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**2000 Valuation Actuary Symposium**  
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**Session 33PD**  
**Low Probability/High Impact Events**

**Moderator:** John O’Sullivan  
**Panelists:** John F. Gies  
James P. McNicholas  
Lance Berthiaume

*Actuaries are trained to consider the risks associated with mortality, persistency, and certain investment risks like asset default or interest rate changes. However, our enterprises might be open to deeper risks that go undetected and that might not be amenable to a single quantification method. Although these risks have a low probability of occurrence, they can destroy or cripple an enterprise.*

*Panelists discuss: how these risks are identified; what tools are available to measure the risk; how the risk exposure is communicated within the organization; the techniques used to manage risk in an integrated fashion; and current industry thinking (including the regulatory and rating agency implications). Practical examples and case studies illustrate the available tools and the benefits derived from an analysis of these risks.*

**MR. JOHN O’SULLIVAN:** I thought I’d start by giving a little bit of background about our speakers. Our first speaker will be Jack Gies, a senior actuary with Ernst and Young. He has almost 30 years of experience in the industry. He works in the Hartford office of Ernst and Young, providing regulatory advisory services as part of his practice. He directed the life and

health examination function for the Connecticut Department of Insurance, and he has been active with the Life and Health Actuarial Task Force (LHATF). He is currently active in setting up the Unified Valuation System (UVS) framework with the Academy, and he's going to be talking about viability surplus.

Our next speaker is Jim McNicholas, and he's a director with New York Life. He has responsibility within the group annuity line for product development, regulatory compliance, and financial reporting. He has been very active in the area of regulatory compliance, both at the New York State level and also the national level. He's currently serving on the Academy's liquidity group. Liquidity is a very hot topic these days.

Our last speaker is Lance Berthiaume from Tillinghast. Lance works in the Hartford office of Tillinghast. His practice includes financial analysis, product development, and asset/liability management, especially through dynamic hedging. He's going to walk us through a variable annuity with secondary guarantees. He'll address the question of, how do you identify the risk, and how do you manage the risk?

I have the easiest job in this whole program. I'm the moderator and the person who put this session together. I have served as a chief actuary of an insurance company and a CFO for an annuity line of business. I've become very comfortable, or as comfortable as one can get, with looking at tail risk. I'm active in the Academy Committee on Variable Annuity Guaranteed Living Benefits, and that really fits into this category of low probability and high impact. I'm a consulting actuary with ASA.

When putting this session together, we thought it would be worthwhile to have something that kind of broadened everybody's framework. The idea here is just to think about things that one normally doesn't think about. These are things that can come back and really haunt you. They have a low probability of happening, but if they do happen, they can be pretty devastating.

I think life and annuity actuaries are more likely to think in terms of expected values, rather than the tail. The tail and the fatness of the tail really do matter when you're taking on risk. If you price secondary guarantees with variable annuities, this is the thinking that you should become very, very familiar with. It's really more like casualty insurance thinking than traditional life and health thinking.

This is not really an academic exercise. Look at what happened at General American, or think about what could happen if this country were to have a scenario like Japan did. These are things that don't happen every day, but when they do happen, they have tremendous impact.

The program is divided up into three parts. Jack will talk about what's happening on the UVS front and the viability analysis. Jim's going to talk about what's happening within the regulators on liquidity. Lance is going to give us a case study in which he's going to talk about a real-life situation with secondary guarantees on a variable annuity and how the risk can be analyzed and managed.

**MR. JOHN F. GIES:** Change is prevalent and encountered almost everywhere. I'd like to tell the story of Father Sorin. He was traveling west, heading for the California hills. He got to South Bend and decided that the weather was pretty tough. He thought he'd stay there a while until the weather changed. Of course, the weather never changed, and the University was founded in South Bend.

Part of the change that we deal with is derived from globalization and financial service integration. We see it in the newspaper all the time. Examples of changed companies are Travelers and City Group, Chase Manhattan, J.P. Morgan, ING, Aetna, and Reliastar. It seems like every day the landscape is changing. Meetings like this valuation actuary symposium attest to the force of change, considering the number of times in the past several days we encountered new and enhanced capacity to model and identify risk. It's clear that we are changing our own view of how to manage the insurance business. This is reflected in a number of ways.

First, there are new products and new combinations of products, including variable annuities with guarantees. Second, there is federal/state cooperation. In terms of changes in the oversight function, we can cite codification, which is an attempt to bring a uniform national focus, accreditation, speed-to-market initiatives of the NAIC, all of which deal with the threat of federal oversight. There are a large number of contacts that are occurring between regulators and foreign jurisdictions, and the American Academy is very active in the area of UVS. All of these developments reflect the rapid pace of change. With respect to the universal valuation system, the objective was to augment the confidence that consumer expectations would be delivered on. The UVS essentially is a process that attempts to move from the black box of implicit safety margins in valuation that involve conservatism that the actuaries have dealt with over the years to an explicit identification or measurement of risk was the first major point.

A second major point was to move toward a more integrated view of the capital requirements needed to back these risks. In lieu of a tabular approach involving a separate reserve and risk-based capital (RBC) framework, UVS proposes a more integrated approach where the capital requirements of the company would be specifically identified.

A third major point was the idea of viability analysis, which was developed as an offshoot to the valuation task force work on the UVS. Viability analysis was an augmentation of UVS. It had similarities to UVS in that it is a forward-looking process. It's dynamic as opposed to static analysis, and it attempts to create a heightened awareness of the level of change and the effect of change on companies.

There are dissimilarities of viability analysis with the UVS mechanism as well. For example, the viability analysis incorporated corporate plan aspects, such as new sales. It also focuses more on short-term and near-term events, as opposed to long-term issues associated with asset/adequacy analysis. Much of this was given impetus by the General American situation.

So there is a greater emphasis on short-term and near-term events where the important element is a focus on risk identification. The risk identification that we're talking about is adversity and variance from an expectation of an anticipated circumstance. The viability analysis focuses on or

attempts to identify plausible variances and plausible adversity, as opposed to moderate adversity.

Viability analysis is really a threat identification document where the intent is to create an awareness of wide tails. This is the circumstance where there is a lot of area under the curve beyond the 80% confidence interval, and it is out in that area where surplus is generally considered to be dedicated to risk. The objective, of course, is not to eliminate risk or to regulate risk out of existence, but to create an awareness level where risk would be identified, managed and hedged.

There are a number of ways to categorize risk. Some of the topics that I might list under a risk framework include guaranteed benefits on volatile platforms and variable annuities with guaranteed benefits. These items aren't captured well in the current regulatory, so there's a risk that the financial report is not capturing what it should capture. For example, the Commissioner's Annuity Valuation Reserve Method (CARVM) is considered a safe harbor in terms of a regulatory framework. On the other hand, I think regulators will challenge the recoverability of the CARVM offset, particularly if the surrender charges are unusual or there are cliff-type surrender charges.

There are balance sheet credits related to offshore reinsurance. These are very hard items to quantify. That doesn't mean that they ought not to be identified and that management should not be aware of the risk involved. Even the casualty concept of maximum potential loss is a device for approaching this kind of issue.

In addition to financial reporting, there are risk of systems and controls, systemic meltdown, and accrued with long-term capital management. For example, there are products that are based on program trading that work very well when the system is working, but what if the system melts down?

There are a number of risk areas that can be discussed in the area of insurance and assets. The major issue there is a substantive and prolonged downturn in markets. The prescriptive rules that

are presented in terms of actuarial guidelines and regulations aren't a good fit for these products because of the volatility involved. I think one has to be careful about what one considers a safe harbor in these respects.

Contractual options and financial flexibility can be considered together. There's the issued corporate cash and the C-3 risk. I think an overlooked area is that of transfers among investment accounts, particularly if there are guarantees involved. Policyholders act in their own self interest. I'm not suggesting that considerations of these translate into balance sheet reserves, but they certainly are an element of the adequacy of the capital base, and management should be aware of these risks.

Consider a company that is predominantly a variable annuity company. Its balance sheet is populated predominately with a CARVM asset that is largely an illiquid asset. It's an often overlooked item in terms of solvency, but I think one has to address the cash strain of new business and whether or not all of that asset base is available for the unforeseen circumstances.

New York Insurance Department is currently drafting a liquidity paper. The NAIC is moving in this area, as well. Counterparty risks and specifically reinsurance prices became a surprise in terms of some of the products with embedded options. Reinsurer default is always a risk element too. The offshore ceding of insurance and the use of letters of credit adds uncertainty.

Finally, the environment, the marketplace perceptions of insurers, and even perceptions of the sector that you're in can influence and should be a part of comprehensive risk assessment.

On balance, there appears to be a heightened awareness on many levels and a move to a more self-regulatory scheme. In the old model, regulator oversight provided a safe harbor, and as long as you complied with the program, you were okay. That appears to be fading.

We're entering into a new environment. Disclosure is a very powerful element in all of this. The involvement of peer groups, boards of directors, the American Academy of Actuaries Standards of Practice, and a different application of regulatory oversight at the state level will produce

different results. This disclosure element is very much a part of this new environment. An important part of what makes it work is confidentiality. Finally, the information is very sensitive, and there are several aspects yet to be addressed.

We need to find mechanisms to protect the actuaries from frivolous lawsuits. These are not areas involving certitude. These are highly uncertain areas. We need to address the issue. There are competitive aspects, and there's also, in terms of the audiences for this information, the aspect of needing to know. Not everyone needs to know this information, but there are groups that would be privy to the information. Peer review is a very important element and confidentiality would be part of that. That sets the stage for Jim.

**MR. JAMES P. McNICHOLAS:** I hope I'm going to be able to provide some background on liquidity and liquidity-related activities, and some thoughts on the management of the liquidity risk. The quote "...supposedly improbable events happen much more frequently than they are expected to..." certainly fits the scope of low probability, high-impact events. I don't think it's open to interpretation. If the statement is credible, it probably deserves quite a bit of our consideration.

Another statement reads as follows: "However, in Moody's opinion, supposedly improbable events happen much more frequently than they are expected to; consequently, the costs of these risks might be much more expensive than product pricing supports." I think the key phrase is "much more frequently." It kind of took me back a little bit when I first saw that.

The second part of it is that the cost of these risks might be much more expensive. So even though they're of the opinion that they do happen more frequently, they're not so sure what the pricing consequences of that are. This comment actually appears somewhat prominently in *Moody's Invested Services* article entitled, "One Step In the Right Direction, The New C-3 Risk Based Capital Component." The comment was simply part of Moody's overall analysis of risk. This article was very positive on the new C-3. I'm certainly in agreement with them on that.

Moody actually followed up this article with a release on C-3 where they were encouraging all companies to adopt the improved method for measuring interest rate risk, and it indicated that the revised calculation highlights the imprecision of the old method. Moody encourages all companies to consider adopting this or similar testing, whether it is required of that company or not.

The article later stated that Moody's was considering views on asset/liability management. They did note liquidity is still king. Moody's used liquidity as a crucial factor in evaluating an insurer, and they went on to say that they quite regularly monitor the adequacy of the insurer's liquid resources.

Liquidity is defined as the ability to sell an asset at close to market value in a reasonable period of time. That particular comment was in a footnote in an earlier draft. It was deleted, but I think it's just interesting to have a basis. The idea of liquidity has been defined in many ways in much of the material that I've looked at.

Standard and Poor's believes that, in general, the industry's liabilities are far more liquid than many companies realize. Having an appropriate level of liquidity means being able to meet maturing obligations promptly and taking advantage of market opportunities. We really have asset liquidity and liability liquidity, and this gets us to the fact that it really is a balance sheet consideration. In addressing liquidity, you have to consider both parts of the equation.

There are certain questions as to exactly how you address this. Are you doing it by total company or are you doing it by business unit? Are you doing it on a going-concern basis or in a crisis? Much of the current regulatory work is mostly concerned about the crisis situation, but if you're looking at it from the company's point of view, I think you're going to find the ongoing concern is of the greatest importance.

Who are the interested parties? There are the rating agencies, regulators, and the insurance industry. The New York Insurance Department released Circular Letter Number 35, issues regarding liquidity and asset/liability management. The release basically is saying it was



requesting information in order to assess potential cash requirements and cash resources available to service these cash requirements.

As for Circular Letter 35, I just want to talk about the format that the insurance department used there. There were basically three tables. Table One was cash demands, Table Two was cash resources, and Table Three was the largest institutional clients.

The insurance department was gathering quite a bit of information available in a simple format. When members spoke about cash demands, they broke it down into institutional, retail and other, and other is always the most interesting category. Other categories were: investment commitments, off-balance-sheet risks, credit guarantees, and possible support for your affiliates.

On the cash resource side, they had asked for information on both a market-value and a statement-value basis. Of course, there was an “other” category there, as well, where you’d have lines of credit, support agreements from affiliates, contractually required premiums and considerations. In liquidity analysis, particularly on the cash resource side, when you get into a crisis situation, some of these other lines for resources for cash can tend to fall apart.

I just want to back up for one moment and go back to liquidity considerations. When the New York Insurance Department put out the Circular Letter, it referenced the General American situation as something that highlights the need for asset/liability management. They had asked that the report be filed as of September 30, 1999 and submitted by December 15, 1999.

The New York Insurance Department had requested that companies report possible cash demands by policyholders and contractholders by the time period in which money would be payable (0–7 days, 8–14 days, etc.). The department wanted to know what your liabilities were in days zero to seven and what the liabilities were in days eight to fourteen. There were a number of categories that ended with anything over 180 days. On the access side, it was a single number that they were looking at.

They had a third table there. The third table was for the largest institutional clients, who were asking for the maximum contractual cash demand. They ended this with two interrogatories. Maybe that was what led them to the new Circular Letter they're currently developing. The interrogatories were most concerned about information not included above. It puts us on the hook, by simply tell us everything that we haven't covered up above.

The second item is the concentration risk. You're going to hear this over and over again as far as liquidity is concerned because it's certain portions of your business. I deal with a group annuity side. We have GIC blocks of business. You can have people control hundreds of millions of dollars. Another example is corporate-owned life insurance (COLI)/bank-owned life insurance (BOLI), where a few brokers can control billions of dollars worth of business. It's quite important that they did include these items in the Circular Letter. I thought it was very simple. I thought it was very well done. They captured quite a bit of the information that is necessary for people to use when doing the analysis.

The NAIC has formed a Life Liquidity Risk Working Group with the intention of addressing the broad range of liquidity issues facing insurers. I'm on the American Academy of Actuaries Liquidity Working Group, a forum to assist with research risk management and to assist the NAIC. The report that has been prepared by the American Academy of Actuaries has been referred to in a couple of sessions that I sat through. It is available. It's at [Actuary.org](http://Actuary.org), and it covers quite a bit of information. It goes into much more detail than I'm going to go into on the liquidity side.

The report of the working group is going to cover types of liquidity risk, embedded options in assets and liabilities. It is quite interesting on the liability side. It suggests methods to measure liquidity and discusses possible regulatory actions.

Let's follow up Circular Letter 35. The Life Insurance Council of New York (LICONY) spent a lot of time and energy on a revision of Circular Letter 35. I wasn't part of this, but I know the people in my company who were, and they really worked very hard with the insurance department to come up with the next draft of the Circular Letter.

Circular Letter Number XX for August 7, 2000 pertains to issues regarding liquidity.

The department is indicating that this is its current thinking with respect to liquidity concerns. They placed a common deadline on the October 1, 2000 draft. The draft at this point is asking that we file a report as of December 31, 2000, which will be signed by the CFO of the company. That's a change from the prior Circular Letter. It was simply an officer of the company in Circular Letter 35. It will be submitted by April 1, 2001.

In the composition of this draft, there are 24 interrogatories. It is broken down into 1 to 10 and then 11 to 24. In a different session, I heard somebody say it might now be 1 through 11, and 12 through 24. So if there was a change made, it has been done since we put this material together.

Interrogatory two asks if your company has a formally written liquidity plan. If you do, you have to provide an overview. If not, explain why a plan is not necessary. In interrogatory seven, they're asking for the information that the rating agencies might be putting together on your company. If your company is rated by a rating agency, provide a summary of the most recent liquidity analysis. What, if any, changes does your company plan to implement? Has there been a significant change since the effective date of the liquidity analysis results? I imagine that's just in your balance sheet since the effective date of that analysis.

They do provide that if you satisfy these two requirements, you're going to be answering the first ten questions, but if you have answered the issue of liquidity analysis development, you are effectively exempt from the last (11 through 24) interrogatories. It's a very interesting proposal. It asks for a considerable amount of information, and if you have an opportunity, I would suggest that you do look at it.

I'm going to get away from what the Circular Letters are dealing with right now. When we get to the analysis of the balance sheet, it's obviously going to be the assets versus liabilities in most of the literature you're going to see right now. A couple of concepts are in there. People are looking at the severity of the scenario. General American has already been mentioned. I think

the number that was quoted was that they probably had \$4.5 billion of demand liabilities within a week. That's a severe situation.

When you're doing the analysis, people are looking at the time horizons. Time horizons most frequently considered would be one month, three months, and one year. What I've noticed from some of this material is the time horizons are probably most important on the asset side because when you have to liquidate these assets very quickly, you're not going to get the full value on those assets.

At another session, the speakers made reference to the fact that if you are trying to liquidate a large block of securities, the people down on Wall Street will find out about it very quickly. You're probably going to pay a premium for that reason. The faster you have to liquidate, the more problems you're going to have.

The next consideration is off the balance sheet. I think this is one of the reasons that the New York Insurance Department has asked that we have a sign off by the CFO on the next Circular Letter. I'm sure there are a considerable number of agreements at New York Life of which I don't have knowledge. I just don't know enough about the whole operations of the company. The impression people have is that there are going to be certain off-balance-sheet agreements that very few people would know about, so the higher the signature, the better it is. There are some other considerations, and some of those were covered earlier with the first Circular Letter.

In looking at the assets versus the liability, the liquidity ratio equals liquid assets divided by projected demand liabilities. Cash resources versus cash demands is more of the set-up of the Circular Letter Number 35. The liquidity ratio could be as simple as taking the ratio of your total cash resources versus your cash demands. I think it's more common that people are again looking at discreet periods of time. In doing an analysis for your company, you probably want to look at what the demands would be within the one-month period or within the three-month period. You might set the liquidity ratio at various levels, depending upon the product. I've seen quite a bit of instances where the liquidity ratio should be one. I don't think that's necessary. It will depend upon the product and the line of business that you're dealing with.

When you are doing multiple liquidity ratios, it tends to be cumulative. You're not looking at each discreet period. You hope you pass in that first period, and then on a cumulative basis on the second. That's the approach that people seem to be taking most of the time.

Let's discuss the severity of the scenario. If you have a going concern in which you really don't have a crisis, the most important aspect is that you now have money coming in. Money coming in is something that can certainly help you to meet your demand liabilities. They don't combine going concern and then ongoing at the same time.

Other situations related to severity of scenarios would be stress. That's more of the situation where you're looking at a month's period of time. When I get you some of the information on the Standard and Poor's liquidity model, you'll see that it uses immediate terms. There are various situations you do want to look at. You don't want to limit it to one situation.

Standard and Poor's has a very nice write-up. It's roughly four pages long, and it covers a tremendous amount of ground. When I was first getting involved with the American Academy group, this was probably one of the first articles that I was given to read. I think it gave me a good idea of what was going on. I'd like to combine a couple of things. In the case of the original proposals that the industry was providing to the New York Insurance Department, I think we did, at one time, look at a factor approach. It didn't make it into the final cut of the New York Insurance Department proposal. The department wants to see what the rating agencies are already doing, which indirectly gets back to the factor approach.

Standard and Poor's builds its liquidity model as an analytical tool. It's going to compare allowable assets with adjusted potential and maturing obligations. It is looking at two scenarios that it is referring to as immediate: immediate implies a "drop dead" situation (immediate and unforeseen stress within a month); and the ongoing assumes a time frame of one year. In both of these instances, it runs the analysis out for an additional year. It will be 13 months or two years, during which it is looking at the obligation versus the resources to meet those obligations. It is a factor-driven model.

If you have a chance to look at the write-up, you'll find liquidity risk factors, surrenderability, negative earnings, and a redundancy factor. S&P is dealing with allowable asset factors at the same time. It's very mechanical until it gets to the very end. S&P simply makes the statement that a vital part of the assessment of the insurer's liquidity incorporates qualitative and quantitative adjustments particular to individual companies.

I guess it gives you a feel for what's going on. You're going to probably see a few things that you want to look at and question. They're going to meet with management.

I'm going back to an earlier slide in which we had simply referenced other items that need consideration in addition to an analysis of liabilities and assets. Let's discuss a couple of off balance sheet examples. You might have a commitment to parents, subsidiaries, or affiliates. In addition, there is a concentration of risk with institutional investors or broker/dealers. This can be a very big issue if you have a small number of brokers who handle quite a bit of your business.

As far as the analysis of liquidity is concerned, I'm going to close with an approach that I favor. This approach is part of the American Academy of Actuaries draft that has gone to the NAIC; I think it covers quite a bit of ground. It'll give you many things you can think about and many things that really have to be built into your analysis of liquidity. Understanding liquidity risk begins with quantification of general liquidity needs on an operational or going-concern basis, as well as an understanding of liquidity requirements during the crisis of competence.

The approach really gives you everything that you need because you want to know, on a day-to-day basis, what things are looking like. It's going to put you in a position where you can deal with the crisis of confidence. How much liquidity is needed on a going-concern basis? How much liquidity is needed to prevent substantial loss? Should there be a run on the bank? What are the sources of liquidity? Has yield been sacrificed?

I believe the last item is a major concern. Of course, you can be very liquid, and you can have many Treasuries supporting your liabilities, but if these things don't match up well, you would be sacrificing yield, and that's not the reason that people are in business.

Let's follow along this same line of thought. The report was prepared on this basis. One approach tells us to focus on the risks associated with having too little liquidity versus the cost of having too much liquidity. In another approach, you should recommend the appropriate level of liquidity as well as a tracking and monitoring program. Periodically record the liquidity ratios. You first set your standards and, on a quarterly basis, you review information that tells you what is going on.

I have reports on available sources of liquidity, but I must recognize the fact that certain of those sources might not be there in a pinch. In external sources of liquidity, for instance, a bank line credit might not be there if you find yourself in a crisis situation. You might want to include nonfinancial measures in your plan. A number of people have noted that in the case of Executive Life and Mutual Benefit, there were a series of newspaper articles. These articles led up to the fact that there was a problem. If you're tracking things of that nature, it could help you.

The final part is simply outlining the crisis management and communication plan. It is extremely important. The communication plan is going to be both internal and external. The power of the press is considerable. You want to have people who are ready to communicate with the press and get the right information out there. That's all a very important part of the plan. If you don't put the plan in place before you need it, there won't be any time to plan when the crisis really comes.

**MR. LANCE BERTHIAUME:** I've typically given this type of presentation at variable annuities sessions. I think it is also very appropriate for an audience that experiences events with low probability and high impact. Products with equity market exposure show a sizable correction in the market, which is not very probable, but if it does happen, it will have a devastating impact on some of the major players.

I'd like to give an overview on what I will cover. We'll discuss some of the things we are seeing in the marketplace. We'll generally cover some of the risk management options in dealing with equity market exposure. I think it's safe to say that the decade of the 1990s is probably the decade of the variable annuity. Because of the tremendous growth in the product and in the

excess returns we've seen over the last ten years, I think it has attracted many new players to this market. These new players have put tremendous pressure on pricing margins.

I've seen tremendous growth in this market. I don't know if that kind of growth is going to continue forever, but I think it should continue because of the current demographics that we're seeing in the market. I think the size of the market has caused some of the reinsurers to rethink how they view this market. It has caused them to kind of revisit their pricing approach.

As I said, one of the reasons I think this market will continue to grow is the current demographics. People are getting older, and they're starting to save for their retirement years. There has been an increased responsibility for every person to take ownership of his or her retirement plan.

The following are embedded options that subject these products to equity market exposure. These are: guaranteed minimum death benefits (GMDBs), guaranteed minimum accumulation benefits (GMABs), guaranteed minimum income benefits (GMIBs), equity-indexed annuities, equity-indexed guaranteed investment contracts (GICs), and segregated funds. I think it's safe to say that 10 or 15 years ago, these products or futures did not exist or were just in their infancy. It has brought new risk and new challenges to many actuaries.

I want to cover two results of the market correction—the economic exposure and accounting exposure. There's the pure economic exposure, which includes revenue loss and payout under guarantees. Actuaries, at least in my experience, are focusing on the benefit guarantees. I don't think we can lose sight of the fact that if we had a serious market correction, the largest loss is going to be in the area of future mortality and expense (M&E). These products are asset-based. They work like mutual funds, and the revenue loss is much more substantial than the payout guarantees. In a typical guaranteed minimum death benefit, the market has to correct and people have to die to collect the benefit. Most pricing actuaries focus on the economic exposure, but I think there is some real accounting exposure.



Most U.S. stock companies are focusing on GAAP, and with *FAS 133*, you can see some volatility in your earnings if a market correction does occur. The other thing is reserve volatility. I'm really more focused here on the statutory side.

Products with equity market exposure have a low probability of a dramatic correction in the market. But if it does happen, it will have a devastating impact on the major players in the market.

The reserve is zero when the options are significantly out of the money and increases dramatically as the option becomes in the money. The reserve exhibits an exponential pattern, which is not the case for most actuarial reserves.

There has not been much action in the U.S. with respect to capital requirements on these benefits. But Canada has introduced some pretty onerous requirements for year-end that probably attract some attention in the U.S.

There are a variety of risk management options that can be used. I'm mainly focused on dynamic hedging, but I'm going to try to cover all of these risk management options. I think there's one thing that we can't forget. We're in the business of taking risk, but we're not trying to eliminate risk. We're just trying to manage risk.

The first option is to run the risk. This is a viable option in many situations. If you have a high appetite for the risk, you can run the risk naked. If you have a small line of business, this might be a viable approach. It won't devastate the company if it's a small line of business. The other thing is it might be complimentary. Some products might do poorly when the equity markets experience negative returns. This would offset negative impact of a variable annuity.

As far as holding capital, the real question becomes, how much capital? The real exposure is really in the tail. The problem is if you're holding a 95% confidence interval, it is probably not going to really cover the tail. If you hold 100% of the confidence interval, it's excessive capital.

As for reinsurance, we're actually seeing some retractions in this area. We are seeing less players in the market. It's becoming extremely expensive. I attribute this to two things. I think these options, as an equity market exposure, are unique. The typical mortality risk or mortality fluctuation can be diversified. Not everybody's mortality is going to fluctuate all at the same time. If the market corrects, it's going to correct for everybody. I think a significant market exposure could really devastate some of the major reinsurers.

The biggest reason that some of the reinsurers reassessed their position in the marketplace is because of the way it's priced. Traditionally, these products are priced using traditional actuarial approaches. The capital markets tend to price this on a risk-neutral basis. All I mean by this is that they tend to discount things at the risk-free rate, which is the Treasury rate. Actuaries typically discount at corporate yields. You get a much different answer in your price using a risk-free rate.

The next type of solution is capital market solutions. The real difficulty is having to go out seven or ten years for some of these guarantees. It is difficult to predict what your lapse and mortality experience is going to be over the ten-year horizon. I think lapses are a very critical liability assumption. A small deviation in your lapse assumption changes the answers dramatically. I think that's one of the difficulties.

There is a large bid-ask spread because the marketplace is providing liquidity. Another concern is whether the derivative writer is going to be there in ten years. To really protect yourself, you need to make sure that your counterparty is going to be there in the long run. Finally, there is no perfect hedge. You can't perfectly hedge this type of stuff. You're always going to have basis risk.

I'm going to try to get into the dynamic hedging process. I'll get into a broad overview and just hit on the highlights. The key is really understanding your risk exposure and your risk appetite. You really can't evaluate any of these options until you really have a good understanding of those two items. As far as dynamic hedging, the key thing on the liability side, as I mentioned before,

is the lapse assumption. The lapse assumption really changes the perceived outcome of doing a dynamic hedging program.

On the asset side, the key assumption is your volatility. Again, just like the lapse assumption, a small change in the volatility assumption really changes the price of a dynamic hedging program.

This last item is really the partitioning of the liabilities. What I'm talking about here is that a variable annuity has maybe 20 to 40 investment options, but you're not going to try to model all investment options. You're going to bundle like funds together and maybe model four to eight or four to six different strategies.

When you first get involved in dynamic hedging, one of the first things you get exposed to is what's called the Greeks. It becomes intimidating because there are five Greeks. These Greeks are somewhat easy. It's just a matter of doing a mathematical formula. The most critical process of dynamic hedging is actually developing assumptions and doing the trading. Those are much more difficult and much more subjective.

The key to Greeks is that many people have been doing dynamic hedging with delta hedge. In the case of the gamma hedge, some people do it, but most people just monitor it, kind of like convexity risk. It can be very costly to hedge gamma. The other risk that people tend to monitor is rho. The reason they monitor rho is because it's sensitive to the risk-free rate. The risk-free rate is key to the capital markets.

Once we have the process set up, we start getting into the execution of a dynamic hedging program. This is probably the next key. Other than developing assumptions, the other key thing is having the necessary expertise to do the trading. I think that requires a special expertise that typical actuaries do not have. It's usually left with the investment department or outside manager. One of the ways that people can get comfortable with this type of process is to do some mock portfolios. This will allow you to fine-tune your models, and it will also let you develop the expertise.

You also can't forget the other consideration. You're still going to have volatility, especially on the statutory side. I'm not an expert on *FAS 133*, but I do not believe this will meet the hedge accounting rule for *FAS 133*. There is still going to be volatility in your GAAP earnings if you're doing this type of program.

There are dynamic hedging risks. One is modeling risk. This includes the calculation and the assumptions. As for basis risk, there is no perfect hedge. You can't perfectly hedge this stuff. I don't know of anybody who is perfectly hedging, so you're always going to have basis risk.

There is also trading risk. I really think you need the expertise on the derivative side because all the analysis in the world isn't any good if you don't really have a feel for the market and what it takes to do derivative trading. Developing controls is also important. I'm sure most people are familiar with Orange County. Orange County's problem wasn't derivative. The problem was lack of control.

I'd like to discuss some numerical examples. The first example is just M&E renewal. The information is as follows:

- Variable Annuity
- Load version (with surrender charge)
- Bank channel
- \$100,000 single premium
- Base scenario assumes a 8.75% growth rate
- Discount rate of 6%

Chart 1 shows a base case. The green line reflects the M&E revenue from the assumptions based on the previous page. The blue line represents a 10% correction in the market without any future growth. What I'm really trying to show here is the loss in the M&E revenue. The black bars represent the year-by-year loss of M&E fees and the red bars represent the cumulative loss of the M&E discounted back to this time of issue. The loss is 5% of the original premium. It is quite sizable when the spread in these products is very low.

The next example that I'm going to try to cover is a variable annuity with a guaranteed minimum accumulation benefit (GMAB). A GMAB is referred to as a living benefit. It's guaranteed, but you don't have to die to get this feature. Typically, you're guaranteed a certain account value after ten years. The example assumes a one-year issue of \$1 billion dollars of premium.

Chart 2 shows a hedge and a nonhedge. The pink lines really represent the unhedge position, and the blue line represents the hedge position.

The other point is that the zero line does not mean zero profit. It's really just a deviation from expectation, so the zero line means you meet your pricing assumptions. There are a couple of things to observe from this. An unhedge position will always have a greater expected profit and a hedge position will always have less variability. In simple terms you're giving up your upside potential for downside protection.

The curve at a 95% confidence interval is a loss of about \$45 million. At a 99.5% confidence interval, the loss is \$175 million. This is a rather devastating impact.

Product Design. I think this is really where everything starts. I think if you're designing products, you're starting from a clean sheet of paper. The whole universe of options is available to you. Once you've designed these products, and they're being sold in the marketplace, I think the range of options has been reduced.

I think you might want to revisit some of your older products. You might want to remove some product features that are costly and that the policyholders don't perceive as being that valuable.

Finally, as for product design, you might want to do some natural internal hedges. You might have situations where you need to go long and on another product where you need to go short. Instead of buying a long option and a short option, you might be able to internally hedge. I might be putting it rather simply. There is some complexity to this, but it will save you the cost of going to the market. You have to develop some pretty complex transfer pricing techniques to be able to do this.

Securitization. In the simplest terms, you're selling the future M&Es for upfront capital needs. This has been used by some carriers to finance the surplus strain. They were just selling off their future M&Es in the investment market. It was done for capital management, but I also see this as a hedge for possible revenue loss. If you've sold off a future M&E revenue, and if the market corrects, the investors are on the hook for it. Securitization is not a way to hedge the living benefits or death benefits.

Combination strategies. I think you're going to have to use many strategies. I don't think that just one strategy is going to work. Reinsurance probably isn't very attractive right now, but I think that will turn around at some point. I think you just have to find out what you're comfortable with. I don't think any one solution is the best.

Risk management. I can't emphasize enough that you really can't enter any of these strategies intelligently unless you understand your risks. What is your risk appetite? I was actually rather surprised recently when I encountered several corporate risk managers. The comment I got was, "I really don't know what senior management's appetite for risk is." You can't do anything until you understand that. It perplexed me, but I guess I never really thought about it until they said that to me.

You need to understand that the capital market prices things differently than we do as actuaries, and that has implications. If you're really looking for a capital market solution, then you really need to price this the way the capital markets do.

I think, in summary, the exposure is increasing. I think the market is going to continue to increase. I do think that in the short term, reinsurance will stay tight, but in the long term, this will attract new players to the market with new techniques.

Again, combination strategies might be the optimum situation. New techniques are being developed. There has been a proliferation in the last couple of years of increased embedded options in these products. I think we won't see that kind of proliferation in the future unless we come up with new techniques.

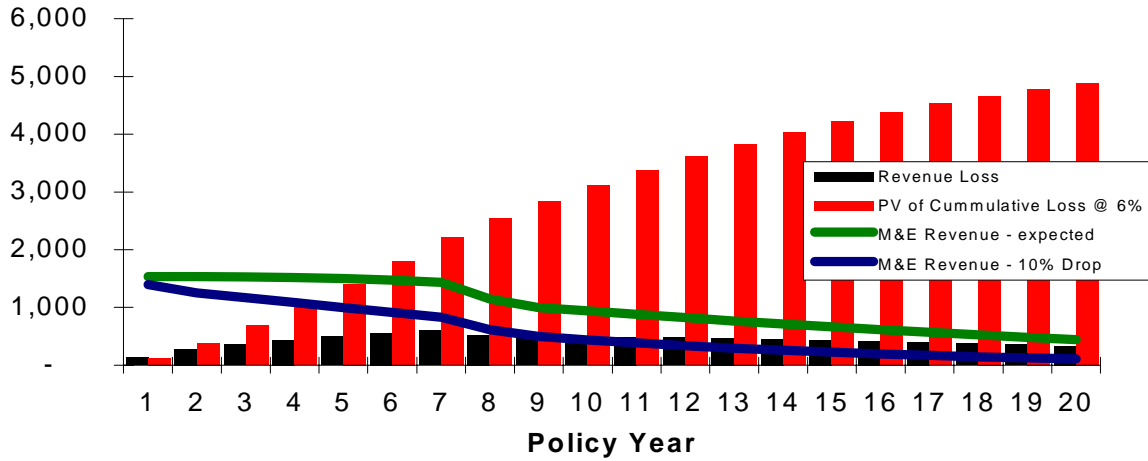
**MR. O’SULLIVAN:** These presentations were a cross sample of three different themes. I just want to reemphasize a couple of points people made. Number one is you can’t run away from risk. It’s really a question of going ahead and knowing what risk you’re taking and figuring out how to manage it. The second thing is it all starts with product development but you just can’t end it there. It’s an ongoing repetitive process.

I have a question that maybe people would like to comment on. Up to now, our regulatory scheme has been sort of like a cookbook. We go back to a new section in the cookbook, whenever the thing changes. I think the regulatory scheme is going to evolve into less of a cookbook thing as Jack had mentioned. Will we have a lot more centralized oversight? Will it be a regulatory oversight or a rating agency oversight or will the emphasis be on disclosure and what form it will take? Would anybody like to address that?

**MR. GIES:** My view is that we’ll have more oversight and less regulation. I think that involves more responsibility and more accountability for the professionals. The actuary is central. I’ve heard a lot of discussion about whether the actuary is the appropriate person to capture all of these risks. And I think the answer to that is, “If not the actuary, who else?” I think a properly trained and experienced actuary is as good a resource as any at the corporate level. By virtue of background and training, in many respects, it’s a superior resource. I see more responsibility being shifted from regulators to appointed actuaries. There is a professional structure, standards of practice, and higher levels of responsibility and accountability. There are a lot of issues to be dealt with, including the litigation aspects, but those are tactical not strategic hurdles. I believe that will be addressed, and we’ll see more involvement of the actuary in these processes as we go forward.

**MR. McNICHOLAS:** I think it’s quite possible that what the New York Insurance Department is now doing is more along those lines. It is going to be oversight. It’s putting more burden on the insurance companies. The extent of the information requested by the interrogatories does ask for a considerable amount of disclosure. As was pointed out to me, it also puts a big burden on the insurance departments because they now have to go through all of that information. I think oversight versus regulation is probably good.

**CHART 1**  
**Revenue Loss for 10% Market Drop**  
**\$100,000 Single Premium VA**



**CHART 2**  
**Distribution of Profits and Losses**

