Reserving for Asbestos Liabilities

Kevin M. Madigan, ACAS, MAAA, and
Claus S. Metzner, FCAS, FSA, MAAA, Aktuar-SAV

Abstract

Significant uncertainties surround the ultimate costs of asbestos liabilities. The goal of the present work is to provide the actuary with the necessary framework to perform a rigorous analysis of such liabilities. It should be noted that while there is no algorithm that guarantees success, there is a proper approach to the problem.

The keys to a rigorous analysis of asbestos liabilities can be summarized as follows:

- Effective knowledge gathering regarding the liabilities of the risk entity under investigation via thorough, open, and constant communication with those responsible for disposing of those liabilities;
- A commitment to keeping abreast of the global issues in the asbestos litigation;
- The application of actuarial skills, judgment and creativity in designing a flexible and transparent model with well documented assumptions and well communicated interpretation of results.

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1 Introduction

Significant uncertainties surround the ultimate costs of asbestos liabilities. Billions of dollars are in the balance. The actions of many insureds, the actual or potential harm to claimants and the legal environment have resulted in staggering asbestos litigation costs. To make matters worse for the actuary, the unique combination of insurance coverage, length of exposure and disease latency issues makes the quantification of asbestos liabilities of insurance and reinsurance companies extremely difficult.

The goal of the present work is to provide the actuary with a framework to perform a rigorous study of asbestos liabilities. However, it should be noted that there is no cookbook recipe for success in this arena. As in all endeavors surrounding the valuation of contingent liabilities, the quality and quantity of available data can be the determining factor in the design and thoroughness of the analysis to be performed. Furthermore, the specific nature of the risk bearer under review (e.g. primary insurance, assumed quota share reinsurance, direct excess insurance, retrocessional reinsurance, characteristics of the (re)insureds) suggests that valuation approaches may need to vary significantly between risk bearing entities.

While it is true that there is no asbestos valuation algorithm that guarantees success, one can say that there is a proper approach to the problem – namely, modeling as much of the exposure as possible at the level of the insured defendant, and modeling the remainder in sensibly defined groups. However, the only way to carry out a truly useful analysis of a specific insurer is to turn to the claims personnel for the necessary details. In fact, the defining theme of this paper is that the only solution to the problem presented by the complexities of the asbestos challenge is the sharing of knowledge between the claims settling function and the actuarial function. A rigorous study of asbestos liabilities requires the analyst to become intimately familiar with the details of the liabilities in question. To that end, there is no substitute for thorough communication with those responsible for discharging the liabilities.

It is the hope of the authors that the present work will spur discussion amongst actuaries and lead to the publication of more papers on this important valuation topic. There are a number of ways to handle the complex asbestos valuation problems, and this paper addresses only a few of the possible ways. We hope that other actuaries will come forward and discuss the tools they have developed to address the valuation of asbestos liabilities.

Reserving for asbestos liabilities is complicated by some rather unique circumstances. The goal of this paper is not to provide an exhaustive description of these unique aspects. Many, if not most, have been discussed in great detail elsewhere (see, for example, [AAA], [CD], [RAND], as well as the session handouts from several recent Casualty Loss Reserve Seminars on the topic of asbestos).

In fact, the environment has been changing so rapidly that any attempt to add to this literature with an exhaustive treatment on this topic would prove futile, as it risks either being redundant or quickly outdated. Our goal here is to make the reader aware of the main issues that must be considered when conducting an asbestos valuation study.

So, what is it that makes asbestos so different, not to mention so difficult? In a nutshell, the answer is:

- the nature of asbestos diseases,
- the legal environment, and
- data.

These are discussed in more detail in Appendix I. The actuary must become comfortable enough with the qualitative issues to arrive at reasonable methods for using the available data.

If an insurance company has reliable data on asbestos payments or reserves, it isn't amenable to triangular analysis. Among the reasons for this are

- the policies were issued years ago, and the company may have no record of them;
- the asbestos "cause of loss" occurred over a period of years – hence the concept of accident year doesn't apply;
- asbestos payments made to an insured cannot be tied to one policy, so policy year is not an appropriate concept.

As background, the defining themes of all rigorous studies of (re)insurance asbestos liabilities are

1. Analyze known sources of liability:
    a. Analyze the liability as close to the source as possible;
    b. Quantify as much of the qualitative facts and opinions held by those responsible with discharging the liability as is possible;
    c. Recognize correlations and dependencies where they exist – even if they cannot be determined with any sense of certainty;
    d. Check all results and assumptions for reasonability *ad nauseum*;
    e. Produce reasonable ranges of aggregate liabilities based upon reasonable assumptions regarding the individual liabilities;
    f. Focus on gross liabilities;
2. Analyze unknown sources of liability ("pure" IBNR).

Points 1.a. and 1.e. are the defining characteristics of a *ground up* analysis, which is the preferred method (provided this is feasible). There is no pre-packaged program for a ground up analysis. The determination of how it will be performed is driven by:

- the available data
- the amount of time during which the valuation study is to be performed
- the available qualitative information
- the nature of the liability
- other factors unique to the risk bearer

Reserving for asbestos losses is best done at the gross level. A net of reinsurance approach poses a substantial risk that the true liability will be understated. Probably the most important reasons for this are:

- The age of the policies in question
- The need to understand the coverage allocation to the various years
- Changes in reinsurance programs over the years
- The large number of reinsurer insolvencies in recent decades, which suggests that a significant portion of an insurer's reinsurance recoveries may be uncollectible
- Many companies may have exhausted their reinsurance limits
- Many solvent reinsurers are insisting on more extensive documentation, making it difficult for cedants to collect.

Once one determines the indicated range of gross liabilities, one can then analyze the reinsurance structure to arrive at the indicated range of net liabilities.

The most important feature of a rigorous analysis is the presence of open and constant communication between the actuary and those responsible for discharging the liabilities. The staff members handling the claims know much more than the actuary about the specifics of the liabilities and the actuary needs to find a way to facilitate the transfer of that knowledge in order to build an appropriate valuation model. Efficiency and effectiveness require the actuary to make simplifying assumptions in building a model - assumptions that may be wrong on an account by account basis but that are, in the aggregate, a reasonable reflection of reality.

The appropriate abstraction from detail in developing an efficient model is critical and involves a bit of tightrope walking. After all, a risk bearing entity does not need an actuary to calculate likely dispositions of specific known claims. That is not where actuarial skills are most needed, and there are other more qualified providers of claim settlement services. The actuary's value added lies in the ability to produce a reasonable range of the total aggregate liability faced by the risk bearing entity. The best way for the actuary to add value is by exercising creativity and judgment in a reasonable fashion at each step of the process and in assuring the process is transparent.

The goal of this paper is to sketch the general framework in which an analysis of asbestos liabilities should be performed. This paper will not attempt to exhaustively discuss the various details that affect the ultimate liability faced by a risk bearing entity. It is imperative that any actuary conducting an asbestos valuation spend considerable time and effort discussing the details of the insureds' liabilities with the claims department and, if possible, with the attorneys engaged by the claims department. While we, the authors, are neither attorneys nor claims professionals and we claim no expertise in the field of law or the disposition of claims, our extensive discussions with the experts in those fields underlie the development of the valuation approach.

2 Analysis of Known Gross Liabilities

This section focuses on quantifying the liabilities from known insureds. Appendix II provides a more detailed discussion of these topics.

As noted earlier, there is no single "right" way to perform an analysis of asbestos liabilities. The central valuation concept is to estimate the total indemnity and legal expense costs for each insured entity, and then apply the insurance coverages to arrive at the insurance company's share of the liability.[1] Therefore, one must obtain as much information as is possible from those handling the claims.

In many companies, the claims department periodically reviews pending and potential asbestos claims to provide company management with a range of possible outcomes. Such a review is highly sensitive, as it requires claims personnel to opine on the probable and possible ultimate liabilities of active claims. Were this information to fall into the hands of the insureds (or of the other insurers responding to the asbestos claims), it could weaken the insurer's position in settlement negotiations. In light of this, many claims departments refuse to offer any written opinion on anything other than the currently held case reserves.

Those who are responsible for disposing of the liabilities have as good an indication as anyone as to the likely ultimate costs of the various pending and potential claims. However, most claims professionals and attorneys are not comfortable enough with the concepts of mean, median, mode, probability distributions and correlations to be able to meaningfully combine their expertise and knowledge regarding the individual accounts to produce a reasonable aggregate cost distribution. It is in this regard that the actuary can add value to the reserving process.

The purely actuarial part of a ground up analysis need not be unduly sophisticated. The complicating factors are generally legal issues.

Once an estimate of the insurance company's share of each insured's liability is available, the actuary must appropriately combine this information to arrive at aggregate liabilities. The crudest way to do this is to arrive at low, medium and high estimates for each insured, and then sum them to arrive at low, medium, and high estimates for the portfolio of known insureds. The biggest drawbacks to this approach are:

1. There is no recognition of dependencies between insureds
2. If the low, medium and high estimates for each insured are being independently produced by several different people (rather than derived by statistical modeling techniques), it may be inappropriate to simply sum these figures to determine the range of outcomes. For example, if the claims professionals managing the accounts periodically produce these estimates without clear guidance, then there will be an unacceptably high level of subjectivity. Some of the claims personnel may view the high estimate as representing a true "worst-case" scenario akin to a 95^{th} or 99^{th} percentile on the distribution of (unknown) possible outcomes.

[1] The allocation of the insured's costs to the policy years in the coverage block and correct information regarding the insurance coverage provided by the insurer are arguably the most important components of a ground up exposure model.

Others may view it as a realistic high cost outcome akin to a 70th or 75th percentile. Some of the claims professionals may view the medium estimate as the most likely outcome, and others may feel that is the role of the low estimate.

Before trying to sum these estimates, it is therefore incumbent upon the actuary to make sure he or she understands what these values represent. The only way to do that is to spend time communicating with the claims department. This can be difficult, as the claims department and the actuarial department have very different tasks within an insurance company, and hence have different viewpoints and specialized jargons. When using claims department estimates in deriving a reasonable range of total liabilities, the actuary ideally would statistically model a sample of cases to "calibrate" the claims department case estimates.

Whether a sample of the cases or the universe of claims is being statistically modeled, the goal of the actuary in this part of the analysis is to build a reasonably realistic model with many "moving parts" – the parts being the insured's liabilities and insurance coverages. In this modeling process there is no substitute for obtaining a fundamental understanding of the claims settling process and gaining the trust of the claims department.

It should be noted that the claims department may have obtained modeled estimates of future liabilities for some of the insureds. There are econometric firms that produce such models, and in fact some firms specialize in not only modeling the liabilities and cash flows at the insured level, but also model the allocation of these liabilities to the years in the coverage block. If these are available, then by all means the actuary should make use of them, but should bear in mind that the models could be biased in favor of the insured (if the insured paid for the study) or in favor of a particular insurer or reinsurer. Frequently, however, these models are more complete than what is discussed below, as they are only developed for insureds whose involvement in this litigation is significant.

2.1 Direct Exposure

The actuary needs to find a way to take the information provided by the claims department and produce a reasonable range of liabilities stemming from known insureds. The bulk of the liabilities – and a large portion of the uncertainties surrounding them – is usually due to a relatively small percentage of the insureds. These insureds deserve close scrutiny. One way to do this is to build a frequency and severity model (ideally stochastic) that estimates the number of future claims that will be filed against the insured and estimates the average cost per claim for the pending and future claims. The data behind the model will be thin, so a large amount of judgment is required. The assumptions underlying the model should be informed by general knowledge of the mechanics of asbestos litigation and by the knowledge obtained from the claims department. Key assumptions should be peer reviewed by claims personnel and/or attorneys.

Once the model is developed and the total liabilities of an insured have been estimated, the liabilities need to be allocated to the relevant insurance policies. This is not a trivial matter. Not all companies allocate liabilities in the same manner. Some of this is driven by legal decisions, and some of it is a matter of practice. It is not uncommon for U.S. primary companies to allocate liabilities based on "time on risk" – this is effectively (in

most instances) a uniform allocation across the coverage block. The London excess market demands that liabilities be allocated based on dates of actual exposure, as best as can be determined (referred to as a "bell curve" allocation). It is imperative that the model reflect the allocation methodology employed by the insurer under investigation.

It is probably not feasible (or desirable) to build individual models for the remaining accounts. Instead, the actuary should review the nature of the insured exposure, the attachment points and limits of the exposed policies, and discuss likely outcomes with the claims department. Aggregate analyses of these accounts, either all together or in obvious groupings, will suffice. It is probably desirable to perform a policy limits analysis as discussed in [CD]. In that paper, the authors suggest policy limits analyses of selected representative accounts, which is then extrapolated to arrive at the total IBNR provision. This is a reasonable approach to take in analyzing large groupings of accounts that do not comprise the bulk of the asbestos liability. The actuary should request that the claims department produce point estimates of ultimate liabilities for each of these accounts to be used as a starting point for this analysis.

It is also advisable to perform benchmark analyses (discussed below) on this group of claims to test the results for reasonableness. Benchmark analyses can be performed quickly, and can sometimes signal unreasonable IBNR provisions or areas that require more attention.

2.2 Assumed Exposure

Assumed reinsurance is usually more difficult to analyze than the primary insured liability. If the assumed exposure is made up entirely of quota share contracts, it may be possible to perform an analysis as described in the previous section - provided the necessary data is available. In most cases, however, this level of detailed analysis will not be possible.

The actuary should analyze recent paid and reserve activity by cedant (tying as much of this as possible to the named insureds) and should obtain information regarding the reinsurance contracts exposed to asbestos liabilities. In particular, the actuary should identify every ceding company that has already ceded asbestos liabilities to the assuming company. Every assumed reinsurance contract with these entities should be examined for possible asbestos exposure. A database containing the named insureds, ceding companies, direct policy details and reinsurance contract provisions would be immensely helpful, but can be difficult to develop. Ceding companies may not want to share any information other than the details of specific reinsurance claims being presented to the reinsurer.

A reinsurance company typically will assume losses from several ceding companies who have common insureds. For example, suppose Company A issued the primary cover to Insured Z, and Company B issued excess cover attaching at the per occurrence limits of the Company A policies. Further suppose that both Companies A and B purchased some form of reinsurance from Reinsurer X. In this case, Reinsurer X may very well know more than Company B does about the actions brought against Insured Z. Clearly Reinsurer X cannot share this information with Company B, but can use this information to arrive at appropriate reserve estimates.

Alternatively, Reinsurer X may have reinsured Company A and issued retrocessional cover to Reinsurer Y, who also reinsured Company A. Data contained in the assumed claims file for Company A can be used to assist in the development of IBNR related to the contracts issued to Reinsurer Y.

In the absence of enough data to perform a ground up analysis, the actuary must find a way to make use of all available information to devise a top down analysis. This can be exhaustive (and at times, even frustrating), as it involves analyzing the information contained in the claims files of each cedant in a quest for commonalities (e.g. the same named insureds).

Given the lack of data, the following top-down model uses the available information to develop the Low, Medium and High IBNR for a given cedant, by adjusting the carried assumed case reserves for each cedant to provide for future development on cases known to the cedants and future asbestos liabilities emanating from insureds of which the cedants are not yet aware (or for which the cedants have not yet made provisions). The adjustments reflect six considerations:

(1) the ratio of ceded IBNR recorded by the cedant in its Annual Statement relative to the cedant's ceded case reserves,

(2) the speed with which the cedant reports claims to its reinsurers,

(3) the quality and reliability of the information the cedant provides its reinsurers,

(4) the recent level of claims activity experienced by the cedant,

(5) the nature of the exposure being ceded, and

(6) the perceived inadequacy of the asbestos reserves of the U.S. insurance industry.

The IBNR is then calculated as follows:

$$\text{IBNR} = \begin{array}{c}\text{Case Reserves Carried by Assuming Entity}\end{array} \times \begin{array}{c}\text{Ratio of Ceded IBNR to Ceded Case Reserves}\end{array} \times \begin{array}{c}\text{Reserve Factor}\end{array} \times \begin{array}{c}\text{Leverage Factor}\end{array} \times \begin{array}{c}\text{Inadequacy Multiplier}\end{array}$$

Appendix II discusses the derivation and the purpose of each of the above factors. The goal of the approach is to overcome some of the data deficiencies when developing the assumed reinsurance IBNR reserve.

3 Analysis of Unknown Gross Liabilities

The previous section was devoted to modeling asbestos liabilities from known sources of exposure. One must also recognize the substantial liability related to truly unknown sources – what the authors prefer to call "pure" IBNR.

One possibility is to examine recent emergence of new defendants (new to the insurer), and make assumptions regarding

- the expected number of new defendants during the next several years

- the number of years during which new defendants will be named
- the future liabilities associated with these new defendants.

If the data to perform such an analysis is available, then it certainly should be done. We are aware of innovative techniques for doing so, and it is our hope that the developers of such methods will publish them and add to the literature on this topic. This is basically a frequency and severity approach. If the data is available, use it to arrive at emergence patterns of new defendants (it is advisable to group these defendants by the nature of the exposure), and also arrive at projected liabilities.

Appendix III discusses a few other methods that can be used.

4 Benchmark Reserving Methods

Certain "benchmark" methods have been developed to perform tests of the adequacy of asbestos reserves. It must be emphasized that these methods are extremely crude, and rely heavily on actuarial judgment, much more so than standard reserving methodologies. They are all highly leveraged. These methods also rely on an estimate of industry parameters (e.g. AM Best's estimate of US insurance industry ultimate asbestos losses), together with company specific parameters. Unfortunately, the data is extremely thin (and volatile), and the actuary must rely heavily on qualitative information.

These tests are not really appropriate for arriving at needed reserves, but they can be used to arrive at a generally wide range of reasonable reserves. They can also be used to determine when one needs to investigate further. The methods are

- *The survival ratio method*
- *The market share method,*
- *The loss "development" method.*

A survival ratio is the number of years that current reserves will suffice ("survive") if average future payments equal average current payments. For example, suppose an insurer has $6M in asbestos reserves. Further suppose that recent asbestos payments have averaged $1M per year. Then the survival ratio of this company is 6, indicating that reserves are adequate to pay $1M per year for 6 years. The actuary can use this method to arrive at a reasonable range of indicated asbestos liabilities by multiplying estimated average future annual asbestos payments by an estimate of the number of years that such payments will be made. The result is indicated total asbestos liabilities. Indicated IBNR is then calculated by subtracting case reserves.

The market share method uses the insurance company's "market share" of the asbestos arena to estimate asbestos liabilities. The market share can be based on premium or on paid losses. One problem with this is that it is very difficult to determine a particular company's market share of the GL (and marine and aviation) policies sold to asbestos defendants. It is possible to determine the company's market share of total industry premium by line by year, but most companies are not exposed to asbestos losses for all years in which they wrote such policies.

Several published studies are available that estimate the US insurance industry's ultimate net asbestos liabilities. These can be used to calculate implied industry paid and incurred loss development factors. One can then adjust these factors to reflect the nature of an insurance company's asbestos exposure, and then apply them to the company's paid to date and incurred to date liabilities to arrive at estimates of ultimate liabilities.

These bulk methods are discussed in more depth in Appendix IV.

5 Ceded Reinsurance

Thus far, we have stressed the need to analyze gross liabilities. But, what an insurance company really cares about is its net liability.

At this stage, we have, at the very least, point estimates of ultimate liabilities for every policy known to be exposed to asbestos losses. The reinsurance department should use this information to calculate the resulting cessions and net liabilities – or provide the actuary with the detail necessary to do so. The ratio of net to gross liabilities can then be used as a starting point for determining the retained portion of the pure IBNR. Special care and attention should be given to any issues regarding reinsurance collectibility and the erosion of reinsurance cover by other sources of loss.

6 Summary

There is no single 'right' way to perform an analysis of asbestos liabilities. The actuary must gather qualitative information from those handling the claims, and must then use all available skills, judgment and creativity to analyze the specific challenges posed by the risk bearing entity under investigation. Issues of materiality, time, costs, and available resources must be considered. In addition, the nature of the risks assumed by the (re)insurer as well as its claims settling philosophy must be taken into account.

However, there is a single unifying theme to every rigorous actuarial analysis of asbestos liabilities. This theme can be summarized as follows:

- Effective knowledge gathering regarding the liabilities of the risk entity under investigation via thorough, open, and constant communication with those responsible for disposing of those liabilities;
- A commitment to keeping abreast of the global issues in the asbestos litigation;
- The application of actuarial skills, judgment and creativity in designing a flexible and transparent model with well documented assumptions and well communicated interpretation of results.

7 Afterword

This work is but one example of the authors' vision of the value an actuary brings to the user of the actuarial work product. In some settings, the actuary is presented with a large quantity of reliable data and a well tested and well accepted actuarial tool box. In other settings, the quantity and/or reliability or credibility of the data specific to the liability being studied may not be optimal, but data from a larger class (of which the entity being analyzed is a member) are readily available, and the existence of the actuarial toolbox is undisputed.

The valuation of asbestos liabilities is a high profile example of another common setting: very little credible data and very few widely accepted actuarial tools or methods, but an abundance of qualitative facts and well educated opinions and reasonable assumptions. In many of these settings, an actuary is not consulted, and some actuaries may not even realize that the problem is amenable to an actuarial approach. The desire to work with cold hard data may lead some to avoid the challenges posed by lack of traditional data.

The reality is that in ALL actuarial projects a considerable amount of judgment is exercised, and what is judgment if not the application of well informed opinions and reasonable assumptions? In the absence of data and well defined and accepted tools, the challenge is to learn as much as possible from the experts (in this case, the claims handlers and those responsible for collecting reinsurance) and to make as much use as possible of their expertise by transforming the expertise into an actuarial model.

One of the side benefits of this approach is that it helps these experts to test their assumptions: Do the perfectly reasonable assumptions regarding individual liabilities support or contradict the experts' opinions as to the aggregate liabilities? Do some of the reasonable looking assumptions contradict each other or contradict known facts? The modeling also provides the opportunity to document the assumptions and assess their continued applicability in the light of emerging experience.

The documentation and validation of modeling assumptions aids in the communication process and provides management with the requisite insight into the derivation of the actuarial liabilities prior to booking a specific reserve position. The areas where traditional loss reserve valuation techniques are not appropriate are most indicative of where actuaries can add immense value to the consumers of their work product.

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Appendix I Unique Aspects of Asbestos Liabilities

As mentioned in the Introduction, a rigorous study of asbestos liabilities requires the analyst to become intimately familiar with the details of the liabilities in question. To that end, there is no substitute for thorough communication with those responsible for discharging the liabilities.

The Nature of Asbestos Diseases

Asbestos is an incredibly deadly substance. The sad reality is that some of the major defendants knowingly unleashed this toxic substance upon society. There are widely publicized "smoking gun" documents that have been said to show that some defendants knew that their products would lead to the deaths of thousands of their employees. In a widely publicized letter dated September 12, 1966, E.A. Martin, Director of Purchases at Bendix, writes to Noel Hendry of the Canadian Johns-Manville plant in Asbestos, Quebec:

> "Just to be sure that you have a copy, an article that appeared in Chemical Week magazine is inclosed (sic).
>
> So that you'll know that Asbestos is not the only contaminate (sic), a second article from O.P. & D Reporter assess a share of the blame on trees.
>
> My answer to the problem is: If you have enjoyed a good life while working with asbestos products why not die from it. There's got to be some cause."

It has been estimated that more than 100 million people in the United States were exposed to asbestos in the workplace during the 20th century ([AAA]). Not everyone exposed to asbestos will become ill, but some will. A small percentage of these people will develop a deadly and painful cancer known as mesothelioma. Other cancers (of the lungs, throat, larynx, esophagus, stomach, colon, and lymphoid) may also result. Asbestosis (a slowly progressing, sometimes fatal pulmonary disease) and pleural injuries may also result. All of these diseases have long latency periods – from 10 to 40 years depending on the disease. This means that there could very well be people developing mesothelioma as of this writing that were last exposed to significant levels of asbestos in the 1960s.

Many epidemiological studies have been performed on the topic of asbestos related diseases, their incidence and latency periods. The AAA monograph contains references to many of them. Each one of these studies indicates that mesothelioma victims make up a minority of those who become ill due to asbestos exposure. As we shall discuss later, the long latency periods of these diseases causes considerable difficulty in quantifying the insurance liabilities related to the use of asbestos.

The Legal Environment

The legal environment surrounding the disposition of asbestos liabilities is perhaps the biggest complicating factor in their analysis[1]. One hint of the complexity of this environment is provided by a quick glance at the specializations of the attorneys involved:

- The plaintiffs' bar
- Defense attorneys
- Coverage attorneys representing the defendants in pursuit of insurance recoveries
- Coverage attorneys representing insurance companies
- Opposing parties in disputes involving the related reinsurance recoveries
- Those specializing in asbestos related Chapter 11 proceedings.

It is extremely difficult for a defendant to arrive at a reasonable estimate of its total asbestos liabilities, and this is one of the reasons that so many of them have pursued the remedy of Chapter 11 reorganization. Econometric firms have entire practice groups dedicated to modeling the asbestos liabilities of defendants, the investment community and ratings agencies perform their own analyses of these liabilities, and there is a burgeoning business of estimating the liabilities to future unknown defendants in the world of Chapter 11 proceedings. This particular "level" of the asbestos litigation is heavily dependant on that area of the law that affects plaintiffs and defendants. This law differs from state to state, and the federal courts have their own unique law as well.

The typical asbestos claimant was exposed to asbestos over a number of years, and, most likely, the asbestos did not come from one source. Many asbestos claimants are members of a large group being represented by the same law firm, who is demanding payment from many companies. The list of defendant companies is growing, with attorneys recently filing claims against companies with only minimal involvement in the manufacture or distribution of asbestos, especially since many of the large asbestos defendants have filed for bankruptcy.

Developments over the last few years have led to what some consider a crisis. There are several good references that discuss this in detail (e.g., [AAA], [RAND], [R], [P]). Several years ago the federal courts instituted procedures to try to make this litigation manageable. One of the unintended consequences of this has been the increase in filings in state courts. One can argue that many of these cases belong in the federal courts. Many states have made changes to their laws or their procedures to deal with this litigation. This has led to an increase in filings in those states that have not done so. In some states it has been permissible for an attorney to represent several plaintiffs in an action against several defendants wherein only one of the plaintiffs is now or ever has been a resident of the state. Furthermore, in some states all that is required for a plaintiff to prevail is a showing of exposure to asbestos and the existence of a lung x-ray

[1]It is prudent at this time to note the case of *Borel v. Fibreboard*, (1973), in which the Fifth Circuit U.S. Court of Appeals ruling effectively shifted asbestos awards from the workers' compensation system to the court system.

indicating that there *may* be scarring of the lung tissue – no actual injury or impairment is required. Some plaintiffs' attorneys who only represent cancer victims claim that these actions are harming their current and future clients. If a company is required to pay a settlement to every person exposed to their asbestos containing products with a shadow on a lung x-ray, that company may not be around to pay the damages due to those who develop cancer in the future (recall the long latency periods involved).

More than 50 companies have declared bankruptcy or filed for Chapter 11 reorganization claiming that they are doing so due to the magnitude of their asbestos liabilities. This has had an enormous impact on the U.S. economy, and on the evolution of the asbestos litigation. As more companies file for Chapter 11 reorganization, plaintiffs are forced to look elsewhere for damage awards. This has led to a wave of new defendants, many of whom were only peripherally involved in the manufacture or distribution of asbestos products. For example, there has been a recent increase in suits against companies who make products with encapsulated asbestos, such as fireproof doors. Another recent target class of defendants is manufacturers and distributors of gaskets, brakes and other friction products – including "mom and pop" auto parts distributors.

For the actuary, however, it gets even more complicated. There is no single algorithm that can be applied to determine the resulting liability of the insurance companies in all cases. In fact, one cannot even say that there is one algorithm that applies for each state. There are a few theories that can be used to determine how asbestos losses are allocated to insurance policies. These have been expounded upon elsewhere. The key is to understand how to apply them.

In practice, the indemnity and legal expenses borne by the insured are allocated to a coverage block. Either by agreement between the insured and the insurance companies or as the result of a court ruling in a declaratory judgment (DJ) action, a determination is made as to which primary and excess policies will respond to the insured liabilities – and how the liabilities will be shared amongst the entities. This is very dependant upon

- the history of the insured (when did they manufacture or distribute asbestos containing products? when was asbestos in use at their facilities?),
- the financial health of the insured,
- the financial health of the insurers
- the claims settling practices of the insurers and
- the amount of coverage available.

Another important question that needs to be addressed is how the claims will be classified. Are they products/completed operations claims, or are they premises and operations claims? This is usually referred to as products vs. non-products. Almost all CGL policies issued after 1986 contain asbestos exclusions that hold up in court. Many of the exposed policies contain aggregate limits for products claims, but only occurrence limits for non-products claims. Therefore, if the claims are considered to be products liability claims, then the total indemnity costs involved are limited to the products aggregate.

Let's consider a very simple example. Suppose an insured manufactured and distributed an asbestos containing insulation product between 1962 and 1971 and that 1000 insulation installers have filed suit against the insured for asbestos related injuries caused by exposure to the insured's product. For illustrative purposes, let's assume we can spread the liabilities of these suits evenly across the 10 years that the insured manufactured the product (it would not be unusual to allocate the liabilities in other ways depending on the specific facts of the case – some insurers strenuously object to uniform allocations). If the insured has paid $100M in indemnity and $150M in legal expenses to dispose of these claims then each policy year would be allocated $10M of indemnity and $15M of legal expense. Assuming policy limits of $5 million per occurrence and $5 million annual aggregate with legal expenses paid in addition to policy limits, the insurance coverage would be $50M for indemnity payments and up to $150M for legal expense[1].

If we make a slight change to the above example, the situation can change dramatically. Suppose that the insured is engaged in a high temperature industry and that 1000 of its employees have filed suit against the insured due to injuries sustained as a result of exposure to asbestos containing insulation. The employees do not have the ability to positively identify the manufacturer of the insulation to which they were exposed, and over the course of their employment may have been exposed to asbestos containing products purchased from many different manufacturers and/or distributors. These claims could be considered premises claims. The primary policies probably do not contain aggregate limits for the premises and operations hazard. We now have to decide a very important question: how many occurrences are there per policy? Again, this is decided either through a negotiated agreement between the insured and the insurers, or through a DJ action. The following are common approaches. Others are possible, as well.

- Each claimant is considered to constitute a separate occurrence, with the losses spread evenly over the coverage block. Total insured losses would probably be $100 million indemnity, $150 million for expense.
- Each claimant is considered to constitute a separate occurrence. Losses are spread over the coverage block based on dates of employment and actual liabilities incurred by the insured. Total insured losses would likely be $100 million of indemnity and $150 million for expense.
- Each physical location is considered to constitute an occurrence. For example, if there were 3 plants operating during the entire 10 year coverage block, and a 4th plant in operation during 5 years of the coverage block – say 1967 to 1971 – then there would be 3 occurrences from 1962 to 1966, and 4 occurrences from 1967 to 1971. Total insured losses could be $85.5 million of indemnity and $150 million of expense.

In these examples, the primary insurers' liability is much greater than it would be if the losses were classified as products claims.

[1] The exact amount of legal expense covered by the policies is dependant upon the timing of the indemnity payments – a policy that pays costs in addition will not respond to legal expenses after the indemnity payments have exhausted policy limits.

Let's put one more wrinkle into this to show why it truly is a legal issue. Suppose the insured had a $500,000 SIR for each of the years in the coverage block. Note that this interpretation of occurrence in the first and second premises/operations cases above probably eliminates all insured losses. There are cases wherein the courts have ruled that considering each plaintiff to constitute a separate occurrence with the insured responsible for one SIR per year per occurrence is against public policy, as it "eviscerates" the insurance coverage. In other words, the insured would never recover any of the loss from its insurers.

Possible approaches to this situation would be to declare one occurrence per policy year with the insured responsible for one SIR per year (this would be strenuously objected to by the excess insurers), or to declare each claimant is an occurrence, with the insured's liability restricted to one SIR per year in the aggregate. Other approaches are possible.

In addition to the uncertainties in reserve evaluation resulting from liability issues involving individual claimants, disputed coverage issues complicate the evaluation of an insurer's liability to the insured. As can be expected when large sums of money are involved, insureds' coverage attorneys carefully review all policies to assess the possibility of and/or extent of insurance coverage. This additional contingency further complicates the valuation/reserving process and tends to lead to a greater variability in possible outcomes from the "best estimate" reserve, i.e. a wider range of possible values. The following are of particular importance:

- *Reclassification of claims.* Many insureds, having exhausted their products liability limits, are going back to their insurers and claiming that a large portion of the losses they have paid are non-products in nature. Any policy wherein the insured has exhausted products limits but has available non-products coverage is exposed to this contingency. In addition to the impact this has on primary insurers who are already deeply involved in the asbestos claims process, reclassification of claims to premises/operations could lead to excess carriers (and reinsurers) suddenly finding themselves with exposure they didn't contemplate.
- *Hunting for all available insurance.* Asbestos plaintiffs, and the insurance attorneys of the defendants, are pursuing recoveries from other types of policies. It seems that any company who issued any insurance to the large asbestos defendants may find themselves faced with an asbestos claim at some time in the future. In addition, insurers who insured companies who had or have any relationship to asbestos, no matter how minor, may well receive notice of asbestos claims. The following scenario is not uncommon: Company A purchased Company B in 1990. By 2001, Company B's asbestos payments have exhausted all of their available insurance coverage (and are, in fact, significantly worse than anyone anticipated when Company A purchased Company B). In an attempt to maximize coverage, Company A files claims against all of its 1986 and prior liability policies, despite the fact that when those policies were issued Companies A and B had no relationship.

Data

There are significant data issues involved in any analysis of asbestos liabilities. As mentioned previously, many commercial liability policies issued after 1986 contain an asbestos exclusion. This means that a large proportion of policies with exposure to asbestos losses were issued before insurance companies had computerized systems. Many insurance companies have no idea what their true asbestos exposure is because, e.g., they do not know who purchased a CGL policy from them in 1950. If they insured any of the big defendants in the asbestos arena, they would know by now, but there is a good chance that many companies who think they have no asbestos exposure, did, in fact, issue policies to companies who are just now being named in asbestos lawsuits.

For ground-up analyses, it is best to obtain as much information as possible at the insured level. In particular, it is desirable to have

- A history of annual payments made by the insured (indemnity and legal expenses separately);
- The total number of claims filed against the insured;
- The number of outstanding claims;
- The number of claims settled;
- The number of claims dismissed.

It is also desirable to obtain a coverage chart for each insured – that is a schedule of all available insurance and how prior payments have been allocated to the coverage. Obtaining all the data desired is not always possible. For one thing, the claims department may only have data at the insurer level. It is also true that the defendant may only have historical data going back a few years.

Appendix II Modeling Liabilities from Known Sources

Direct Exposure

It is most likely not cost effective to model the liabilities stemming from each known account. The important decision is to determine which accounts will be individually modeled.

For example, one could build a stochastic model for that subset of the known asbestos insureds that has been identified as requiring close scrutiny. The inputs will be subjective, and must be tested for reasonability – mainly by asking for the opinions of those handling the claims. The key variables could be:

- The total number of future claims
- The first year that new claims will be filed (if the insured is in Chapter 11)
- The claims filing pattern
- The number of claims closed each year
- The average indemnity cost of closed claims
- The average legal expense of closed claims
- The number of occurrences per policy for exposures other than product liability
- A methodology to allocate liabilities to policy year (this is a key assumption!)

The discussion below assumes stochasticity, but the stochastic routines need not be overly sophisticated.

It is very important to model indemnity costs and legal expenses separately. One could assume as a default that primary policies cover defense costs in addition to limits and that excess policies consider legal expenses to be subject to the policy limits, but this is not always true. In the default situation, it is not unusual for defense costs to be the major driver of the primary policies' liabilities.

The total number of future claims. The claims department and/or outside counsel representing the insurer in coverage matters should have historical and current data on the insured. The actuary must use the qualitative information about the nature of the alleged exposure to arrive at estimates of the likely number of future claims. For example

- Is the exposure products liability, non-products liability, or both? Is there any marine, aviation, or railroad exposure (these are handled differently than 'typical' CGL exposures)?
- Is the classification a matter of debate?
- In what state are the actions being brought?
- Who are the plaintiff attorneys?
- Is the insured a traditional defendant, a recent target defendant, or a peripheral defendant with limited exposure?

A reasonable way to approach this problem is to obtain some general information about the insured, and then suggest plausible percentiles of the distribution of future claims. It is doubtful that a claims handler or attorney will answer a question such as "How many future claims do you think there will be?" or "What do you envision as a worst case scenario for this insured?" They are much more likely to respond to something like this: "This insured has only been named in asbestos suits for the last five years, and I see the main exposure stems from their manufacture of brake linings. We know the plaintiffs' bar is targeting manufacturers of friction products, so there is a high likelihood that this insured will be named in many more suits. The latest data indicates that there have been a total of 8000 claimants, with 6500 still pending. There have been very few dismissals, and the insured has changed their defense strategy from vigorously defending every claim to settling those claims that have a high probability of being decided against them. Considering the states in which the suits are being filed and the success of the plaintiffs thus far, it seems to me that it is reasonable to expect another 20,000 claims. It also seems that there could be as many as another 50,000 claims, but the probability of that many claims is roughly 5%."

Phrasing the question as a statement begins a dialog. If those knowledgeable about the litigation involving the insured find the assumptions unreasonable, then a conversation will ensue that allows the actuary to gain a much better understanding of the exposure.

One can implement the assumptions outlined in the above example with a negative binomial distribution with parameters $n = 2.0002$ and $p = 0.9999$. This distribution has an expected value of 20,000 and 50,000 is close to the 95^{th} percentile. The low percentiles for this distribution might be too low - this needs to be verified by the claims professionals.

The first year that new claims will be filed (if the assured is in Chapter 11). If the insured has recently filed for Chapter 11 protection, then a temporary restraining order is in place, blocking the filing of any suits until the reorganization plan is approved. If this is the case, then the year in which claims will again be filed should be a variable of the model. A discrete distribution, with the years and associated probabilities judgmentally selected can be used for this purpose.

The claims filing pattern. There a few obvious ways to model a filing pattern. One of the keys is the year in which the last claim will be filed against the insured - actually, the last year in which a claim that would trigger insurance coverage would be filed. For example, if all of the insured's 1986 and subsequent policies contain asbestos exclusions then it would be safe to assume that any claims filed after the period 2025 to 2035 (due to latency periods, depending on diseases suffered by the plaintiffs) would not trigger insured claims. A judgmentally selected discrete distribution for the final year in which claims will be made will suffice.

The final year in which claims are filed and the total number of future claims should be correlated – more years of claims filing should, on average, lead to more claims. One way to do this would be to select a distribution for the number of claims filed in each year, taking care that the resulting distribution of total future claims is in agreement with the assumptions arrived at earlier. Another way would be to arrive at an expected filing pattern that is used as a baseline to be adjusted given the number of total claims filed and

the number of years in which they will be filed. In this case one should introduce random variation into the expected filing pattern.

The claim closure pattern. For each insured a claim closure pattern is needed. This can be based on data specific to the insured, the insurer or on industry data. A discrete distribution should suffice. Note that we need to model the closing pattern of the pending claims as well as that of the future claims.

The average indemnity cost of closed claims. The points discussed above all relate to frequency. We now address severity. The most elementary approach is to select a baseline average indemnity cost per closed claim and apply annual inflation factors so as to have average indemnity amounts per closed claim per year. If this is done, then random variation should be introduced. A random walk process is fairly easy to use for this process.

A more sophisticated approach would be to explicitly determine expected distributions of disease type (including those that will be closed without payment), with associated average indemnity costs. There has been a recent explosion of claims filed by those suffering from non-malignant injuries. These claims are usually settled for much less than those of victims suffering from mesothelioma or other cancers. Appropriate assumptions can be made regarding the likely future disease mix and related liabilities.

If an insured has already completed the Chapter 11 reorganization plan, then it will probably have a schedule of benefits paid based upon disease type. The 524(g) trusts established by the bankruptcy courts to dispose of these liabilities usually have stringent rules regarding who is indemnified and the amount of indemnification they receive.

The average legal expense of closed claims. Legal expenses will be incurred by the defendant whether a claim is dismissed or not. Similar to the discussion above, it is desirable to model the average liabilities per closed claim per year.

At this stage, one has a model that produces

- Total number of future claims filed against the insured
- The year in which these claims will be closed
- The associated costs of these claims.

We now turn our attention to the insurer.

A methodology to allocate losses to policy year. The issue of how various insurance policies respond to asbestos claims is fundamental to the modeling process. There is no single "right" way to allocate the losses. The specific details of the insured and the insurer are the driving factors. A coverage block is determined, either through a DJ action or through agreement of all interested parties. It is not uncommon for U.S. primary companies to allocate liabilities based on "time on risk" – this is effectively (in most instances) a uniform allocation across the coverage block. The London excess market demands that liabilities be allocated based on dates of actual exposure, as best as can be determined (referred to as a "bell curve" allocation). In some states, court rulings require the *entire* block of primary coverage be exhausted before *any* excess policy will respond. This is referred to as *horizontal allocation* or *filling the* bathtub. It is imperative

that the model reflects the allocation methodology employed by the insurer under investigation.

For example, suppose the following:

- There are $10M in products liabilities to be allocated to the period 1967 to 1986
- From 1967 to 1972 the insured purchased primary insurance with per occurrence limits of $250,000
- From 1973 to 1978 the primary limits were $500,000
- From 1979 to 1986 the limits were $1M.
- There have been no other products liability claims filed against these policies
- None of the policies contain an SIR
- None of the primary policies cover legal fees in defense of claims.

Let us assume that the liabilities are allocated uniformly across the coverage block ($500,000 per year). The 1967 to 1972 primary policies will only pay $250,000 each, for a total of $1.5M. This leaves $8.5M for the remaining 14 years. The 1973 to 1978 primary policies will each exhaust, paying a total of $3M, leaving $5.5M for the 1979 to 1986 policies. Each of these will pay $687,500, for a total of $5.5M.

Now suppose that the $10M is made up of $4M of legal expenses and $6M of indemnity, and that each of the primary policies are "costs-in-addition". Then the liabilities could be allocated to the policies as follows:

Policy	Per Occurrence Limit	Indemnity	Legal Expenses
1967	250,000	250,000	166,667
1968	250,000	250,000	166,667
1969	250,000	250,000	166,667
1970	250,000	250,000	166,667
1971	250,000	250,000	166,667
1972	250,000	250,000	166,667
1973	500,000	321,429	214,286
1974	500,000	321,429	214,286
1975	500,000	321,429	214,286
1976	500,000	321,429	214,286
1977	500,000	321,429	214,286
1978	500,000	321,429	214,286
1979	1,000,000	321,429	214,286
1980	1,000,000	321,429	214,286
1981	1,000,000	321,429	214,286
1982	1,000,000	321,429	214,286
1983	1,000,000	321,429	214,286
1984	1,000,000	321,429	214,286
1985	1,000,000	321,429	214,286
1986	1,000,000	321,429	214,286
Total	12,500,000	6,000,000	4,000,000

Now let us assume a few years have gone by, and the primary policies are all exhausted. Further suppose there is $50M in indemnity and $75M in legal expenses to be allocated to the following excess policies:

- From 1967 to 1972, there was one layer of excess coverage, $750,000 xs $250,000, and these policies cover costs in addition
- From 1973 to 1978 there were three layers of excess coverage - $500,000 xs $500,000, $1.5M xs $1M and $2.5M xs $2.5M. All of the policies cover legal expenses within policy limits
- From 1979 to 1986 there were three layers of excess coverage: $4M xs $1M (costs inclusive), $5M xs $5M (costs excluded) and $15M xs $10M (costs excluded).
- Assume there were no other claims eroding the available limits.

Then the liabilities could be allocated as follows. (This would be the allocation if the decision had been made that each layer of coverage in the coverage block must exhaust before the next layer responds. So the $4M xs $1M policies in the 1979 to 1986 period would exhaust before the $1.5M xs $1M policies in the 1973 to 1978 period would respond).

Policy Year	1st Excess		2nd Excess		Total	
	Indemnity	Legal Expenses	Indemnity	Legal Expenses	Indemnity	Legal Expenses
1967	750,000	1,125,000	N/A	N/A	750,000	1,125,000
1968	750,000	1,125,000	N/A	N/A	750,000	1,125,000
1969	750,000	1,125,000	N/A	N/A	750,000	1,125,000
1970	750,000	1,125,000	N/A	N/A	750,000	1,125,000
1971	750,000	1,125,000	N/A	N/A	750,000	1,125,000
1972	750,000	1,125,000	N/A	N/A	750,000	1,125,000
1973	200,000	300,000	600,000	900,000	800,000	1,200,000
1974	200,000	300,000	600,000	900,000	800,000	1,200,000
1975	200,000	300,000	600,000	900,000	800,000	1,200,000
1976	200,000	300,000	600,000	900,000	800,000	1,200,000
1977	200,000	300,000	600,000	900,000	800,000	1,200,000
1978	200,000	300,000	600,000	900,000	800,000	1,200,000
1979	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
1980	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
1981	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
1982	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
1983	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
1984	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
1985	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
1986	1,600,000	2,400,000	3,487,500	0	5,087,500	2,400,000
Total	18,500,000	27,750,000	31,500,000	5,400,000	50,000,000	33,150,000

Note that this allocation leaves $41.85M in legal expenses paid by the insured. The insured might argue that the total excess limits available in a year – regardless of how

many layers make up the total limits - should determine the allocation. The table below shows this allocation, which leaves only $32.85M in legal expenses unfunded.

Policy Year	1st Excess		2nd Excess		3rd Excess		Total	
	Indemnity	Legal Expenses	Indemnity	Legal Expenses	Indemnity	Legal Expenses	Indemnity	Legal Expenses
1967	750,000	1,125,000	N/A	N/A	N/A	N/A	750,000	1,125,000
1968	750,000	1,125,000	N/A	N/A	N/A	N/A	750,000	1,125,000
1969	750,000	1,125,000	N/A	N/A	N/A	N/A	750,000	1,125,000
1970	750,000	1,125,000	N/A	N/A	N/A	N/A	750,000	1,125,000
1971	750,000	1,125,000	N/A	N/A	N/A	N/A	750,000	1,125,000
1972	750,000	1,125,000	N/A	N/A	N/A	N/A	750,000	1,125,000
1973	200,000	300,000	600,000	900,000	1,000,000	1,500,000	1,800,000	2,700,000
1974	200,000	300,000	600,000	900,000	1,000,000	1,500,000	1,800,000	2,700,000
1975	200,000	300,000	600,000	900,000	1,000,000	1,500,000	1,800,000	2,700,000
1976	200,000	300,000	600,000	900,000	1,000,000	1,500,000	1,800,000	2,700,000
1977	200,000	300,000	600,000	900,000	1,000,000	1,500,000	1,800,000	2,700,000
1978	200,000	300,000	600,000	900,000	1,000,000	1,500,000	1,800,000	2,700,000
1979	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
1980	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
1981	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
1982	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
1983	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
1984	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
1985	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
1986	1,600,000	2,400,000	2,737,500	0	0	0	4,337,500	2,400,000
Total	18,500,000	27,750,000	25,500,000	5,400,000	6,000,000	9,000,000	50,000,000	42,150,000

The situation can get much more complicated. If some of the policies contain SIRs, or if the treatment of legal expenses are significantly different between policies, or if there were other products liability claims that impacted available limits, then the allocation would be different.

The number of occurrences for exposures other than product liability. The policyholder only cares about number of occurrences in so far as it affects collection of insurance proceeds. If the claims are clearly products liability claims, then this is rarely an issue – there is almost always an aggregate limit for products liability claims.

However, if it is unclear how the claims should be classified, then the insured will try to find a way to avoid the products aggregate. If the insured has a large amount of excess coverage available, and legal expenses are covered by these policies, then the insured may not aggressively pursue this point. If the total products aggregate limits are woefully inadequate to fund the insured's liability, and there are no aggregate limits for the premises and operations hazard, then the insured may very well argue that a portion (perhaps 100%) of the claims are non-products in nature. Primary carriers have a vested interest in arguing for a products/completed operations classification. Excess carriers have a vested interest in arguing for a non-products classification – provided the underlying cover is not exhausted.

Each of the account specific models produces a distribution of possible insured liabilities for each insured. These results must now be aggregated. Clearly, these accounts are not independent of one another. For example,

- They may, on occasion, be named as codefendants;
- They may be in the same or similar industries;
- They may have common corporate ancestors;
- They may have the same legal representation;
- The various state and federal laws and court rulings affect them all – though not all in the same way.

The model that aggregates the results of the individual account models should reflect the correlation among them. This is not a simple matter, especially since there is no data upon which to base the correlations.

Perhaps the best solution is to use several different correlation coefficients and review the sensitivity of the results, and perhaps the best way to reflect the implicit dependencies is to recognize that there is some correlation between the number of claims filed against one insured and those filed against another insured. There is also some correlation between the liabilities incurred by one insured and those incurred by another. These are not exact relationships, and determining them precisely is impossible. The important thing is to recognize that dependencies exist and find a reasonable (and creative) way to reflect them.

Assumed Exposure

Assumed reinsurance is usually more difficult to analyze than the primary insured liability. If the assumed exposure is made up essentially of quota share contracts, it may be possible to perform an analysis as described in the previous section - provided the necessary data is available. In most cases, however, this level of detailed analysis will not be possible.

In the absence of enough data to perform a ground up analysis, the actuary must find a way to make use of all available information to devise a top down analysis. The following top-down approach can be used. Begin by adjusting the carried assumed case reserves for each cedant. These adjustments are intended to provide for future development on cases known to the cedants and future asbestos liabilities emanating from insureds of which the cedants are not yet aware (or for which the cedants have not yet made provisions). The adjustments reflect six considerations:

(1) the ratio of ceded IBNR recorded by the cedant in its Annual Statement relative to the cedant's ceded case reserves,

(2) the speed with which the cedant reports claims to its reinsurers,

(3) the quality and reliability of the information the cedant provides its reinsurers,

(4) the recent level of claims activity experienced by the cedant,

(5) the nature of the exposure being ceded, and

(6) the perceived inadequacy of the asbestos reserves of the U.S. insurance industry.

The first step of the procedure is to calculate the cedants' ratios of ceded IBNR to ceded case reserves, as recorded on Note 29 of the Annual Statement. The task here is

somewhat complicated by the way in which insurers record liabilities, especially for those that are part of a large underwriting group or which are no longer filing an Annual Statement. There will also be some cedants whose ratios appeared unrealistic or for whom data is not available.

The second step is the calculation of a "reserve factor" to adjust the case reserves for the speed with which the cedant reports claims to the reinsurer, as well as the quality and/or reliability of the data. Total asbestos case reserves for assumed liabilities from cedants who are slow to report are less adequate – relative to ultimate liabilities – than total asbestos case reserves from cedants that report losses quickly. Furthermore, prudence and conservatism require one to assume that total asbestos case reserves for assumed liabilities from cedants with a history of poor data quality and/or reliability are less adequate – relative to ultimate liabilities – than total asbestos case reserves from cedants known for providing good, reliable data.

The third step is the calculation of a "leverage factor" in recognition of two aspects of the cedant – the typical risk being ceded (primary, excess, or retrocessional) and the level of activity currently being reported by the cedant. Excess and retrocessional losses will, on average, be reported to the cedant later than primary losses will. Such losses are reported even later to the reinsurers assuming them. However, the amount of adjustment necessary should be tempered by the amount of recent claim activity experienced by the cedant.

The reserve and leverage factors can be determined by interviewing assumed reinsurance claims professionals and asking them to score the cedants in the four categories discussed above – speed of reporting, type of risk ceded, level of recent claim activity and quality of data. The selected factors will be based on actuarial judgment; a review of the reasonability of implied results is extremely important. The actuary should search the business, investment and trade presses for announcements regarding significant settlements, reserve increases and other actions that have been taken during the current year, as this information will not be reflected in the most recent Annual Statement, and could have a significant bearing on the assumed liabilities.

At this stage we have the following data for each cedant:

- case reserves carried by the assuming company,
- the cedant's ratio of ceded asbestos IBNR to ceded asbestos case reserves from Note 29 of the Annual Statement,
- a reserve factor and
- a leverage factor.

It would seem natural to multiply the four numbers to arrive at the IBNR related to the cedant. The implicit assumption underlying the procedure thus far is that carried asbestos reserves are a reasonable reflection of the ultimate expected liabilities. However, it is widely believed that the carried asbestos reserves for the U.S. insurance industry are inadequate – i.e. the implicit assumption is flawed. To overcome this deficiency in the

reported asbestos liabilities, we should rely on other expert assessments of the total liabilities.

Several firms and research groups publish separate studies of asbestos liabilities. Frequently, these studies estimate that the ratio of net unfunded liability to net carried reserves. This information can be used to select "inadequacy multipliers" and arrive at Low, Medium and High estimates of IBNR. The multipliers should be chosen to reflect the industry reserve inadequacy, but should also recognize that some of the inadequacy is already reflected by the leverage factor, and, possibly, by the reserve factor and the carried reserves of the assuming company (if the assuming company has conservative reserving practices, it may be a matter of practice that the carried assumed case reserves from a particular cedant are higher than those reported by the cedant).

The Low, Medium and High IBNR for a given cedant is then computed by performing the following calculation:

IBNR =	Case Reserves Carried by Assuming Entity	X	Ratio of Ceded IBNR to Ceded Case Reserves	X	Reserve Factor	X	Leverage Factor	X	Inadequacy Multiplier

It is important to note another assumption implicit in this methodology: the assuming entity is aware of all of the cedants from whom it is assuming asbestos liabilities, but substantial uncertainty surrounds the original sources of the liability (that is, there are possibly many "unknown" original insured defendants).

Appendix III Modeling Liabilities from Unknown Sources

Judgmental Selection

One of the drawbacks of a rigorous exposure based analysis of asbestos liabilities is that by its very nature it exclusively considers known sources of exposure. After the analysis of known defendants is completed, one must then add a provision for liabilities emanating from defendants who are not known to the (re)insurer. A portion of this "pure" IBNR liability could be estimated by performing an exhaustive policy audit, comparing all known GL, aviation, and marine policies to the universe of all known asbestos defendants. This is discussed below. Assuming the expenditure of time and resources presented by such a project were worthwhile (not to mention the critical data issues raised), this approach does not provide a complete solution to the problem since many, if not most, of these defendants have not yet been named in any asbestos litigation.

Given the above data and analysis issues, sometimes all that can be done is to set up a reasonable provision for this pure IBNR. Determining a reasonable provision is not easy: there is no widely accepted methodology for arriving at this IBNR provision – a large amount of actuarial judgment is required.

Consider the following table, which is based on data contained in the September 2002 RAND report entitled Asbestos Litigation Costs and Compensation: An Interim Report (This table reflects the total asbestos litigation universe, *not* just the insurance industry).

	1982	2000
Number of Claimants	21,000	600,000
Number of defendants	300	At least 6,000
Total paid liabilities	$1B	$54B
Bankruptcies	3	60
Estimated Future Liabilities	$38B	$145B - $210B

Note, in particular, the explosive growth in named defendants from 1982 to 2000. There is considerable uncertainty as to how many more defendants will eventually be named in the asbestos litigation, and this is the heart of the challenge one faces in trying to estimate pure IBNR.

Consider also these additional facts:

I. From the RAND report:

1. Estimates of the number of people who will file claims in the future vary widely, but they are all extremely high. All accounts agree that, at best, only about half the final number of claimants have come forward. At worst, only one-fifth of all claimants have filed claims to date.
2. Annual Claims Filings Have Risen Sharply in the last few years.
3. Analysts' projections of the numbers of future claims and their likely costs also vary dramatically. Analysts at Tillinghast-Towers Perrin project an ultimate total of 1 million claims, costing defendants and insurers $200 billion ([AB]). Analysts

at Milliman project a total of 1.1 million claims, but they estimate that the total liabilities of asbestos personal injury claims will reach $265 billion ([BMR]).

4. The Manville Trust commissioned a deliberately high-side estimate designed to set an upper boundary on what would happen if everything turned out to be as bad as it could get. The estimate was 3 million total claimants, which means the process is only about one-fifth finished ([A]).
5. RAND estimates that defendants and insurers have spent $54 billion through the end of 2000 to compensate the 600,000 claimants who have come forward. Thus, these projections imply that we have seen only about half of the claims and roughly one-fourth to one-fifth of the eventual liabilities.
6. RAND estimates (thru 12/00) US insurers have paid $22B, non-US insurers have paid $8B - $12B (half of which are London), and the remainder has been paid by the defendants.
7. Bankruptcies are causing the plaintiffs bar to seek out new defendants.

II. Tillinghast-Towers Perrin projects an approximate 50/50 split of ultimate insured losses between U.S. and non-U.S insurers ([AB]).

III. Milliman projects a 70/30 split of ultimate insured losses between U.S. and non-U.S insurers ([BMR]).

IV. U.S. Net Insurance Industry (A.M. Best) as of 12/2000:

Cumulative Paid Loss and Expense	$21.6B
Stated Reserves	$10.3B
Incurred Liability @ 12/00	$31.9B
Unfunded Liability	$33.1B
Total	$65.0B

V. The Faculty and Institute of Actuaries projects a $30B - $60B total liability for non-US insurers.

VI. Average severities are decreasing and the plaintiffs bar claims that they are getting less money for their clients.

VII. U.S. Insurance Industry 2001 Note 29 (formerly Note 27) of US Annual Statement:

	2001	2000	1999	1998	1997	1996
Gross Reserves	$23.49B	$19.29B	$19.02B	$19.80B	$18.67B	$18.94B
CY Gross Paid	$3.43B	$3.54B	$5.07B	$2.35B	$2.25B	
Gross Incurred	$7.64B	$3.80B	$4.29B	$3.61B	$1.98B	
Incurred / Beginning Reserves	40%	20%	22%	19%	10%	
Gross IBNR	$12.86B					

1997 – 2001 Incurred Losses and Expenses	21,317,086,618
As a % of 1997 beginning reserves	113%

Note that the table above shows that US insurance industry gross paid losses and expenses plus increases in gross reserves in the period 1997 to 2001 are greater than the gross reserves held at the beginning of the period – by $2.4B!

In summary, an exposure based modeling approach projects the number of new claimants for the known defendants, but provides no information regarding liabilities emanating from unknown defendants. There is no way to know how many defendants there are likely to be in the future. Some analysts suggest that the majority of U.S. based companies will eventually become part of the litigation.

In the absence of the data necessary to project the emergence of new defendants and the associated costs, there are few options other than to judgmentally select a factor to apply to the IBNR, or to the total liability, resulting from the modeling process. The modeling process provides rigorously produced estimates of liabilities stemming from known asbestos defendants, taking into account the policy attachment points, limits, and prior consumption, as well as the nature of the asbestos exposure of each individual assured. It is reasonable to assume that the unknown defendants will have similar policy characteristics, but that the nature of the exposure may be different from that of the known defendants.

The resulting "pure" IBNR is very subjective, but must be driven by a desire to make a reasonable but not overly burdensome provision for this unknowable liability. For example, using a rather crude analysis, it can be shown that a "pure" IBNR provision of 50% of the IBNER is equivalent to assuming 2,000 to 6,000 future defendants.

IBNR based on "probable" future insureds[1]

It is possible to obtain lists of known asbestos defendants. It is also possible, though expensive and labor intensive, to compare such a list against the policy records of an insurer to determine if any of these known defendants are possible sources of IBNR. If the insured has enough past experience with asbestos liabilities, then there are two methods for estimating the IBNR stemming from these insureds. Both methods use historical experience to select a base line for some year, say 2002, which can then be trended into the future. A reporting pattern and a trend must therefore be selected.

It is unlikely that any of the insureds that have yet to bring claim will suffer losses as large as those of the larger well-known defendants. Therefore, it is reasonable to exclude this experience from the data.

Account Based Method

This method assumes that the insured has an estimate of annual ultimate ground-up losses for each known account. Projected annual ultimate ground-up losses are bucketed to layers, with total losses by layer calculated for each report year. The burn rate for a layer in a report year is computed by dividing the total losses in the layer by the product of the number of accounts and the width of the layer. For example, suppose the following

[1] The authors are indebted to Peter Cooper, Dave Ostrowski, and Bill Rowland for many valuable discussions on the topics contained in this section.

- The best estimate projected liabilities for report year 1995 in the layer $0 to $500,000 is $6,000,000
- There were 20 accounts with losses reported in 1995.

Then the burn rate for the $0 to $500,000 layer for report year 1995 is $6,000,000 / (20 * $500,000) = 60%.

Suppose further that

- The best estimate projected loss for the last 10 years of experience in the layer $0 to $500,000 is $20,000,000
- There were 250 accounts with losses reported during that time.

Then the burn rate for the layer $0 to $500,000 is $20,000,000 / (250 * 500,000) = 16%.

As an example, the table below illustrates the calculations for a given report year. For simplicity's sake, assume that ABC Asbestos Co, Insulations R Us and Acme Widgets each purchased a total of $40M of limits.

	Account:	ABC Asbestos Co	Insulations R Us	Acme Widgets	TOTAL	Burn Rate
	Annual Loss:	$35,000,000	$6,000,000	$48,000	$41,048,000	
Layer						
$0	$500,000	$500,000	$500,000	$48,000	$1,048,000	69.87%
$500,000	$1,000,000	$500,000	$500,000	$0	$1,000,000	66.67%
$1,000,000	$5,000,000	$4,000,000	$4,000,000	$0	$8,000,000	66.67%
$5,000,000	$10,000,000	$5,000,000	$1,000,000	$0	$6,000,000	40.00%
$10,000,000	$20,000,000	$10,000,000	$0	$0	$10,000,000	33.33%
$20,000,000	$30,000,000	$10,000,000	$0	$0	$10,000,000	33.33%
$30,000,000	$40,000,000	$5,000,000	$0	$0	$5,000,000	16.67%

Ideally, one would want a reasonable range of burn rates. It is probably best to do this for each report year and then judgmentally select the lower and upper bounds of the burn rates to be used for each layer.

The final step is to apply the selected burn rates to the policies in question. This is done by

(1) Distributing the exposure of each potentially exposed policy to the relevant layers

(2) Computing the total potential exposure for each layer

(3) Applying the burn rates to the total potential exposure of each layer.

For example, suppose the identified insureds have a total of $500M in limits for the layer $4M xs $1M. The table below shows an example of the calculation of the lower bound of the expected IBNR from these insureds for the layer $4M xs $1M. The table assumes a 20 year reporting period, with a -2% annual trend in report year losses.

Lower limit of Burn Rate for Layer:			26%
Exposure in Layer:			$500,000,000
Year	% Reported	Trend Factor	Projected Ultimate Losses
1	10.4%	0.980	$13,200,299
2	9.4%	0.960	$11,717,663
3	8.5%	0.941	$10,424,130
4	7.7%	0.922	$9,291,765
5	7.1%	0.904	$8,297,446
6	6.4%	0.886	$7,421,905
7	5.9%	0.868	$6,648,983
8	5.4%	0.851	$5,965,055
9	4.9%	0.834	$5,358,567
10	4.5%	0.817	$4,819,680
11	4.2%	0.801	$4,339,976
12	3.8%	0.785	$3,912,226
13	3.5%	0.769	$3,530,194
14	3.3%	0.754	$3,188,488
15	3.0%	0.739	$2,882,427
16	2.8%	0.724	$2,607,937
17	2.6%	0.709	$2,361,460
18	2.4%	0.695	$2,139,885
19	2.2%	0.681	$1,940,481
20	2.0%	0.668	$1,760,847
		TOTAL	$111,809,413

It is probable that there would have been no accounts during the historical period with annual ultimate ground-up losses piercing layers above a certain threshold – say $40,000,000 for example. It hardly seems prudent to select burn rates of 0.0% for these layers. Therefore, burn rates for the higher layers should be extrapolated from the burn rates for the lower layers.

The total IBNR provision from the potential insureds is given by adding the IBNR of the individual layers.

Policy Based Method[1]

In [H], Haidu arrives at projected report year ultimate losses by applying a loss cost factor (he calls it "Ultimate Percent of Exposure") to the potentially exposed policy limits, but he doesn't tell us how he arrived at the policy limits. In many settings, one may be confronted by a wide assortment of attachment points and coverage amounts, making the use of a single factor for all policies problematic. Therefore, if one were to do this, one would need to 'normalize' the exposure, so that sensible results would result

[1] Bill Rowland provided the inspiration for this method

from *both* the application of this factor to the 'normalized' $45M layer share attaching at $300M and also to the 'normalized' $10M layer attaching at $1M. The normalization procedure used by this method is to multiply the layer share by the probability that a loss actually pierces the layer. This product will be referred to as the adjusted layer share:

- Adjusted Layer Share = Layer Share * Prob(Ground-Up Loss > Attachment Point).

So, the loss cost factor should be based on the ratio of report year direct losses to total report year adjusted exposure (sum of adjusted layer shares). All that remains is to compute the probability of piercing a layer. The ground up liabilities from the model of known asbestos accounts can be used to compute empirical cost distributions. Interpolation is used for attachment points not in the historical data.

The low and high adjusted layer shares are computed for each policy, and summed by report year, leading to low and high report year adjusted exposure ("low" and "high" refer to the lower and upper bounds of a reasonable range of ultimate liabilities – remember, we are assuming the existence of an account based model that produces such projections). The low and high losses for each report year are then divided by their respective adjusted exposures to arrive at the loss cost factors.

The table below contains an example of calculating a loss cost factor for a given report year.

	Policy Att Point	Pr(GUL > AP)	Policy Limit	Adjusted Exposure	Policy Liabilities
Policy 1	$1,000,000	40.0%	$500,000	$200,000	$2,500
Policy 2	$1,000,000	40.0%	$1,500,000	$600,000	$2,500
Policy 2	$5,000,000	30.0%	$4,000,000	$1,200,000	$0
Policy 2	$10,000,000	20.0%	$15,000,000	$3,000,000	$0
Policy 2	$15,000,000	10.0%	$5,000,000	$500,000	$5,000,000
Policy 2	$20,000,000	5.0%	$5,000,000	$250,000	$0
Policy 2	$25,000,000	1.0%	$25,000,000	$250,000	$1,000
			TOTAL	$6,000,000	$5,006,000
			LOSS COST FACTOR		0.834

As with the Account Based Method, the resulting cost factors must be adjusted for trend by application of the decay factors. The table below calculates the trended projected loss cost factor for a given report year, and assumes a 20 year reporting period, with a -2% annual trend in report year losses. It is important to note that these would be calculated for each report year. Judgment would be applied to select trended projected loss cost factors to be used for the identified policies.

The result of applying these two methods is a set of ranges of asbestos pure IBNR (depending on the decay rates and reporting patterns used). Judgment must be used to select a reasonable range of pure IBNR for the policies analyzed. It is highly likely that additional defendants will be named in future asbestos litigation and there also exists the

potential of re-openings of closed accounts. Therefore, an addition "truly unknown" IBNR provision should be added to the above estimates.

Example of Calculating Trended Projected Loss Cost Factor

Year	% Reported	Trend Factor	Baseline Loss Cost Factor	Product
1	10.4%	0.980	0.834	0.085
2	9.4%	0.960	0.834	0.075
3	8.5%	0.941	0.834	0.067
4	7.7%	0.922	0.834	0.060
5	7.1%	0.904	0.834	0.053
6	6.4%	0.886	0.834	0.048
7	5.9%	0.868	0.834	0.043
8	5.4%	0.851	0.834	0.038
9	4.9%	0.834	0.834	0.034
10	4.5%	0.817	0.834	0.031
11	4.2%	0.801	0.834	0.028
12	3.8%	0.785	0.834	0.025
13	3.5%	0.769	0.834	0.023
14	3.3%	0.754	0.834	0.020
15	3.0%	0.739	0.834	0.018
16	2.8%	0.724	0.834	0.017
17	2.6%	0.709	0.834	0.015
18	2.4%	0.695	0.834	0.014
19	2.2%	0.681	0.834	0.012
20	2.0%	0.668	0.834	0.011
			Trended Projected Loss Cost Factor	**0.717**

The selected trended projected loss cost factors would then be applied to the adjusted potential exposure of the identified policies. For example, if the insurer had discovered named defendants with the following policies, and chose to use the trended projected loss cost factor calculated in the table above, then the IBNR from these insured would be 0.717 x $147,000,000 = $105,399,000.

Number of Policies	Policy Attachment Point	Pr (GUL > AP)	Policy Limit	Adjusted Exposure
25	$500,000	60.00%	$500,000	$7,500,000
50	$1,000,000	40.00%	$1,500,000	$30,000,000
45	$5,000,000	30.00%	$5,000,000	$67,500,000
12	$10,000,000	20.00%	$10,000,000	$24,000,000
72	$25,000,000	1.00%	$25,000,000	$18,000,000
			TOTAL	$147,000,000

Appendix IV Bulk Reserving Methods

The Survival Ratio Method

A survival ratio is the number of years that current reserves will suffice ("survive") if average future payments equal average current payments. For example, suppose an insurer has $6M in asbestos reserves. Further suppose that recent asbestos payments have averaged $1M per year. Then the survival ratio of this company is 6, indicating that reserves are adequate to pay $1M per year for 6 years.

The actuary can use this method to arrive at a reasonable range of indicated asbestos liabilities as follows.

- Use historical asbestos paid loss data to arrive at an average annual asbestos paid loss amount. This average loss amount should be adjusted to remove the effects of any larger than average payments, or the effects of years in which payment activity was unusual (e.g. due to changes in claims or litigation practices).
- Estimate the number of years into the future that such payments will be made
- Multiply the two estimates to arrive at indicated asbestos liabilities.

Suppose Company A's paid asbestos liabilities are given by the table below. The opining actuary has learned that deteriorating results during the mid 1990s led to the hiring of a latent claims specialist in 1998. This caused a slow down in payments during 1998, followed by a "catch-up" period during 1999. The actuary also discovered that there was one large gross payment of $3M in 2001, of which $2.5M was ceded to various reinsurance contracts. The claims specialist is of the opinion that such a payment is highly unlikely in the future, and that the company is aggressively settling claims with those insureds that present the most significant exposure to the asbestos loss. Policy buybacks are being pursued on all claims, with limited success.[1]

Year	Gross Paid Asbestos Losses	Net Paid Asbestos Losses	Net to Gross Ratio
1996 and prior	$8.00M	$6.50M	0.81
1997	$2.00M	$1.50M	0.75
1998	$0.50M	$0.40M	0.80
1999	$4.50M	$3.50M	0.78
2000	$1.40M	$1.15M	0.82
2001	$4.00M	$1.30M	0.33
5 year average	$2.48M	$1.57M	0.63
"high/low average"	$2.47M	$1.32M	0.50

Armed with this information the actuary creates the table below. Conversations ensue with the reinsurance department, wherein it is determined that there should be no reinsurance collection issues in the future. In recognition of the company's focus on

[1] Insurers frequently try to obtain agreements from their insureds that they will file no additional asbestos claims. Such an agreement is called a "policy buy-back". Insureds usually refuse to enter such agreements, but those with limited asbestos exposure, or with other pressures to obtain payment from their insurers sometimes will do so.

asbestos and their aggressive claims practices, the actuary selects $1M to $1.5M as a reasonable range for the average annual loss amount. Company A reinsures all GL exposure above $500K per occurrence. The actuary selects .77 to .85 as a reasonable range of the ratio of net to gross liabilities, producing a range of $770,000 to $1.25M for the average annual loss amount.

Year	Modified Gross Paid Losses	Modified Net Paid Losses	Net to Gross Ratio
1997	$2.00M	$1.50M	0.75
Average for 1998 & 1999	$2.50M	$1.95M	0.78
2000	$1.40M	$1.15M	0.82
2001	$1.00M	$0.80M	0.80
5 yr average	$1.88M	$1.47M	0.78
3 yr average	$1.63M	$1.30M	0.80
Selected Average	**$1.0 to $1.5M**	**$.77M to $1.25M**	**.77 to .85**

The only thing left to do is to arrive at a number of years for future claims payments. A.M. Best has begun to use a discounted survival ratio of 12 (meaning the ratio of discounted asbestos reserves to current average payments is 12). This implies that the undiscounted survival ratio is higher than 12. Let's say it is 15 (meaning 15 is "in the middle" of a reasonable range of survival ratios). It is the opining actuary's opinion that Company A will settle all of its asbestos claims a few years before the industry does, and that sometime in the next 5 to 10 years there will be a noticeable downward trend in their asbestos payments.

	Low Estimate	High Estimate
Average Annual Gross Paid Losses	$1.00M	$1.50M
Average Annual Net Paid Losses	$0.77M	$1.25M
Selected Survival Ratio	8	15
Indicated Gross Asbestos Liability	$8.00M	$22.50M
Indicated Net Asbestos Liability	$6.16M	$18.75M

The difficulties, advantages, and disadvantages of this method are clearly explained in [AMB].

The Market Share Method

The market share method uses the insurance company's "market share" of the asbestos arena to estimate asbestos liabilities. The market share can be based on premium or on paid losses.

Year	Industry Net Paid Asbestos Losses
1995	$1,297M
1996	$1,146M*
1997	$972M
1998	$1,038M
1999	$1,595M*
2000	$1,350M
Cumulative Net Paid Losses through 12/00	$21.6 Billion

*excludes unusual Fibreboard payments (AM Best Special Report 5/7/01)

The table to the right shows P&C industry net paid asbestos losses from 1995 to 2000 (unfortunately, we do not have historical gross paid asbestos losses). Let us continue with our previous example. Company A's "market share" of net asbestos payments from 1997 to 2000 averaged 0.1244%, with a weighted average of 0.1322%. Company A's cumulative asbestos losses through December 2000 net paid asbestos losses as of December 2000 were $13M, so we can see that Company A's market share of cumulative net paid is 0.0604% ($13M / $21.6B). The recent market shares (with the exception of 1998) are rather high, but this has been partially explained. In light of the discussion in the section on survival ratios, a reasonable range for Company A's market share of future asbestos liabilities could be 0.070% to 0.10%.

The table below shows estimates of ultimate net asbestos liabilities for the US P&C industry from 3 different sources. These numbers indicate that future industry liabilities (for calendar years 2001 and subsequent) are between $33B and $48B. Applying the range of market shares from the preceding paragraph leads to asbestos liabilities (@ 12/2000) for Company A of between $8.75M and $29M. Now subtract net payments for calendar year 2001 of $1.3M to arrive at the range $7.45M to $27.7M.

Estimates of Ultimate Net Asbestos Liabilities for the US P&C Insurance Industry

AM Best (May 7, 2001)	$65 Billion
Tillinghast (3rd quarter 2001) http://www.towers.com/towers/services_products/Tillinghast/sizing_up_asbestos.pdf	$55 to $65 Billion
Milliman USA (3rd quarter 2001) http://www.bestreview.com/2001-09/pc_asbestos.html	$70 Billion

Another method referred to as the "market share method" relies on premium instead of losses. One problem with this is that it is very difficult to determine a particular company's market share of the GL policies sold to asbestos defendants. It is possible to determine the company's market share of total industry GL premium by year, but most companies are not exposed to asbestos losses for all years in which they wrote GL policies.

"Loss Development" Method

According to the numbers above, the remaining asbestos liabilities for the US P&C industry are between 1.546 and 2.24 times cumulative paid losses as of December 2000. Assuming that Company A's asbestos liabilities will pay out, on average, in a manner similar to those of the industry leads to ultimate liabilities of between $20M and $29M. One can then adjust this range based on the nature of the company's asbestos exposure. This could be called a "paid loss development" method.

As mentioned before, the opining actuary believes that Company A will settle all of its asbestos claims a few years before the industry does, and that sometime in the next 5 to 10 years there will be a noticeable downward trend in their asbestos payments. Therefore, it would be reasonable to conclude that the range of $20M to $29M is too high.

The methods discussed above yield the following results.

	Indicated Gross Asbestos Liabilities		**Indicated Net Asbestos Liabilities**	
Method	**Low**	**High**	**Low**	**High**
Survival Ratios	$8.00M	$22.50M	$6.16M	$18.75M
Market Share	N/A	N/A	$7.45M	$27.7M
Loss Development	N/A	N/A	$20.00M	$29.00M

It would not be unreasonable for the actuary to select a range of $7M to $20M for Company A's ultimate asbestos liabilities.

Ideally one should obtain gross industry paid and incurred to date data so one can apply the Market Share and Loss Development Methods to Company A's gross losses. Both Tillinghast and Milliman have published estimates of the US P&C industry's gross asbestos liabilities, so such an analysis could be performed if one could obtain the needed industry data.