lessened if contracts are only written for short periods of time such as a year. It may be very difficult, however, to finance geological sequestration projects if only short-term insurance products with very high pricing are available.

Various insurance experts have suggested that third party insurance firms could act as the manager of carbon pools among entities with similar risk signatures. The question is whether traditional insurance management offers any particular value added in assessing risk to the various components of the pool that the participants themselves are not capable of handling. For a group of fairly similar projects in a defined geography such as the United States the actual value added would be questionable. This type of insurance management expertise might be useful in the future, however, when geological sequestration projects would be spread around the globe and the potential for local and regional companies to undertake due diligence of projects and their sponsors may be limited.

Role of Government

As discussed previously, there remains the issue of potential catastrophic loss early on in the life cycle of new technologies. It should not be the responsibility of the government to step in and offer liability caps to participants and remove all excess liabilities. This has largely been the position of the government in relation to potential major accidents involving nuclear power and space launches. There can be, however, an important role for government to play in emerging markets using new technologies. While a deductible helps create the proper incentive for day-to-day performance and take first dollar risk out of the equation for the insurance pool, government guarantees work on the opposite end of the spectrum by effectively taking last dollar risk out of the pool. This caps the maximum liability giving insurance companies or self-insured pools a more effective manner to quantify their total risk exposure and more accurately price their products. The quid pro quo for this participation is that government will likely take a very participatory role in the projects themselves and subsequently create very stringent internal performance reporting requirements for those involved.

Government guarantees should only be used during the outset of a new technology, when actuarial understanding is poor and application of technology is not fully standardized. In a case such as geological sequestration, where risks are mainly

within a compliance perspective rather than a potential catastrophic loss, government involvement may only make sense for a fairly short period of time. Once the various counter parties get comfortable with the issues and risks around such projects, the commercial market can take over.

Traditional Third Party Insurance

No traditional insurance company currently offers coverage in the event of carbon underperformance, though it appears to be getting close to that point as CDM projects move toward operational status. Both Swiss Re, the world's largest re-insurer, and AON, the world's largest insurance broker, have looked closely at the market and are expected to soon start providing products for participants in the European Union Emissions Trading Scheme. Both companies actually entered into the market from a sequestration perspective rather than from an emissions mitigation perspective, because they both have significant business interests in forestry insurance.

One of the key issues in using traditional insurance products is the long-term position that would potentially be required. Insurance companies will not fix a long-term premium at the outset of a project especially if the project is new. It is likely that premiums will shift with every renewal and renewal periods will not be more than a few years in length. Insurance companies would even be expected to set premiums on an annual basis. This means that new data such as an unexpected catastrophic loss of a carbon dioxide reservoir could immediately impact the operating expenditures of all geological sequestration projects. Tying insurance to the value of the sequestered emissions would also add variability to the premiums, because the market for emissions could take very significant turns at any time. For example, Swiss Re currently provides insurance for natural gas storage in geological strata, but will not write the policy out more than one year at a time because of potential losses due to unforeseen leaks. Permanent sequestration in various geological formations would presumably have different risk signatures. A company such as Swiss Re, however, would certainly have some experience in this area and could provide a fairly credible assessment of the potential liabilities.

It seems reasonable to assume that insurance companies would not insure carbon losses on a cash basis, but rather on an in-kind basis. This is similar to what was suggested in both the single project buffer and mutual insurance approaches. Under these scenarios loss of credits would simply be provided with other credits. This analysis is confirmed by conversations with Swiss Re and AON. Several years ago the Norwegian insurance company Storebrand suggested that it might invest in a portfolio of emission reduction projects specifically to back underperforming assets that its clients and others might have in an emissions trading context. While this has so far not moved forward, it is highly likely that insurance companies will position themselves to have access to a wide range of emission credit instruments in order to provide this service to their customers. Evolving knowledge will allow insurance

companies the ability to price insurance products for various sequestration activities based upon a better understanding of the risks surrounding potential failures of this particular asset class.

If geological sequestration develops a strong reputation for reliable performance, it may end up being one of the volume holdings to back other forms of emission mitigation projects. If nothing else, geological sequestration projects would involve relatively large volumes of claimed performance, which is what insurance providers would want access to in order to write risk policies to cover other types of projects. In this scenario, third parties, typically through intermediaries such as Swiss Re or AON, would pay geological sequestration projects for the rights to extract credits from the pool in order to cover underperformance elsewhere. This would likely be done on an options basis, which would give those parties the right, but not the obligation, to take emission credits at various points in the future. Several parties who are currently "long" in emission credits around the world are already being tapped for this role.

Questions

The following is an inventory of pertinent questions concerning liability as it would relate to the permanent sequestration of carbon dioxide in geological formations. The questions and the discussion following each question form a baseline review summarizing key areas of interest. Although a comprehensive answer to each of these questions is beyond the scope of this initial study, these questions outline significant issues that need to be considered as geological sequestration projects move forward. This section provides a framework for additional research and analysis in future follow-on studies involving specific aspects of liability. The questions in this section were developed through informal interviews conducted with insurance and legal experts.

Permitting Process

What needs to be considered in the permitting process for the geological sequestration of carbon dioxide?

1. What is the actual purpose of the permitting process?

Before a permitting process is created for an activity, identification of the ultimate purpose is important to make the process rationale, efficient, and productive. Sometimes the purpose is expressed in the laws creating the permitting process. Sometimes the purpose is only implied. Sometimes the purpose is inadvertently changed by practice. A first step in any analysis is asking, “why are we doing what we are doing and what do we hope to achieve?” Different stakeholders in the process may perceive a different purpose completely unrelated to an express statement of statutory purpose. One technique for identifying the actual purpose is to interview various stakeholders.

2. Should more than one permitting process be created for different aspects of a project, with different parties, different procedures, different decision-makers, and different sanctions?

Regulatory bodies gain experience and learn more about regulated activities over time. The cumulative experience of regulatory staff is a source of expertise. Over extended periods of time, specialized procedures are developed for distinct regulated activities. For example, regulatory staff might recognize different procedures as applicable to domestic and foreign sources of carbon dioxide. Similarly, different permitting processes might be appropriate if the collection and transportation of carbon dioxide is by integrated enterprises or is accomplished by unrelated enterprises working together by contract. This issue can best be reviewed through interviews with appropriate regulatory staff and participants in the process.

3. Which various aspects of project costs, engineering, science, financing, legal, and insurance, are emphasized by the permitting process?

Priorities need to be set according to these costs and the process and standards designed according to priorities. Any permitting process entails costs and these costs ultimately are imposed on government agencies and private parties. The preparation of any application for a permit will require knowledge of certain facts. When a permitting process is designed, it should be examined and evaluated according to the kinds of information that the process will develop and record. Judgments can be made as to the relative value of what the process creates.

4. What authority is responsible for the permitting process?

There are two basic questions to ask. What are the government agencies that have authority for the permitting process? This is both a "do have authority" question and a "might have authority" question. This becomes a particularly complex issue when the carbon dioxide sequestration involves domestic and foreign sources and various storage locations. After the government agencies are identified, the second basic question is what are the internal resources and staff responsible for the permitting process? If there are multiple government agencies responsible, involved, or interested in the process, the diversity of training and responsibility can be determined through interviews with appropriate officials and agency staff.

5. Should it be an existing authority or new authority?

This is an opportunity to interview government agency staff for their insight into developing a modern system of regulation. Their experience can be applied to making a system rational, effective, and efficient.

6. Who should be the authority incumbents? Should the system be elective or appointive? Should qualifications be established for candidates for these positions? Who should control the nomination and selection process? Should there be term limits on incumbents?

These are ultimately public policy questions about democratic institutions. Although these questions seem far removed from the practical matter of carbon dioxide sequestration, the selection of decision makers is important for keeping the work of a permitting process legitimate.

7. Should the authority be governmental or quasi-governmental, private for-profit or private non-profit?

All of the stakeholders probably have different opinions on this topic. Each of the options has different consequences for accomplishing safe and effective carbon dioxide sequestration. Different approaches will have different benefits according to their context as single state, multi-state, and international sequestration projects. These options will have material differences on the finance and costs of insurance. Non-governmental organizations (NGOs) should also be interviewed for development of

this issue.

8. If government agencies are involved, should they be international, regional, federal, or state?

This topic involves an analysis of the different kinds of governmental authority that exist at different levels of government. Obviously, the federal government has the most general authority and expertise regarding carbon dioxide sequestration, but for specific transactions international, regional, and state authorities might be paramount. Interviews with relevant officials and executives at NGOs should be conducted for their insight.

9. Why must the permitting process be governmental?

This is an analytical issue and is designed to sharpen the understanding of risks and consequences of having government agencies being responsible and recognized as the central players in the regulation of natural resources, environmental quality, transportation, energy, and public safety. This analysis can be developed through interviews and surveys of officials and other stakeholders in the process.

10. What are the issues to consider if some non-governmental authority is responsible for permitting?

Insurance underwriting standards can often be more exacting than regulations. Many government permitting processes are already indirectly affected by private entities. For example, the availability of private bonds can limit the number of permits granted if the permitting process makes this a requirement. This topic can be covered as a series of case studies of how the unavailability of bonds or liability insurance severely limited a regulated activity. Examples of regulated activities that were severely restricted by the insurance industry's withdrawal of underwriting support include strip mining and asbestos removal. Some discussion should be offered about the consequences that exist when private business decisions prohibit or impact activities that are otherwise legitimate.

11. What is local government's proper role?

Democracy is local. Politics is local. Environmental consequences are always local and public safety is always local. Frequently, however, the importance of local government institutions is not expressly addressed. Interviews with local officials in a variety of local government agencies would give an appropriate picture of the types of concerns that could develop when carbon dioxide sequestration becomes a reality for a local community.

Another aspect of this topic is to develop appropriate responses when the local government is passive. Techniques for the engagement of a local government in the

process should be described.

A final aspect of this topic relates to disaster response practices in the event of an accident involving carbon dioxide transportation or storage. First responders in disaster circumstances are typically local police, fire, and rescue departments as well as volunteers. This aspect is covered later in this section.

12. What are the private options such as a self-regulatory organization (SRO), trade association, or other interest group in overseeing the permitting process?

The use of SRO's in the permitting process is probably rare. It is more common in the financial industry where the first levels of regulation are the standards imposed by the industry itself. The securities and insurance industries both use SRO's to train, test, and discipline their membership. Research should determine if there are any existing SRO's that might be invigorated to become active participants in a permitting process. An SRO might have only a limited involvement in the permitting process. For example, an SRO of appropriate contractors or private security firms might set standards for disaster recovery plans. Rather than having a government authority set standards for an activity that is not part of its core competency, the authority might defer to an SRO with members that have such expertise. This assumes that the SRO is ultimately responsible to a pubic regulator.

Trade associations and other interest groups are seldom taciturn. They are open and vocal with their ideas about the best public policy on many issues. Identifying all of the trade associations and interest groups that may have an interest in offering ideas about carbon dioxide sequestration should be conducted. This should be followed by a compiling and reporting of their views.

13. What is the subject matter of permitting? Should it be people, entities, processes, conditions, or events?

This is related to identifying the purpose of a permitting process. It is also related to choosing what expenses the permitting process will create. Very different results can be expected if the focus of a permitting process is on the people responsible for a transaction or merely measuring the compliance and regulating the transaction. This is largely an analysis of a process, but should be supplemented by pertinent case studies or interviews with stakeholders.

14. Can credentialing be an alternative to permitting?

Credentialing is a process that focuses on the skills, experience, and education of individuals involved in activities of importance to the public. This process focuses entirely on the individuals responsible for an activity. When something goes wrong in the activity, there is no ambiguity about who is responsible. The credentialing process is important for insurers when they evaluate risks of any activity. Identifying

appropriate credentials and the institutions that award the credentials should be reviewed. Additionally, an evaluation of the standards used by the institutions for awarding the credentials should be completed.

15. Who are the stakeholders?

The usual definition of a "stakeholder" is the people who potentially win or lose from the result of a given action. The list of stakeholders for a typical public business enterprise includes stockholders, bond holders, bank lenders, trade creditors, employees, service businesses, suppliers, and local communities. For a wide ranging activity such as carbon dioxide sequestration, the government regulators involved in the process and members of the general public would also be included as stakeholders. Some consideration should also be given to the concept of hidden stakeholders. These are individuals and institutions who are not obviously involved or affected by the core activity. For example, the scientists, engineers, and academic researchers who study related issues have a very significant interest in the activity. Other such hidden stakeholders are likely to be identified with further consideration.

16. How can stakeholders be empowered in the permitting process?

Studying the possible stakeholders in the carbon dioxide sequestration process will develop an understanding of the values and interests involved. Once these values and interests are identified, suggestions can be made for establishing administrative procedures that enable stakeholders to assert their preferences.

17. How can stakeholder input be managed during the permitting process?

If various categories of stakeholders are involved in the permitting process, some consideration of how to manage their participation should be made. Must they be present at any public hearing to assert their positions? Will only written presentations be permitted? Various administrative models for public participation should be considered. Two obvious examples with different levels of formality are the Administrative Procedures Act (APA) and the practice of conducting open public hearings. The APA is at the more formal end of the spectrum while public hearings are typically marked by a great deal of informality.

18. What role do adjacent property owners have in the permitting process?

Whether carbon dioxide sequestration occurs on public property, private property, or quasi-private property, issues related to adjacent property ownership should be considered. Prior to the identification of specific sites for sequestration, some general concepts regarding the potential impact on property valuation and legal liability should be developed.

19. Do prevailing winds affect the role of adjacent property owners? Should upwind

and downwind property owners be treated differently?

Once possible sites for carbon dioxide sequestration are identified, specific meteorological data will most likely be important in discussing issues related to adjacent property ownership.

20. What are the limits of regulator authority in the permitting process?

The limits on authority placed on the regulator in the permitting process should be examined. The type and the extent of authority have a significant impact on the liability of the stakeholders in the process and also on the government agencies involved in the process. In legal terms, this issue is one of identifying whether the government agency is performing a governmental function or proprietary function. The actual vocabulary of this distinction varies between state and federal law and also varies among the states, but the core idea is the same.

21. Is there potentially over-lapping or concurrent authority in the permitting process?

This is largely a legal issue with significant practical consequences. Preliminary legal research should focus on the core US Constitutional Law doctrine of “federal pre-emption”. There are analogous state law provisions that should also be identified that involve choice of law doctrine and conflict of law doctrine.

22. What is the role of Alternative Dispute Resolution (ADR) in the permitting process?

There is wide recognition of the importance of ADR in most areas of legal practice. ADR includes such common procedures as arbitration, referral to magistrates, mediation, and mandatory counselling. In considering the variety of stakeholders in the permitting process, it would be productive to consider whether there are opportunities to employ ADR in helping resolve potential conflicts.

23. What technical standards will be used in the permitting process?

Technical standards for carbon dioxide sequestration include both existing and new standards to measure technology performance. This should include research of applicable technologies in related fields and an analysis of emerging technical advances specific to sequestration.

24. What financial reporting standards will be used in the permitting process?

Significant effort must be given to identify the financial implications of carbon dioxide sequestration and how this is reported to stakeholders. Straightforward balance sheet and income statements should be made available for all stakeholders. An analysis of insurance industry and banking capacity should be provided that also takes into consideration allocated and budgeted government resources.

25. What are considered prudential standards for the permitting process?

This topic focuses on identifying the elements that a “reasonable” business decision-maker must consider in making a business judgment. It included a range of considerations beyond straight financial data such as counterparty credentials, experience, integrity, and macro-economic analysis.

26. What is the role of risk management?

This should include a review of the methodologies of commercial insurance underwriters for large property and liability risks and of internal risk managers for large industrial chemical installations.

27. What are the key governance issues?

The decision-making structure, audit plan, and comptroller functions of the various stakeholders should be examined. Those practices that are particularly significant for the safe and efficient operation of carbon dioxide sequestration projects should be identified.

28. What are the key ethical issues?

Once the stakeholders in the process are identified formal ethical standards applicable to particular stakeholders should be considered. All of the professionals involved in the process would typically be subject to ethical codes issued by their corresponding professional bodies. Pertinent ethical standards should be researched and outlined.

29. What about background investigations?

Background investigations on the various participants and stakeholders sometime need to be conducted. An effort should be made, however, to make clear distinctions between when the investigations are absolutely necessary and when they are not.

30. How will the public be kept informed?

Consideration should be given to how different stakeholders as well as the general public will be kept informed about carbon dioxide sequestration activities. Standard public information strategies implemented by government agencies, non-profit groups, and private companies should be researched. Crisis communications in the event of an accident should also be summarized. Crisis communications should be specifically addressed in relation to disaster response and disaster recovery planning.

31. How does the language of the process affect public perception?

A review of the language used by the technicians and interest groups involved in the

process should be made. The words and phrases used to identify the process should be identified and critiqued for negative connotations that could create prejudices against carbon dioxide sequestration projects. One obvious example is the term "sequestration" itself, which may not be the best possible word to describe the process. In Europe, "sequestration" can have a negative connotation especially when translated into French or Spanish.

32. How can a descriptive vocabulary be developed that explains public costs and benefits clearly, simply, and coherently?

This builds on dealing with "the language of the process" and attempts to identify a vocabulary that is accessible to the broadest possible public including the various stakeholders. This is related to "clear language" laws enacted by Congress and state legislatures.

33. Does the vocabulary anticipate doctrinaire responses to the proposal?

It is predictable that any carbon dioxide sequestration activity will precipitate public discussion. Some of that discussion will be by advocates of particular doctrinal positions. For example, public health advocates and environmental groups will bring their specific points of view to the issue. Recreational users of public lands and conservation groups will do the same. When developing a vocabulary for the process, some consideration should be given to using language that is as neutral as possible and does not advance the doctrinal position of one group over that of another.

34. What are the procedural rights in the permitting process?

A simple legal review of the various procedural rights in the process should be made. It is important to identify the possible effects certain procedural rights have on making the system efficient and open. For example, the subpoena right can be used to make many records public that would otherwise be kept private. Other procedural rights have similar, often unintended, consequences. Consideration of potential implications and outcomes should be given.

35. Who are the standing, notice, and proper parties to the permitting process?

This involves an in-depth stakeholder analysis that focuses on the formal legal requirements of the process. Unlike the previous stakeholder discussion, which focused on the business environment, this analysis should consider the formal legal requirements of the permitting process.

Insurance Industry

What is the insurance industry willing to take on and how would rates be established?

Questions

1. What are the specific insurance risks?

This was discussed in the previous section. Each step in the process and all the entities involved in the implementation of carbon dioxide sequestration projects need to be included. Analogous risks should be identified and an inventory list of insurance underwriting standards applicable to sequestration activities should be completed.

2. How can the absence of actuarial data be addressed?

A determination should be made of all related activities that could provide a basis for evaluating the viability of carbon dioxide sequestration projects. Data from these precedents could be used to support initial projects until long-term actuarial data would be developed directly. It is generally assumed that as actuarial data becomes available from functioning geological sequestration projects, familiarity with the technology and related activities will result in a reduction of perceived risks. This assumption must be verified and tested against counter assumptions that describe elevated risks as more and more carbon dioxide is pumped into underground formations. Although a proven track record would tend to increase confidence in geological sequestration, ever larger volumes of underground carbon dioxide could potentially be seen as a greater overall risk especially in regards to liability under a worst case scenario.

3. What is the significance of mandated insurance coverage?

The impact of government mandated insurance coverage on the insurance market should be analyzed.

4. What is the role of self-insurance?

Self-insurance is equivalent to having no insurance. When the insurance industry refuses to write particular coverage, self-insurance is sometimes the only option. The standards a regulator can reasonable require under self-insurance should be defined.

5. What is the role of private pools?

The use of private pools as a substitute for commercial insurance should be evaluated.

6. What is the role of mutual and cooperative approaches?

Other mutual and cooperative approaches to financing insurance risks should be considered.

7. Who takes the risk?

The standard practices and precedents that relate risks to particular persons and

organizations defined in the previous section should be investigated in detail.

8. Who takes the loss?

The various candidates for carrying the burden of any losses should be discussed. The losses need not be strictly financial. Losses can include things detrimental to professional reputation and other issues difficult to quantify in monetary terms.

9. How might workers compensation be involved in a potential loss?

The extent public and private workers compensation could potentially be involved in any loss should be reviewed.

10. What effect does the form of coverage have?

The two common forms of commercial insurance policies involve either occurrence or claims-made coverage. The form of coverage defined by a policy would be very significant in allocating potential losses resulting from underperformance of carbon dioxide sequestration projects.

11. Is there applicable insurance coverage existing in previous, but still active insurance policies?

There might already be coverage in old occurrence forms of commercial general liability (CGL). A modern technique of providing risk finance is to "mine" old insurance policies for coverage that might still pertain to contemporary losses. Possible examples should be identified and discussed in the context of carbon dioxide sequestration.

12. What is the significance of nuclear accident pools?

These are pools created by state statutes and the nuclear industry to deal with large potential losses that the private sector are unable to address. They should be examined for liability provisions and key aspects of pool administration. They should also be researched for how contracts are written and industry insurance pools operate.

13. What is the significance of hurricane pools?

These are pools created by state statutes and the insurance industry to deal with catastrophic property losses that single insurers are unwilling to engage. They typically cover property losses, but they should also be examined for liability provisions and aspects of pool administration. These pools describe how private insurers participate in the administration and financing of risks related to natural disasters.

14. What is the significance of aircraft pools?

Like nuclear accident and hurricane pools, aircraft pools are created to deal with large potential losses that individual insurers are reluctant cover under standard contracts. The pools typically cover property losses like hurricane pools, but they should also be examined for liability provisions and specific aspects of pool administration.

15. How is risk addressed for government strategic reserves?

An inquiry into risk management for government strategic reserves should be researched and summarized. The actual or potential role of commercial insurance, either liability or property, in this risk management structure should be included.

16. What effect does the current total capacity of the insurance industry have on offered coverage?

The financial capacity of the insurance industry defines the total risk as well as the nature of the risk that can be made available and covered by the commercial market. The current financial health of the overall insurance industry should be reviewed to determine how new activities with undocumented risk profiles would be considered. The role played by the reinsurance marketplace should be included in this analysis.

The insurance industry is able to absorb the multibillion dollar losses caused by natural and man-made disasters such as hurricanes, earthquakes, and terrorist attacks because losses are spread among thousands of companies including catastrophe reinsurers who operate on a global basis. The ability and willingness of insurers to sell insurance fluctuates with the availability and cost of catastrophe reinsurance. After major disasters, such as the recent hurricanes in Florida and the World Trade Center terrorist attack, the availability of catastrophe reinsurance becomes extremely limited. Claims deplete capital of reinsurers with the result being that companies are more selective in the type and amount of risk they assume. Prices for reinsurance rise, because the available supply is limited. This contributes to an overall increase in prices of premiums across the entire insurance market.

17. What is the impact of new risk-based capital requirements?

A discussion of the risk based capital requirements adopted by the National Association of Insurance Commissioners (NAIC) should be included. The new financial caution in the insurance industry resulting from risked-base capital requirements should be described.

18. When does the government, as insurer of last resort, need to play a role?

The role of both federal and state governments in providing insurance when the private insurance market is unable or refuses to write particular coverage should be

analyzed in detail. Key precedents related to government sponsored insurance should be reviewed and summarized. Some examples include catastrophic events related to nuclear power plant accidents, terrorist attacks, and natural disasters.

19. What types of banking products are substitutes for insurance?

A review of banking products that can be used as insurance substitutes should be discussed. The insurance concept of post-loss underwriting and how banking products can compete with insurance coverage in post-loss situations should be included.

20. How can sovereign immunity and charitable immunity be used as approaches to risk management?

In the realm of large losses, various legal immunities can sometimes be used as methods for risk management. In particular, the use of non-profits as participants in the process of carbon dioxide sequestration could be considered from the point of view of certain legal immunities that non-profits are granted. The same issue could be discussed in terms of governmental sovereign immunity. Brief mention should be made of the US Court of Claims and analogous tribunals in the various states. Discussion of post-loss compensation regimes should also be covered.

Existing Models

What are the existing models for this type of liability?

1. What are the implications of typical common law, tort, trespass, real property, and agency court decisions?

The report should give brief summaries of basic “judge-made” theories of liability from past court decisions that are pertinent to carbon dioxide sequestration.

2. What is the significance of statutory liability?

A compendium of the various environmental, energy, natural resource, and transportation statues that create private party civil liability should be developed.

3. What is the significance of contractual liability?

How the private law of contracts allocates risk and liability among private parties should be considered. Exceptions to this legal right should be noted where statutory law or judicial policy refuses to recognize private allocations of responsibility.

4. What are the implications of governmental liability?

The legal theories of governmental liability that are pertinent to carbon dioxide sequestration should be summarized. How these theories may expose government agencies, officials, and civil service staff to organizational and personal liability should be included. The circumstances when government employees are eligible for representation as individuals by assistant attorneys general, defense-cost reimbursement, and indemnification should be defined. A brief discussion should also be offered of the situations when private insurance coverage is available and potentially required for government employees.

5. What is the significance of class action litigation?

Examples should be provided of how class action lawsuits have changed the rules in mass tort litigation. Case studies of class actions, both successful and failed efforts, in the fields of chemical release and workplace chemicals should be included.

6. What is the significance of cross border liability through treaties?

The report should include a summary of international, multi-lateral, and bi-lateral treaties pertinent to establishing legal liability for accidents related to carbon dioxide sequestration.

7. What are the implications of maritime and common carrier liability?

The theories of legal liability involved in the transportation of chemicals should be summarized.

8. What is the significance of workers compensation on liability?

A discussion of public and private approaches to workers compensation and its effect on liability should be included.

9. What kind of damages are foreseeable?

This should be addressed from a legal, engineering, and logistical perspective, because it has a very significant impact on the pricing of insurance coverage.

10. What are current insurance practices regarding liability of projects involving enhanced oil recovery (EOR) using carbon dioxide injection?

Case studies involving EOR operations that includes interviews with operators and commercial insurance underwriters should be provided.

11. What are the current insurance practices regarding liability in underground storage of natural gas?

Case studies involving underground storage of natural gas in depleted coal gas reservoirs and other geological formations should be included. This could not only provide a precedent framework for structuring insurance, but also valuable data on the long-term storage of a pressurized gas in geological formations. There has been some concern expressed regarding the use of certain chemicals to maintain reservoir pressure and its impact on groundwater.

Ownership

Who ultimately will "own" the carbon dioxide once it is in the ground?

1. Can there be ownership by imposition?

Modern litigation to establish tort and environmental liability frequently imposes legal responsibility on persons who are not current owners of the property or operation causing harm. Individuals or companies can be treated as if they were current owners, however, and the responsibilities of ownership can sometimes be imposed on them long after they have sold a particular property.

2. Can there be "abandonment" of a particular property?

Owners of property have long had the right to give property away or more importantly to abandon property. Archaeology attests to the long standing legal principal of abandonment. Municipal dumps are the current visible example of this legal principal. How the right of ownership and abandonment has changed with modern environmental law should be discussed.

3. Does everything need an owner?

An old principle of English property law is that "everything has an owner". In former times the default owner of property was typically the monarch. In American law the default owner typically was the state. How these long-established principles have changed should be summarized in a discussion of their application to carbon dioxide sequestration.

4. Who is likely to want ownership of carbon dioxide and why?

There is an assumption that no one wants to own the carbon dioxide once it has been sequestered. Some consideration should be given to who might actually want to own geologically sequestered carbon dioxide and what reasons they would have for wanting to own it.

5. Who is likely to want to avoid ownership and why?

All of those who might be legally viewed as owners of carbon dioxide should be determined as well as which ones would want to avoid ownership. This should include a discussion of critical reasons why some entities would want to avoid ownership. Existing methods for describing ownership of ambient gases should be considered.

6. What is the significance of market-based ownership?

An examination of various commodity exchanges should be conducted to determine how ownership is defined. Attention should be given to how the exchanges specifically treat various chemicals and industrial gases.

7. What is the role of value and pricing?

Commodity exchanges should be considered as a pricing mechanism for industrial gases. Other pricing mechanisms such as long-term supply contracts should also be considered .

8. What is the significance of charitable ownership?

Ownership of natural resources and lands by charitable groups has an impact on value and price. How charitable ownership of sequestered carbon dioxide would affect pricing should be reviewed. This is a separate discussion then the matter of immunity from liability when charities accept ownership of carbon dioxide.

9. What is the significance of governmental ownership?

Government intervention into commodity markets has a large impact on value and price. Government involvement is usually for the very purpose of affecting the valuation of commodities. An exception to government intervention for price control is when purchases are designed to create and maintain strategic reserves. Both of these circumstances should be examined. Governmental ownership of commodities is sometimes made through a government-sponsored enterprise (GSE). Consideration should be given to what effect GSE ownership of carbon dioxide has on program costs, liability, and availability of insurance.

10. What is the significance of bankruptcy?

When private parties are involved in risky activities, bankruptcy is a technique for limiting and allocating financial losses among various stakeholders. Examples of bankruptcy should be examined for potential lessons that might be applicable to carbon dioxide sequestration activities. Particular attention should be paid to modern asbestos litigation and current corporate bankruptcies.

11. What are the significance of title issues?

A brief discussion should be included of how American law treats title to ambient gases compared to gases in storage. This is significant for how insurance companies determine whether anyone has an insurable interest in the carbon dioxide. It also impacts the ability of banks to provide risk-transfer products.

12. Can ownership be split?

This is a relatively straightforward issue that has complex implications. Precedents for joint-ownership of gasses should be investigated. The implications of shared ownership on legal liability when one owner has legal immunity from liability and the other owner is not immune should be included.

13. What is the significance of leasing on liability and finance?

If something can be owned, it can be leased. Approaching ownership and title from a leasing perspective should be analyzed in relation to sequestered carbon dioxide.

14. What is the significance of off-balance sheet accounting after Sarbanes Oxley legislation?

The accounting issues related to carbon dioxide sequestration and various ownership arrangements discussed above such as full titles, liens, and leases should be identified. Any pertinent pronouncements of the Financial Accounting Standards Board (FASB) should be considered. Attention should be paid to FASB requirements for “commitments and contingencies”. For stakeholders that are public companies, the Sarbanes Oxley legislation may require disclosures or limitations on how sequestered carbon dioxide is treated in financial statements and 10Q and 10K reports to the Securities Exchange Commission (SEC).

15. What are the financial issues related to ownership?

For each of the ownership options previously identified, the corresponding financial issues should be summarized. A GSE balance sheet and a charitable financial statement should be outlined and contrasted for a hypothetical carbon dioxide sequestration project involving both straight ownership and leasing arrangements.

16. Is the underlying assumption that carbon dioxide always has a negative value accurate?

There is a generally accepted assumption that sequestered carbon dioxide has an inherently negative value. This assumption should be fully tested and verified and the reasoning behind it clearly identified. There are certain circumstances in which carbon dioxide could have a positive value. Large quantities of carbon dioxide can provide quantifiable benefits in applications such as EOR and coal-bed methane extraction.

17. How can a value for carbon dioxide be established?

Whether the value of carbon dioxide is negative or positive, that value is important to businesses and financial institutions undertaking responsibility for sequestered carbon dioxide. Insurers and banks will begin their analysis with estimates of value if there is no market price available. Credible estimates should be made for the value of sequestered carbon dioxide under various scenarios.

18. How much carbon dioxide is potentially involved?

Estimates of the potential total amount of carbon dioxide that could ultimately need to be sequestered should be made to assist in valuation calculations.

19. What are the various costs involved in the sequestration of carbon dioxide ? What are the appraisal issues for the real estate where sequestration occurs? What are the appraisal issues for adjacent real estate? What is the effect of sequestration on real estate tax assessment?

These issues were discussed previously from a liability perspective. Experienced appraisers should be interviewed to make such estimates.

20. What are the potential costs of property insurance for carbon dioxide sequestration?

This is related to the previous discussions involving an assumed negative value of carbon dioxide. If this assumption is inaccurate, then there might be a positive value that can be offered by the owner of sequestered carbon dioxide.

21. What are the potential costs for liability insurance for carbon dioxide sequestration?

Small quantities of industrial carbon dioxide are the subject of current insurance policies. Large quantities of stored natural gas are the subject of existing liability insurance. Commercial insurance underwriters should be interviewed to learn typical pricing strategies that might be used for various quantities of carbon dioxide.

22. What are the potential personnel costs for carbon dioxide sequestration?

This is a business planning issue that involves budgetary items related to staffing. The personnel costs associated with sequestering carbon dioxide include categories such as supervisory, monitoring and verification, engineering, testing, maintenance, and security.

23. What is the interest of academia, foundations, private groups, and government agencies in carbon dioxide sequestration?

An inventory of experts in all public and private sector institutions that might have an interest in carbon dioxide sequestration should be conducted.

24. What is the cost of processing carbon dioxide into another more beneficial chemical?

The potential cost of processing carbon dioxide into some other chemical is important for evaluating the financing of geological sequestration. Interviews with appropriate industry professionals should be conducted regarding specific operational costs.

25. What are alternatives to the sequestration of carbon dioxide in geological formations?

Alternatives to geological sequestration that so far may not have received the same consideration should be analyzed and described. The comparative costs and risks of these other options should be included.

Responsibility

Who will ultimately be responsible if there is a release of carbon dioxide?

1. Who exactly is responsible?

Many institutions set responsibility. Legislators set responsibility through legislation. Courts set responsibility through common law. The press sets responsibility through editorial expression and news reporting that influence public opinion. NGO's set responsibility through conferences and recommendations. Responsibility can be structured so that no one other than a regulator can impose it on a given party. Responsibility can also be set in a variety of other ways where specific individuals or agencies are granted the authority to enforce rights and duties. A recurring question in regulatory law is whether a regulatory provision creates a private cause of action. The legal principles that establish when regulations establish a private cause of action should be explored. The development of class action litigation has changed the calculus of identifying who is ultimately responsible and should be investigated in detail. The concept of “potentially responsible party” (PRP) should also be examined for lessons.

2. What exactly is the responsibility?

Various approaches to defining the limits of responsibility should be analyzed. There are two aspects of this topic. The first is to identify the consequences of action. Consequences can be obvious and immediate or they can be subtle and remote. The consequences of a potential leak of carbon dioxide should be described. The second aspect is to consider who is affected by the release of carbon dioxide and determine

how they would describe the consequences. This includes an in depth understanding of potentially affected parties and their legal relationship to the responsible party. The concept of PRP should also be examined for applicable lessons involving typical responsibilities in various business contexts.

3. What is the impact of a multiple party structure on responsibility?

The insurance and legal professions label this issue as “joint and several liability”. Its practical expression is found when American plaintiff lawyers name as many defendants as possible in lawsuits. The financial reason for this practice is to implicate multiple insurance policies on a claim and aggregate the dollar limits of all policies. Common techniques for insurance policy drafting to minimize the chance of this tactic succeeding should be outlined.

4. What are the types of potential damages?

A comprehensive analysis of the types of damages that might potentially result from carbon dioxide sequestration should be made. Theories of legal liability for immediate and remote injuries should be included. Valuing the damages would be important for pricing insurance coverage or bank products that could provide financial protection. Actual, exemplary, and punitive damages should all be discussed. The insurance concept of “shock losses” should be reviewed along with the possible outcomes of insurer insolvency, responsible party bankruptcy, and bank impairment. The use of strategic bankruptcies in asbestos litigation should also be described with the lessons learned in allocating financial losses among all stakeholders.

5. What are the circumstances under which the release of sequestered carbon dioxide might be considered proper?

Circumstances under which the release of sequestered carbon dioxide might be considered proper should be investigated and defined. If a release of carbon dioxide might be considered proper in certain situations, determination should be made how these “appropriate” releases can be excluded from the liability system.

6. What would be the decision-making structure for authorizing “appropriate” releases?

To the extent circumstances are identified where carbon dioxide releases are deemed proper, a description of the decision-making structure for approving these releases should be given. The parameters for public notice and public involvement should also be described. Similar communication parameters should be considered for all of the stakeholders in the process.

7. What would be involved in an accidental release?

The sequence of events that would be expected for an accidental release should be identified. Certain events would apply to all storage locations such as simple calculations of maximum volume and rates of dispersal while others would vary with storage location such as population density and the potential effects on local flora, fauna, and livestock.

8. What would be expected under a worst-case scenario?

The sequence of events that would be expected under a worst-case scenario should be outlined along with what can be expected in human, social, economic, and financial terms. A discussion of techniques for mitigating the resulting consequences should be provided.

9. What types of physical security should be provided for carbon dioxide sequestration operations?

The public and private security potentially required for sequestration operations including transportation and temporary storage should be outlined. This should include a review of staffing, monitoring practices, and equipment needed as well as the estimated costs of security over time.

10. Are carbon dioxide sequestration operations potential targets of terrorism?

The implications of a hypothetical intentional attack designed to release carbon dioxide should be discussed. The consequences of such an attack should be described and comments on the special security measures needed to defend against a terrorist attack should be provided.

11. What would comprise a typical disaster response plan?

When a disaster occurs either caused by an accident or terrorist action, the first responders are usually from local government agencies or volunteer organizations. Local resources should be inventoried and interviews conducted with appropriate officials to determine the available capacity of localities to respond to disasters.

12. What are the financial aspects of disaster response?

Federal Emergency Management Agency (FEMA) officials and staff should be interviewed for their insight into major disaster response and management. Particular attention should be given to the financial resources and reserves that can be marshalled. Interviews with major commercial insurance underwriters should also be conducted to determine the role insurance and banking products play in major disasters.

13. What would comprise a typical disaster recovery plan?

After a disaster event has been stabilized, the next step is to identify the path to recovery. All available resources for disaster recovery should be inventoried including local healthcare, construction, and financial capabilities.

14. What are the financial aspects of disaster recovery?

In addition to their thoughts on disaster response, FEMA officials and staff should be interviewed for their insight into the recovery aspects of major disaster programs. Besides the immediate response of FEMA, there are long-term financial assistance programs provided by FEMA and other federal agencies such as the Small Business Administration (SBA).

Multi-State Jurisdiction

What is the impact of multi-state jurisdiction (MSR)?

1. What are the benefits of multiple-state public review by different authorities?

Ways in which the involvement of multi-state regulators could improve transactions should be identified. Interviews with participants who have been involved in previous multi-state transactions should be included along with any pertinent case studies.

2. What are the benefits of multi-state measures for regulatory compliance?

The impact of federalism on public policy should be discussed. When different states establish separate standards for the same or similar transactions, each state receives the specific protection its democratic institutions have established. The insurance industry is the textbook example of federalism. The insurance regulatory system is almost entirely a state system with varying legal standards in each of the fifty states. Even this diverse regulatory regime, however, recognizes that there are situations where state-by-state regulation is not appropriate. This is the so-called excess and surplus lines of insurance and marine insurance both of which would likely be sources of insurance for carbon dioxide sequestration activities.

3. What are the various points of view under multi-state jurisdiction?

Interviews with state regulators in appropriate functional agencies should be conducted to include a diversity of views, interests, experiences, and qualifications of different governmental authorities. This should also include viewpoints from various trade associations, non-profit organizations, and NGOs.

4. How does multi-state jurisdiction impact cost?

Federalism and multi-state regulation can be expensive. A cost-benefit analysis

should be provided that considers all expenses related to regulation. Applicable case studies should be provided with the lessons applicable to sequestration.

5. Is there an increased risks for transgressing bureaucratic rules?

Under multi-state jurisdiction there is an increased risk of transgressing bureaucratic rules. The level of this risk corresponds to the number of agencies involved in overseeing performance. Internal management processes should identify the rules in each jurisdiction that are most important to public safety. Subsequent compliance efforts should be directed toward following these critical rules and meeting key requirements.

6. What are the problems of insurance coverage under multi-state jurisdiction?

The impact of multi-state jurisdiction on insurance coverage should be reviewed. This includes a determination of which state receives the premium tax and how guaranty funds are made available to provide protection to policyholders and claimants. When all of the risks, transactions, and parties are located in the US, the issues related to insurance are subject to fairly well established legal principles, business practices, and financial considerations. If there is a willing buyer and they find a willing insurer with sufficient capital to cover a risk asking for a reasonable premium, then an insurance policy is written. Beyond this straightforward transaction multi-state transactions involve determining an allocation of premium tax and guaranty fund protections for insolvencies.

7. How can communication be coordinated among multi-state government authorities?

The challenge of coordinating communication among multi-state authorities should be anticipated. Carbon dioxide sequestration is a matter of potential interest to all levels of government. Some consideration should be given to existing modes of communications between and among government authorities and whether specialized modes of communications would need to be developed. This should include a review of both routine and emergency communications. Interviews with government officials and staff in the appropriate functional agencies should be conducted.

8. How can communication be coordinated to the public across multiple states?

As has been discussed previously a variety of public interests in carbon dioxide sequestration activities should be anticipated. General interest from the public regarding sequestration could range from grade school student science projects, college and university seminars, visits from international delegations, and other routine public policy, journalistic, and scientific inquiries. A proactive plan for dealing with and capitalizing on this interest should be identified.

International Jurisdiction

What is the significance of international participation where one country produces the carbon dioxide, but it is being sequestered in another country?

1. What are the international organizations interested in carbon dioxide sequestration?

International institutions that potentially have an interest in any aspect of sequestration should be identified. This would include a diverse range of scientific, engineering, and technical organizations including those responsible for data collection and others having potential regulatory authority.

2. What are the pertinent international, multilateral, and bilateral treaties?

Treaties such as the Kyoto Protocol have received far-reaching publicity in the press, but there are countless other treaties, many of them strictly bi-lateral that deal with more narrow functional areas having relevance to sequestration. An inventory of these less well-known sources of law should be compiled.

3. What are the interests of international commercial enterprises?

Stakeholder issues have been previously discussed in the context of domestic activities. Additional research should be conducted on international stakeholder involvement with a focus on the "multi-national" characteristics of international sequestration projects. The potentially complicated legal compliance issues of international commerce and how these issues affect commercial operations should be discussed. The impact that different levels of regulatory sophistication have on the allocation of project resources should be considered. Whether a nonexistent or indifferent regulatory posture attracts commercial operations to a particular country should also be included.

4. What are the international finance issues?

Research into the sources of funding for carbon dioxide sequestration projects should include a discussion of international financing options. Finance, accounting, and risk-pricing structures should be defined in the context of international business and law. Proposed fiscal and tax options should be included. Accounting insurance and risk financing issues already discussed from a federal and state perspective should be expanded to identify international implications.

5. What are the issues related to transportation?

All modes of transportation that could be used to move carbon dioxide from source to final sequestration point should be identified to assist in determining the specifics of cost, safety, and insurance. An evaluation should be included regarding whether

carbon dioxide transportation requirements would be considered specialized and if commercial enterprises would be able to provide appropriate transportation. Discussion of both federal and international anti-trust protections should be included. Transportation liability and insurance issues should also be covered in the context of international transactions.

6. What are the issues related to temporary storage?

The financial aspects of temporary storage and impoundment are often overlooked, but temporary storage and impoundment could create special risks, because staff at storage facilities might not be specialists in dealing with large amounts of carbon dioxide. Temporary storage issues parallel the previous discussion regarding transportation, specifically those related to anti-trust, civil liability, and insurance. Although considered within the context of international transactions, temporary storage and impoundment areas are typically subject to local law rather than international law. Specific risks and general laws applicable to various harbor and port authorities should be included.

7. What are the international sources of carbon dioxide transportation data?

Insurance underwriters, brokers, and actuaries can measure risk only if extensive and reliable data is available. Reliable data is key to pricing finance and insurance contracts. Interviews should be conducted with underwriters and brokers in insurance and reinsurance markets as well as with international banks to determine what type of data would be needed to validate carbon dioxide transportation.

8. What is the significance of a cross-border insurance environment?

Insurance underwriters usually present cross-border insurance as a higher-risk undertaking. Pricing and rates are generally unregulated. The only interest of cross-border government agencies is typically ensuring that premium, policy, or franchise taxes are collected. Insurers who write policies in cross-border transactions are careful to minimize their legal presence in multiple jurisdictions. The insurers also want to avoid exposure to legal proceedings in national courts. Their insurance policies typically require arbitration or legal review in European Union or United Kingdom tribunals. Cross-border insurance is generally characterized by having fewer financial disclosures than those required in the regulated US market. If foreign unlicensed insurers become insolvent, US policy holders and claimants are not protected by US guaranty funds. If an unregulated foreign insurer cancels its insurance policy for any reason, trying to enforce a third-party notice requirement can be difficult if not impossible.

As a general rule insurance companies do not want to insure the first of a kind or the last of a kind. A stated mantra is "no first time, no last time". The insurance industry wants to base the coverage they provide and the premiums they charge on scientific data and a clear actuarial history. If a project is considered a demonstration or experimental in any way, there is an inherent uncertainty and the potential project risks become much more difficult to quantify. Coverage in this environment would automatically involve some type of specialty insurance. Specialty insurance is created for activities where very little or no actuarial data is available. The pool is most likely too small and the history of experience too short to come up with any kind of meaningful statistical analysis. Because there is no history of past experience, expected future performance is hard to predict. Under this situation an insurance carrier who has some understanding of the technology or a similar commercial technology in a related field must be sought to provide specific coverage for a limited time under a specialty insurance contract.

Although the geological sequestration of carbon dioxide has clear precedents in the petroleum industry, specifically in enhanced oil recovery operations, permanent sequestration for environmental reasons offers new challenges and, subsequently, new potential liabilities. For this reason geologically sequestering carbon dioxide would most likely require a consortium or pool of existing insurance carriers. This insurance pool could potentially be set up in any number of ways, but having the pool initially funded by both government and industry is one likely scenario. Under this arrangement insurance companies involved in the pool would be required to add funds on a set timetable as sequestration activities began to establish a proven track record. Initial premium rates would be set high, not because of a proven risk profile, but due to the lack of solid performance data specific to geologically sequestering carbon dioxide for GHG mitigation. As more projects came on line over time, however, confidence would increase among both operators and insurers. Relatively high rates that originally were for short periods of time and subject to frequent renegotiations would receive competitive downward pressure as other insurance companies entered the market. High rates for a relatively low risk activity would not last long in an open market.

Based on the previous research and interviews with insurance and legal experts, there appears to be no major insurance or legal issues that would keep geological sequestration projects from moving forward. Right now the major challenges are related to funding for demonstration projects and the technical challenge of capturing carbon dioxide emissions from power plants in a cost effective manner. As long as it remains proven that a sudden, mass release of sequestered carbon dioxide is highly unlikely or even structurally impossible due to the geology, liability will not be a limiting factor for sequestration projects. Demonstration projects will be the key to increasing the comfort level of both the insurance industry and the public. Once large amounts of carbon dioxide that would have otherwise gone into the atmosphere are safely and securely sequestered, the public benefits of geological sequestration will no longer be simply conjecture. There will always be those who are against geological

sequestration for a variety of reasons. If the long-term storage of carbon dioxide is successful over time, however, liability concerns will not be the limiting factor for future projects.

Insurance Business

Insurance for a given activity is based on risk and value. High risk and high value equates to high premiums. If the risk is well defined, however, obtaining insurance is typically a straightforward business activity. This is the realm of regular insurance, where actuarial data is available from a large pool. Using the "law of large numbers" insurance underwriters and actuaries are able to use statistical analysis to clearly define risk and accurately calculate the amount an insurance company would have to pay out in claims over time. Taking the dollar value of projected claims and adding operating costs and profit results in the rates that would be charged for a particular insurance coverage.

Without a solid base of actuarial data, however, it is difficult for underwriters to price insurance products. If a performance history is not available for a given activity, insurance underwriters will want to know everything they can about what they are being asked to insure. This includes asking a lot of questions. Everything about when an activity will be scheduled, who will be involved, and what is going to occur would need to answered in great detail. Even if insurance would be offered in this situation, the insurance may be granted for only a very short time and would need to be renegotiated periodically before it is renewed. If the activity is proven over time record, however, additional insurance companies would most likely want to get involved in what would be an emerging market. Once a positive track record is established, more competitive rates would typically be offered as everyone, including other insurance companies, become familiar with the given activity.

Insurance is typically structured to cover losses related to the following:

- Physical Damage
- Time Element
- Liability

For example, in a drilling operation physical damage would include damage up to complete loss of drilling equipment such as a drilling rig. A time element event would involve not meeting a schedule such as not achieving a desired well depth in a set amount of time. The broad category of liability covers a wide range of additional damages and negative impacts related to accidents and negligence.

Insurance coverage is granted for specific activities in the following areas:

- Design: Engineering All Risks (EAR)
- Construction: Construction All Risks (CAR)
- Operation: Project All Risks (PAR)

An insurance broker works for the individuals seeking insurance and tries to get the

highest coverage and the lowest deductible for the lowest possible premium. Brokers typically get a percentage of the premium. Gaps in coverage are those items missed by brokers. Brokers need their own liability insurance to cover errors of omission in the insurance coverage they put together for their clients. An insurance underwriter works for an insurance company to define the risk involved in granting a particular coverage. A manuscript is written that documents the nature of the risk and describes applicable precedents. This forms the framework under which the risk is structured and sold on them market. Major domestic brokers include Marsh, AON, and Willis; and major domestic insurance companies include FM, XL, AIG, ACE, and Zurich.

Insurance companies maintain a large holding of investments in real estate, bonds, and cash on hand in order to pay claims. The domestic insurance industry is the single largest owner of commercial office space in the US. After taking on clients insurance companies typically sell stakes in some of their policies to reinsurance companies such as Zurich. This allows insurance companies to share the risk even though the original insurance company still holds the policy. This shared risk structure allows the initial insurer to reduce the amount of cash that must be maintained to pay claims. For large insurance policies with potentially large claims the business structure can be quite complex. Insurance companies can form partnerships to provide primary coverage while other companies become involved in reinsurance. Over time the structure can become even more complex as different pieces of both primary insurance and reinsurance are bought and sold to other companies and partnerships. Figure 1 provides a diagram depicting a typical business structure for five hundred million dollars of insurance coverage.

An insurance company can be a mutual insurance company in which case it is a private company or a stock insurance company that is publicly held. The two basic business models involve either a Net 90 or a Cash Flow Underwriter structure. Under a Net 90 structure the combined percentage (combined ratio) of losses plus operating expenses is managed to equal ninety percent of total income. Cost from loss claims equal approximately sixty percent and costs from operating expenses equal approximately thirty percent. The remaining ten percent of the total income is projected profit. This is the traditional operating structure of long-standing insurance companies that try to make ten cents on every dollar earned. A more aggressive business model is the Cash Flow Underwriter structure. Here losses plus expenses equals one hundred percent or even higher of total income. Profit is sought through the investment of cash reserves. This can be quite lucrative in a competitive environment when the stock market and other investments are paying good returns. This structure allows companies to underprice their competition, because income from clients does not have to cover profit. Once the stock market and other investments falter, however, as was the case a few years ago, these companies can quickly become insolvent.

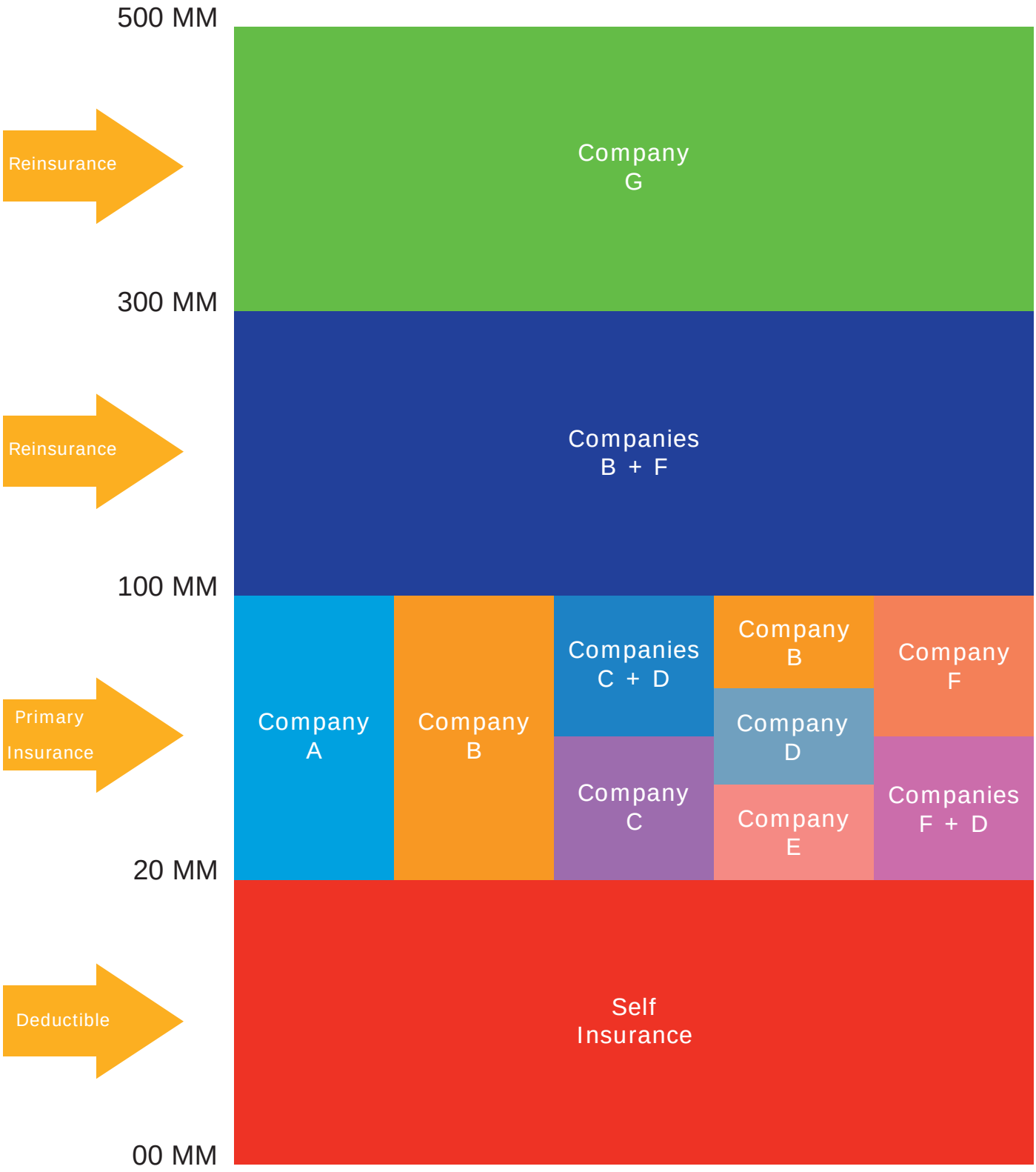

Figure 1: This diagram depicts a typical business structure for five hundred million dollars of insurance coverage.

Appendix II

Insurance Glossary

The following is a brief list of insurance terms that were discussed during the interviews conducted with insurance and legal experts. A more comprehensive list of terms is found on the following pages, which contain the latest version of the *Glossary of Selected Reinsurance Terms* from Gill and Roeser (www.gillroeser.com).

D&O - directors and officers insurance; covers liability due to negligence of company management

long tail liability - the long-term liability that continues after a project is closed out as defined by ownership agreement; insurance companies do not want to be responsible for this type of liability; this is generally considered to be an area where government can play a critical role

FAC - facultative of reinsurance; typically high risk; reinsurance under which the entity ceding risk can choose to submit specific, individual risks and the reinsurer has the option of accepting or declining those risks

MFL - maximum foreseeable loss; the very worst loss imaginable when all safety systems are out of service; worst case scenario

NLE - normal loss event; event that happens at a certain known frequency; insurance companies do not want to cover these types of losses and typically consider them as maintenance that would be covered by the deductible

PML - probable maximum loss; a fortuitous event that is of the type intended to be covered by insurance; rates based on scientific data and actuarial history; the largest loss that could be expected under normal circumstances, but not the worst case

sublimit - exclusions to coverage; sets limits on claims regarding specific areas of coverage defined in the contract

Accident Year Experience - Underwriting result based on earned premiums and ultimate losses from loss events falling within the same twelve-month accounting period, regardless of when the losses are actually reported, booked or paid. See Calendar Year Experience and Underwriting Year Experience.

Acquisition Costs - Expenses incurred by an insurer or reinsurer in the process of writing new or renewal business, including producer commissions.

Adjustable Feature - A cost modification provision found in some reinsurance agreements. Parties agree to adjust final premium rate or final ceding commissions retrospectively, in accordance with the loss experience, by formulas set forth in the agreement.

Admitted Assets - Cash and investments that meet criteria for liquidity and safety set by the National Association of Insurance Commissioners and by individual state commissioners. Only admitted assets are used in measuring the capacity and soundness of an insurer. Non-admitted assets, such as overdue receivables, are excluded from statutory assets and surplus.

Admitted Reinsurance - Reinsurance that is provided by a reinsurer licensed or authorized in the jurisdiction in question. Cedants may automatically take credit in that jurisdiction for admitted reinsurance. A cedant may take credit for non-admitted reinsurance only if it is secured by a letter of credit, trust agreement or funds withheld. Also called authorized reinsurance.

Aggregate Limit - The maximum sum of recoveries payable under those reinsurance agreements that provide an overall maximum loss limitation.

Aggregate Retention - An additional retention kept net by the cedant of losses otherwise recoverable from the reinsurer. There are two retentions in a program having an aggregate retention. The first retention applies to each risk or occurrence. The second, or aggregate retention, applies to amounts that would normally be recoverable from the reinsurer. Only after the aggregate retention is exceeded can the cedant recover from the reinsurer.

Alien Reinsurer - A non-US domiciled reinsurer writing reinsurance in the US

Arbitration Clause - A provision in reinsurance agreements that provides for non-judicial settlement of disputes between parties. Generally, each party chooses an arbiter; the arbiters agree on an umpire and these three agree on a resolution of the dispute. Under some clauses, an unsatisfied party may have the option to seek judicial relief following an arbitration finding.

Assume - To take over a risk, the converse of cede.

Assumption Reinsurance - A form of reinsurance under which policy administration and the contractual relationship with the insured, as well as all liabilities, pass to the reinsurer; the novation of liability is evidenced by an assumption certificate issued to the insured who, in some jurisdictions, has the right to refuse the change in insurers. See Indemnity Reinsurance and Coinsurance.

Attachment Basis - A provision in reinsurance agreements that determines whether, and in what manner, a reinsurance agreement covers a specific loss. See Claims Made and Occurrence Basis.

Balance - A reinsurance underwriter's benchmark which measures premium volume against the limit exposed under a reinsurance agreement.

Bank - An informal, non-contractual multi-year summing up of the total premiums ceded to reinsurers less losses paid by reinsurers over the duration of a layer or program, usually a catastrophe program. For instance, cessions of $10,000 in premiums for each of five loss-free years would be said to constitute a $50,000 bank.

Binder - In reinsurance, a preliminary contract signed by the accepting underwriter which summarizes terms and conditions of coverage, pending the issuance of a formal contract, which replaces the binder. See Slip and Cover Note.

Blended Reinsurance - Reinsurance that integrates in a single contract traditional risk transfer and financial reinsurance or finite risk reinsurance coverage components. An example would be a contract that combines catastrophe coverage on a per occurrence basis with casualty coverage having an aggregate limit and aggregate retention.

Bordereau - A written schedule of insureds, premiums and losses submitted to reinsurers under certain types of reinsurance agreements. See Facultative Automatic.

Brokerage Market - Reinsurers that write business through reinsurance intermediaries. Reinsurers who do not generally accept such business are referred to as the direct market.

Burning Cost Ratio - Historical incurred losses, usually excluding IBNR, to an existing or proposed reinsurance agreement divided by subject premium. The burning cost ratio, adjusted for IBNR, other costs and a profit factor is a tool used in making rates for excess of loss reinsurance.

Calendar Year Experience - Underwriting result based on earned premiums and booked incurred losses, paid losses plus beginning-of-year to end-of-year changes in case reserves and IBNR, for the same calendar year accounting period, regardless of the dates of the loss events. See Accident Year Experience and Underwriting Year Experience.

Capacity - The percentage of surplus or the dollar amount of exposure that an insurer or Reinsurers is willing to place at risk. Capacity may apply to a single risk, a program, a line of business, or an entire book of business.

Capitation - A risk arrangement in a managed care environment in which a health care provider is paid a fixed amount per month for each enrolled member in a health plan regardless of the actual number or nature of services provided to each person. The capitation contract may include a risk-sharing arrangement, in which there is an allocation of financial results, both favorable and unfavorable, among the participants to the agreement.

Captive - An insurance or reinsurance subsidiary of an industrial company, trade association, or not-for-profit organization. Captives insure or reinsure parent-related business, non-parent business, or both. Although the number of domestic captives is increasing, most captives are still located in tax-advantaged offshore domiciles such as Barbados, Bermuda, or the U.K.'s Channel Islands.

Carryover Provision - A multi-year rating device found in some reinsurance agreements which provides that a loss to reinsurers in a given time period may be applied to the results of a previous period (loss carryback) or may be applied to a future period (loss carryforward).

Case Reserve - Known also as outstanding loss reserves, case reserves are recorded estimates of outstanding unpaid liabilities associated with specific reported claims. Case reserves may pertain to losses, allocated loss adjustment expenses (ALAE), or both. Case reserves are established by the cedant; if the reinsurer believes a case reserve is inadequate, it may establish an additional amount known as the additional case reserve (ACR).

Catastrophe - A disaster involving multiple insureds and/or locations. Hurricanes, tornadoes, explosions, and earthquakes are the most common catastrophe examples. Catastrophe is also sometimes used to designate a single large loss, generally $5,000,000 or more, or an event affecting a minimum number of lives, e.g., three. Catastrophe reinsurance indemnifies the cedant for such losses, subject to an agreed retention and limit.

Cedant - A ceding insurer or a ceding reinsurer. A ceding insurer is an insurer that underwrites and issues an original, primary policy to an insured and contractually transfers (cedes) a portion of the risk to a reinsurer. A ceding reinsurer is a reinsurer that transfers (cedes) a portion of the underlying reinsurance to a retrocessionnaire.

Ceding Commission - The cedant's acquisition costs and overhead expenses, taxes, licenses and fees, plus a fee representing a share of expected profits sometimes expressed as a percentage of the gross reinsurance premium.

Claims Made Basis - A form of reinsurance under which the date of the claim report is deemed to be the date of the loss event. Claims reported during the term of the reinsurance agreement are therefore covered, regardless of when they occurred. A claims made agreement is said to "cut off the tail" on liability business by not covering claims reported after the term of the reinsurance agreement, unless extended by special agreement. See Occurrence Basis.

Clash Cover - A form of reinsurance covering a cedant's exposure to multiple retentions and a larger single loss than intended by reason of two or more insureds being involved in the same loss occurrence, or clash. A clash cover absorbs such additional retentions.

Coded Excess - A form of excess of loss reinsurance under which different premium rates are applied to successive bands of primary coverage limits. Coded excess is considered more accurately to measure exposure than averaging methods.

Coinsurance - Indemnity life reinsurance under which the reserves as well as the risk are transferred to the reinsurer; the cedant retains its liability to and contractual relationship with the insured. See Modified Coinsurance and Assumption Reinsurance.

Combined Ratio - The sum of two ratios, one calculated by dividing incurred losses plus loss adjustment expenses (LAE) by earned premiums (the calendar year loss ratio), and the other calculated by dividing all other expenses by written premiums. When applied to a company's overall results, the combined ratio is also referred to as the composite, statutory, or trade ratio. Used in both insurance and reinsurance, a combined ratio below 100% is indicative of an underwriting profit.

Commutation - The termination of all obligations between the parties to a reinsurance agreement, normally accompanied by a final cash settlement. Commutation may be required by the reinsurance agreement or may be effected by mutual agreement.

CoModCo - A combination of coinsurance and modified coinsurance under which some part of the reserves, e.g. deficiency reserves, are a liability of the reinsurer ("co" portion) while some are returned to the cedant ("modco" portion).

Concurrency - Coordination of the coverage, terms and conditions of a reinsurance agreement with those of a contract reinsured or between reinsurance agreements. Reinsurance agreements are said to be concurrent when there are no gaps or overlaps.

Cover Note - Confirmation by the intermediary to the cedant of terms and conditions and percentage placed with each reinsurer. In effect, a cover note is a receipt for slips or binders received by the intermediary from underwriters on behalf of the cedant.

Credibility - A statistical measure of the reliability of experience data, based on the size of the sample.

Cut Through Endorsement - An endorsement to a reinsurance agreement which requires that, in the event of the cedant's insolvency, any loss covered under the reinsurance agreement be paid by the reinsurer directly to the insured or a third party beneficiary. Also called assumption endorsement or assumption of liability endorsement (ALE).

Direct Market - Reinsurers that deal with the cedant through their account executives, rather than through intermediaries. See Brokerage Market.

Direct Premium Written - An insurer's premium income calculated before reflecting reinsurance inward or outward.

Errors and Omissions Clause - A provision in reinsurance agreements which is intended to neutralize any change in liability or benefits as a result of an inadvertent error by either party.

Excess of Loss - A form of reinsurance under which recoveries are available when a given loss exceeds the cedant's retention defined in the agreement.

Experience Refund - Under a reinsurance agreement, that part of the profits which is returned to the cedant after recognition of contingency reserves, loss carryforward and loss carryback provisions. See Carryover Provision.

Exposure - Measure of vulnerability to loss, usually expressed in dollars or units.

Extra Contractual Obligations (ECO) - A generic term that, when used in reinsurance agreements, refers to damages awarded by a court against an insurer that is outside of the provisions of the insurance policy, due to the insurer's bad faith, fraud or gross negligence in the handling of a claim. Examples are punitive damages and losses in excess of policy limits.

Facultative - Reinsurance under which the cedant has the option (faculty) of submitting and the reinsurer has the option of accepting or declining individual risks.

Facultative Automatic - A form of property and casualty reinsurance that is a hybrid between facultative and treaty. A bordereau of risks ceded is submitted to the reinsurer that has limited rights to decline individual risks. See Bordereau

Financial Guaranty - Insurance which indemnifies an insured claimant, obligee or indemnitee for financial loss resulting from (a) default or insolvency, (b) changes in interest rate levels, (c) changes in currency exchange rates, (d) restrictions imposed by foreign governments, or (e) changes in the value of specific assets or commodities.

Financial Quota Share - A form of reinsurance that enables a cedant to increase its statutory surplus by the amount of the ceding commission in the reinsured unearned premium reserve. Surplus relief arises because statutory accounting requires insurers and reinsurers to charge immediately all acquisition costs to the accounting period in which the business is written, even when the premium is unearned at the end of the period. Referred to as pre-paid acquisition costs in the unearned premium reserve, or the equity in the unearned premium reserve.

Financial Reinsurance - A form of reinsurance which considers the time value of money and has loss containment provisions. One of its objectives is the enhancement of the cedant's financial statements or operating ratios, e.g., the combined ratio; loss portfolio transfers and financial quota shares are examples.

Finite Risk Reinsurance - A form of retrospectively-rated reinsurance in which the reinsurer's ultimate liability over the term of the contract is typically limited to no more than 300% of the premium ceded. Its primary objectives are to stabilize earnings and reduce reinsurance costs.

Follow the Fortunes - A provision in reinsurance agreements, not always specifically identified as such, in which it is agreed that the reinsurer is bound to the same fate as the cedant with respect to risks covered.

Foreign Reinsurer - A reinsurer chartered (domiciled) in one state writing business in another state is considered to be foreign in the non-domiciliary state. In its own state, the reinsurer is considered to be domestic.

Funds Withheld - Assets that would normally be paid over to a reinsurer, but are withheld by the cedant to permit statutory credit for non-admitted reinsurance, to reduce a potential credit risk or to retain control over investments.

Gross Line - The maximum limit an insurer or reinsurer is willing to accept before taking reinsurance into account. Such limits are usually expressed per insured, per line of business, etc. See Net Line

Ground Up Loss - The entire amount of an insurance loss, including deductibles, before application of any retention or reinsurance. The original loss to the insured, after recognizing known salvage and subrogation.

Guaranteed Cost Reinsurance - A form of reinsurance that has no adjustable features. The final premium rate for the coverage is exactly as set forth ab initio in the contract.

Honorable Undertaking - A phrase in some reinsurance agreements, usually in the following context: "This agreement is considered by the parties hereto as an honorable undertaking, the purpose of which is not to be defeated by a strict or narrow

interpretation of the language thereof."

Incurred But Not Reported (IBNR) - The actuarial estimate of reserves required to pay ultimate net losses (UNL) after netting out existing reserves on reported, but unpaid claims (case reserves). This estimate includes an allowance for potential changes in such existing reserves as well as additional reserves for claims that have already occurred but are yet to be reported. See Long Tail Liability.

Indemnity Reinsurance - A form of reinsurance under which the risk, but not the administration is passed to the reinsurer which indemnifies the cedant for losses covered by the reinsurance agreement or treaty. The cedant retains its liability to and its contractual relationship with the insured.

Indexing, Indexation - The adjustment of a cedant's retention and the reinsurance limit by a measure of inflation such as the Consumer Price Index. Under indexation, the cedant's original retention and the reinsurance limit are multiplied by the result of dividing the index on the settlement date by the index as of the effective date of the reinsurance agreement.

Insolvency Clause - A provision in reinsurance agreements that provides for the continuance of payments of the obligations of the reinsurer as though no insolvency had occurred, with appropriate recognition of additional expenses of the reinsurer caused by the insolvency. Required in New York and in certain other states.

Intermediary - A third party in the design, negotiation and administration of a reinsurance agreement. Intermediaries recommend to cedants the type and amount of reinsurance to be purchased and negotiate the placement of coverage with reinsurers. At Lloyd's of London, called a broker. See Brokerage Market and Direct Market.

Intermediary Clause - A provision in reinsurance agreements that identifies the intermediary negotiating the agreement. Most intermediary clauses shift all credit risk to reinsurers by providing that: 1) the cedant's payments to the intermediary are deemed payments to the reinsurer, 2) the reinsurer's payments to the intermediary are not payments to the cedant until actually received by the cedant. This clause is mandatory in some states.

Layer - A horizontal segment of the liability insured, e.g., the second $100,000 of a $500,000 liability is the first layer if the cedant retains $100,000, but a higher layer if it retains a lesser amount. See Pro Rata.

Lead Reinsurer - The reinsurer that negotiates the terms, conditions and premium rates and first signs on to the slip; reinsurers that subsequently sign on to the slip under those terms and conditions are considered following reinsurers.

Letter of Credit - A financial guaranty issued by a bank that permits the party to which it is issued to draw funds from the bank in the event of a valid unpaid claim against the other party; in reinsurance, typically used to permit reserve credit to be taken with respect to non-admitted reinsurance; an alternative to funds withheld and modified coinsurance.

Lloyds - An insurance or reinsurance organization in which individuals or groups of individuals, called syndicates, rather than corporations, are at risk.

Long Tail Liability - The liability for claims that do not proceed to final settlement for some time, often a decade or more; characterized by a high IBNR. The loss distribution curve by duration of payment appears to have a "tail".

Loss Adjustment Expense (LAE) - All expenditures of an insurer associated with its adjustment, recording and settlement of claims, other than the claim payment itself. The term encompasses both allocated loss adjustment expenses (ALAE), which are loss adjustment expenses identified by a claim file in the insurer's records, such as attorney's fees; and unallocated loss adjustment expenses (ULAE), which are operating expenses not identified by claim file, but functionally associated with settling losses, such as salaries of the claims department.

Loss Development - An actuarial method used to predict ultimate net losses (UNL) and IBNR. The growth of paid losses and case reserves is observed at regular intervals to arrive at age-to-age development percentage. Also known as "triangulation" for the characteristic shape of the tabular data employed.

Loss Event - Any trigger for a recovery under an insurance or reinsurance agreement. Examples include occurrence, claims made, death or disability.

Losses in Excess of Policy Limits - A term that, when used in reinsurance agreements, refers to damages awarded by a court against an insurer in favor of the insured, due to the insurer's having failed to settle a third party claim against the insured within the policy limits by reason of bad faith, fraud or gross negligence. See Extra Contractual Obligations and Punitive Damages.

Loss Portfolio Transfer - A form of financial reinsurance involving the transfer of loss obligations already incurred which, when ultimately paid, will exceed the consideration paid to the reinsurer for undertaking such obligations. The amount by which the transferred obligations exceed the consideration paid is the resultant increase to the cedant's statutory surplus.

Loss Ratio - Incurred losses, including applicable IBNR, divided by earned premium for an accounting or treaty period. Loss ratios can be calculated on an accident year, calendar year or underwriting year basis.

Loss Ratio Coverage - A form of stop loss reinsurance under which the reinsurer pays a portion of the claims represented by a loss ratio in excess of a specified loss ratio. For example, "20% in excess of 110%" will result in claims between 110% and 130% of premium being paid by the reinsurer.

Managed Care - Systems designed to integrate the delivery and financing of health care of the highest possible quality at the lowest possible cost. In contrast to traditional fee-for-service arrangements, under managed care, health care providers (1) agree to negotiated payment levels for specified services to defined patient populations, (2) agree to more aggressive utilization and quality assurance review, and (3) assume financial risk leading to more severe restriction on patient choice to obtain services outside the network.

Market Cycles - Market-wide fluctuations in the prevailing level of insurance and reinsurance premiums. A soft market, characterized by increased competition in which prices are depressed, is usually attributed to excess capacity, more sellers than buyers, and/or high interest rates. A hard market following a soft market is often triggered by a major catastrophe loss and/or a protracted period of operating losses, combined with declining investment income from falling interest rates and/or security market values.

Maximum Foreseeable Loss (MFL) - A property underwriter's estimate of the cost in the event of a total loss where all loss control systems (e.g. sprinklers and firewalls) fail. See Probable Maximum Loss (PML).

ModCo Reserve Adjustment - The net of two modified coinsurance items: the interest on reserves payable by the cedant to the reinsurer less the increase in reserves, payable to the cedant by the reinsurer.

Modified Coinsurance - Indemnity life reinsurance that differs from coinsurance only in that the reserves are returned to the cedant while the risk remains with the reinsurer; the cedant is required to pay interest to replace that which would have been earned by the reinsurer if it had held the assets corresponding to the reserves in its own investment portfolio. Originally devised to permit reserve credit to be taken with respect to a non-admitted reinsurer, now also used to secure credit and retain control of investments. See Funds Withheld, Coinsurance, and Assumption.

Net Line - The maximum limit an insurer or reinsurer is willing to accept after taking reinsurance into account. Such limits are usually expressed per insured, per line of insurance, etc. See Gross Line.

Occurrence - An adverse contingent accident or event neither expected nor intended from the point of view of the insured. With regard to limits on occurrences, property catastrophe reinsurance agreements frequently define adverse events having a common cause and sometimes within a specified time frame, for example seventy-two

hours, as being one occurrence. This definition prevents multiple retentions and reinsurance limits from being exposed in a single catastrophe loss.

Occurrence Basis - A form of reinsurance under which the date of the loss event is deemed to be the date of the occurrence, regardless of when reported. See Claims Made Basis.

Offset Clause - A provision in reinsurance agreements which permits each party to net amounts due against those payable before making payment; especially important in the event of insolvency of one party which ceases to remit amounts due to the other. This clause is often challenged by state insurance departments, creditors, and others interested in maximizing the assets of the insolvent party.

Overline - An inadvertent reinsurance acceptance that results in a reinsurer committing more capacity on a single risk than its intended exposure.

Policy Expense Allowance - An amount payable to the cedant by the reinsurer in lieu of actual commissions and expenses incurred by the cedant.

Portfolio Runoff - A form of reinsurance under which the inforce business is reinsured to the subsequent anniversaries of the underlying policies; often accomplished by ceding the unearned premium reserve on such business.

Premium (Written/Unearned/Earned) - Written premium is premium registered on the books of an insurer or reinsurer at the time a policy is issued and paid for. Premium for a future exposure period is said to be unearned premium. For an individual policy, written premium minus unearned premium equals earned premium. Earned premium is income for the accounting period while unearned premium will be income in a future accounting period.

Probable Maximum Loss (PML) - A property underwriter's estimate of the cost in the event of a total loss where loss control systems (e.g. sprinklers and firewalls) operate. Used in underwriting and in determining reinsurance limits. See Maximum Foreseeable Loss (MFL).

Profit Commission - A provision found in some reinsurance agreements which provides for profit sharing. Parties agree to a formula for calculating profit, an allowance for the reinsurer's expenses, and the cedant's share of such profit after expenses. See Adjustable Features, Risk Charge, and Experience Refund.

Pro Rata - A form of reinsurance in which premiums and losses are shared proportionately between cedant and reinsurer. One such reinsurance agreement is quota share, in which the same percentage applies to all policies reinsured. Another is surplus share, in which the percentage may vary from policy to policy and usually increases as policy limits increase.

Provider Excess of Loss - Reinsurance for providers of health care services under capitation contracts, e.g., coverage limiting financial risk of health care providers for individual patients if the cost of care exceeds a pre-determined limit.

Punitive Damages - A term that, when used in reinsurance agreements, refers to damages awarded by a court against an insured or against an insurer in addition to compensatory damages. Punitive damages are intended to punish the insured or the insurer for willful and wanton misconduct and to serve as a deterrent. When the award is against an insurer, it is usually related to the conduct of the insurer in the handling of a claim, and can arise in both first party and third party coverage situations. See Extra Contractual Obligations and Losses in Excess of Policy Limits.

Quota Share - See Pro Rata.

Rate - The premium rate is the amount of premium charged per exposure unit, e.g., 10 cents per $1,000 of exposure.

Rate on Line - A percentage arrived at by dividing reinsurance premium by reinsurance limit; the inverse is known as the payback or amortization period. For example, a $10,000,000 catastrophe cover with a premium of $2,000,000 would have a rate on line of 20% and a payback period of five years.

Recapture - The process by which the cedant recovers the liabilities transferred to a reinsurer.

Refund Reinsurance - A form of reinsurance, typically yearly renewable term, under which the premium rates are subject to an experience refund as opposed to being fixed (non-refund).

Reinstatement Premium - An additional premium paid to replenish (reinstate) the limit consumed in the event of a loss.

Reinsurance - In effect, insurance that insurance companies buy for their own protection, "a sharing of risk." Reinsurance enables an insurance company to (1) expand its capacity; (2) stabilize its underwriting results; (3) finance its expanding volume; (4) secure catastrophe protection against shock losses; (5) withdraw from a class or line of business, or a geographical area, within a specified period of time.

Reinsurance Pool - A multi-reinsurer agreement under which each reinsurer in the group or pool assumes a specified portion of each risk ceded to the pool. Contrast with Reinsurance Wheel.

Reinsurance Wheel - A procedure for retroceding individual life insurance risks in excess of a reinsurer's own retention to a group of retrocessionnaires, up to their subscribed limits, in rotation, the order being determined by their positions as spokes

on an imaginary wheel. The spokes need not be of the same length, i.e. limit, and a company may have more than one spoke. Contrast with Reinsurance Pool.

Reinsurer - A reinsurer contractually accepts a portion of the cedant's risk. A professional reinsurer is a reinsurer whose principal business is reinsurance, as opposed to the reinsurance department of a primary company.

Reserve Adjustment Interest Rate - In modified coinsurance, the interest rate used to calculate the amount payable by the cedant in consideration of the reserves being transferred back by the reinsurer. See ModCo and Reserve Adjustment.

Retention - The dollar amount or percentage of each loss retained by the cedant under a reinsurance agreement. The point at which the retention is used up is said to be the attachment point for the reinsurer.

Retrocessionnaire - A reinsurer that contractually accepts from another reinsurer a portion of the cedant's underlying reinsurance risk. The transfer is known as a retrocession.

Retrospectively Rated Reinsurance - Reinsurance that provides for adjustments based on contract experience. Such adjustments include additional premiums, experience refunds, and for multiple year contracts, early termination penalties, or changes to coverage in subsequent years.

Risk Charge - An amount identified in some reinsurance agreements as specifically to be retained by the reinsurer for assuming the risk under the policies reinsured; a share of the profits in excess of the risk charge is returned to the cedant as an experience refund.

Salvage and Subrogation - Those rights of the insured that under the terms of the policy automatically transfer to the insurer upon settlement of a loss. Salvage applies to any proceeds from the repaired, recovered or scrapped property. Subrogation refers to the proceeds of negotiations or legal actions against negligent third parties and may apply to either property or casualty coverages.

Securitization of Insurance Risk - The transfer or sale, in the form of an investment security, of the underwriting and timing risks associated with one or more insurance policies. It is similar in concept to asset securitization, which involves turning illiquid assets into liquid instruments that can be traded freely on the open market, e.g., mortgage-backed securities.

Self-Insurance - Protecting against loss by setting aside one's own funds to provide for future contingencies. Through self-insurance it is possible to protect against high-frequency, low-severity losses. Utilizing self-insurance eliminates the various loadings such as acquisition expense, taxes and general expenses that would be incurred if the

same loss coverage were secured through an insurance company.

Sliding Scale Commission - A ceding commission that varies inversely with the loss ratio under the reinsurance agreement. The scales are not always one to one: for example, as the loss ratio decreases by 1%, the ceding commission might increase only 0.5%.

Slip - A binder often including more than one reinsurer. At Lloyd's of London, the slip is carried from underwriter to underwriter for initialing and subscribing to a specific share of the risk. See Binder and Cover Note.

Special Acceptance - A risk that is not otherwise covered, due, for example, to underwriting class or limit, but is endorsed into the reinsurance agreement by specific written agreement with underwriters. Used in treaties and facultative automatics.

Spread Loss - A form of reinsurance under which premiums are paid during good years to build up a fund from which losses are recovered in bad years. This reinsurance has the effect of stabilizing a cedant's loss ratio over an extended period of time.

Stop Loss - A form of reinsurance under which the reinsurer pays some or all of a cedant's aggregate retained losses in excess of a predetermined dollar amount or in excess of a percentage of premium. See Loss Ratio Coverage.

Subject Business - A shorthand way of saying "business of the class, size and limitations" covered under a reinsurance agreement.

Subject Premium - The cedant's premiums, written or earned, to which the reinsurance premium rate is applied to calculate the reinsurance premium. Often, subject premium is gross/net written premium income (GNWPI) or gross/net earned premium income (GNEPI) where the term "gross/net" means gross before deducting reinsurance premiums for the reinsurance agreement under consideration, but net after all other adjustments, e.g., cancellations, refunds, other reinsurance. Normally, subject premium refers to premium on subject business. Also known as base premium.

Surplus - The excess of assets over liabilities. Statutory surplus is an insurer's or reinsurer's capital as determined under statutory accounting rules. Surplus determines an insurer's or reinsurer's capacity to write business.

Surplus Relief - An increase in the cedant's surplus through financial reinsurance. Cedants are able to use the increase in surplus to write more business while retaining reasonable operating ratios, e.g. the combined ratio and the ratio of written premium to surplus.

Surplus Share - See Pro Rata.

Target Risk - In personal lines casualty insurance, a phrase which refers to celebrities and wealthy individuals. At one time, the Target Risk Exclusion Clause in property reinsurance listed major bridges, tunnels and art collections, but that clause has been replaced by the Total Insured Value (TIV) exclusion clause.

Termination - The formal ending of a reinsurance agreement by its natural expiry, cancellation, or commutation by the parties. Terminations can be either on a cutoff or runoff basis. Under cutoff provisions, the parties' obligations are fixed as of the agreed cutoff date. Otherwise, obligations incurred while the agreement was in force are run off to their natural extinction.

Time Value of Money - Relationship determined by the math of compound interest between monetary values at one point in time and their values at other points in time. Implicit in any consideration of time value of money are the rate of interest and the period of compounding.

Total Insured Value (TIV) - A provision in reinsurance agreements that excludes coverage of individual properties in cases where total insured values across all property lines equal or exceed a certain level, e.g., $200,000,000. This clause is used to prevent multiple exposures to reinsurers on large single risks.

Treaty - A reinsurance agreement covering a book or class of business that is automatically accepted on a bulk basis by a reinsurer. A treaty contains common contract terms along with a specific risk definition, data on limit and retention, and provisions for premium and duration.

Trust Agreement - An agreement under which certain assets are deposited by one party (the grantor), for the sole benefit of another party (the beneficiary), into an account managed by a third party (the trustee). In reinsurance, such an agreement is typically established to permit a licensed cedant to take credit for non-admitted reinsurance up to the value of the assets in trust.

Uberrimae Fidei - "Utmost good faith". A provision sometimes found in reinsurance agreements and considered descriptive of the reinsurance relationship.

Ultimate Net Loss (UNL) - The loss amount, including covered loss adjustment expenses (LAE), against which the retention and the reinsurance limits apply.

Unbundled Services - Term that describes commercial insurance with no administrative services attached, or alternatively, administrative services from an insurer without insurance coverage. Unbundled services are frequently the domain of third party providers done on a contractual basis.

Underwriter - An insurer, reinsurer, or an individual person employed by the insurer or reinsurer that assumes risks and "signs below" (underwrites) terms of the insurance or reinsurance accepted.

Underwriting Year Experience - Underwriting result based on written premiums and ultimate losses from loss events falling within the same accounting period, where the accounting period is the period covered by the insurance policy or reinsurance agreement, regardless of when the premiums and losses are actually reported, booked or paid. See Accident Year Experience and Calendar Year Experience.

Unusual Expenses - In life reinsurance, non-routine expenses of the cedant for claims investigation, legal defense or rescission actions. The reinsurer typically agrees to pay such expenses as distinct from punitive, exemplary or other non-contractual expenses that it does not agree to pay.

Working Layer - The first layer above the cedant's retention wherein moderate to heavy loss activity is expected by the cedant and reinsurer. Working layer reinsurance agreements often include adjustable features to reflect actual underwriting results.

Yearly Renewable Term - A form of life reinsurance under which the risks, but not the permanent plan reserves, are transferred to the reinsurer for a premium that varies each year with the amount at risk and the ages of the insureds; may be subject to an experience refund.

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Notes