# RECORD, Volume 29, No. 1*

Washington D.C. Spring Meeting
May 29–30, 2003

## Session 65PD
## Managing Risk Concentration in the Post-9/11 Environment

**Track:** Reinsurance

**Moderator:** PATRICK J. SHANNON
**Panelists:** GEORGE E. DAVIS†
TIM J. MCGRATH
PATRICK J. SHANNON

*Summary: The disastrous events of September 11, 2001 have focused the reinsurance community's attention on the subject of managing concentration of risk. A panel of experts discusses:*

- *Techniques for limiting exposure*
- *Impact on group and COLI/BOLI insurance*
- *Changes in the catastrophe reinsurance market*

**MR. PATRICK J. SHANNON:** I'm an actuary at Towers Perrin Re. I currently work on reinsurance placements, reinsurance structure analysis and general consulting. I used to be the group-pricing actuary for CIGNA Group Insurance, and prior to that I was the chief actuary of personal-accident reinsurance at CIGNA Re. Also speaking will be Tim McGrath. Tim is the executive director of corporate-owned life insurance (COLI) at ING Re. He's a fellow of the Society of Actuaries and a member of the American Academy of Actuaries. He has been involved in COLI since 1994 and currently manages ING Re's COLI and business-owned life insurance (BOLI) line of reinsurance. ING Re is the leader in the COLI/BOLI reinsurance market, currently reinsuring 20-plus writers of COLI and BOLI while actively working with the industry in regards to issues surrounding concentration of risk.

Also speaking will be George Davis. George is an actuarial consultant at AIR. He works with companies using catastrophe modeling in areas such as exposure analysis, reinsurance planning, pricing and underwriting. He has a strong background in insurance-company operations, including a wide variety of actuarial-



†Mr. George Davis, non a member of the sponsoring organizations, is a consultant for AIR.

field office and home-office-management experience. He was vice president for home-office-personal lines at One Beacon Insurance Group and executive vice president at CU Homeland Insurance Company. He was also chief actuary at Commercial Union Insurance. He is a fellow of the Casualty Actuarial Society (FCAS) and a member of the American Academy of Actuaries. George has a BA in math from Boston College and an MBA from Northeastern University's executive program.

My discussion items include the CAT market pre-9/11, the CAT market post-9/11, the insurers' reactions, alternative solutions, CAT modeling and what you should do to manage risk.

Prior to 9/11, premiums were underpriced and irrational. People were just lowering rates to get business. Personal accident underwriters were pulling numbers out of the air in order to get lead terms and a big line. There was no analysis of incidence rates and no attempt in any way to project expected claims. It was just, "throw out a line and try to get it." Sometimes we would just take 10% off the line that was offered in the prior year.

It was a very managing-general-underwriter (MGU)-driven market. MGUs did not take risks. They either had a pool behind them or an issuing carrier—a reinsurer or an insurance company. But they would just collect fees and not take any risk.

Professional reinsurers were also players in this market. A lot of retrocessionaires were in Lloyds of London and throughout the rest of the world. Then you had the special pooled risk administrators (SPRA) pool. At the time, reinsurance was over capacity. There was $1 billion per occurrence worldwide. Individual reinsurers could offer $100 million per occurrence. When I worked at CIGNA Re, we had $100 million per occurrence. You tried to get your $100 million out there, so if someone was looking to buy $250 or $249 million excess of $1 million, you would put out your lead terms. But you would also follow anybody else's lead terms and try to use as much of your $100 million as possible in that marketplace. The further up you could get, the more willing you were to throw it around. That was just common industry practice. It really didn't matter, because when we at CIGNA Re and other companies were putting out that $100 million, it really wasn't our $100 million because we were just going to keep $1 million or so. Everybody was relying on the retrocession, and everybody was creating a spiral.

As for terms and conditions, there were high limits and low retentions. One example is $100 million excess $1 million. In some programs, there could have been up to $700 million and you were just keeping $1 million on your own. There were also free and unlimited reinstatements and few exclusions. Some pro sports teams or underground mines, things like that, might have been excluded. Terrorism wasn't covered explicitly, but it wasn't an exclusion, so it was covered.

As I said earlier, there was no loss experience. There were a few aircraft crashes,

but there were no big losers. There was the Oklahoma City bombing, but people felt that was an isolated incident. No insurance company was really hurt by that occurrence, so it rolled along and everything was fine. Of course, a lot of the big insurance carriers, if they did have big programs, would have some kind of concentration when an airplane did go down. The loss could be $4 or $5 million. There were a couple of losses in the low teens, but there wasn't anything in the hundreds of millions. Everybody was playing fast and loose with other people's money.

Exposure data really wasn't tracked beyond state level. People cared about California. Some people cared about Japanese CAT exposure, especially after the Kobe earthquake, but other than that, no one really even looked at where exposures were.

In summation, it was a product with no credible experience, so it was a commodity. The low price won, and people were willing to compete with the low price. There was so much capacity that people kept having to lower prices to get any business. Given that they were previously in a loss-free environment, people thought of it as free money. You couldn't write enough life CAT business prior to 9/11. It was written by managing general underwriters (MGUs), and MGUs were all over the place. Some MGU's were supported by the same people. If the same people supported them, each MGU would put out $50 million on an occurrence and the company behind them would have $100 million. They really didn't even know about it because no one was tracking anything. There was heavy reliance on retrocession for reinsurance capacity. It was almost that if you wanted to be a reinsurer or MGU, all you really needed to do was find capacity. Some people would find reinsurance first and then find an issuing carrier to support them. They'd hang a shingle, and they'd be in business very quickly and easily. Then 9/11 occurred.

When 9/11 occurred, the first thing that happened is that no one even knew their exposures. Everybody was scrambling to find out what kind of business they had and how many claims they could have. Group insurance carriers were all doing the same thing—trying to find out how many people they had in that building and whether or not they had any people in those planes. Then they realized that no one was tracking exposures, and they had all this business. There were all of these potential losses that no one even worried about before, and now it was a crisis. The initial response, and still the strongest response, was irrational pricing going the other way. I describe it as the pendulum that didn't swing back. It went all the way around the top and started back on the other side, so you went from irrational underpricing to irrational overpricing.

Paybacks are now one in 10 years. When we would talk to some reinsurers, the response would be: how can you justify that? Well, we can, and we want payback. They wanted the losses paid back, but then, at the same time, they cut back the exposure. Some of the initial pricing, excluding terrorism, would be assuming that there would be 20 200-plus-life plane crashes a year, when, on average, there had

been about 1.5 over the last 20 years. That's how far they'd go. When you'd discuss it, you'd talk about asking for payback to support this risk, but you're no longer pricing for the risk where you had the claim. You're pricing for a new risk, where you really do have experience, and there really is a crash or other type of incident once or twice a year.

MGUs lost "paper." Most of their retrocession support disappeared. The insurance companies and pool supporters finally understood that they were in the dark. This MGU was in a black box that was taking no risk. Some professional reinsurers or reinsurance companies dropped out of the market; others have limited their capacity and are changing the way they do business. Retrocession capacity has greatly diminished. When we spoke with the people in London, they realized what happened on 9/11 was that they were not only insuring the risk, but they were the backbone to keep the American insurance companies in business. If it weren't for retrocession, insurance companies could have gone out of business because of 9/11, but really nothing happened to the insurance companies. So retrocession capacity is limited; there are very few entrants as far as retrocession goes. Finding people in Australia and other places doesn't really happen as much as it used to.

There have been minimal changes with SPRA. In the new environment, a lot of people are looking at SPRA to see if they can take advantage of it. Should they put their New York business in it, or should they try to get their large cases or large exposures in that? Because SPRA is a true pool. If you can skew your exposures to be riskier than the others, then you can try to take advantage of that. A lot of companies are trying to do that. Some of the smaller companies and Midwest companies are realizing that, and they're dropping out.

The capacity has greatly diminished. Now you can get $200-$250 million. You can't get that much with terrorism, and you certainly can't get that much including nuclear/chemical/biological/radiological (NCBR). There are lower limits and higher retentions. Common coverages might be $50 million excess of $50 million, or $75 million excess of $25 million. Gone are the days where people are buying $19.9 million excess of $100,000 or $99 million excess of $1 million. Reinstatements, which used to be free and unlimited, are now limited to one, and it's fully paid. Terrorism is explicitly excluded, but there is some market out there including terrorism and NCBR. In terms of loss experience, we now have one significant loss, and everybody is concerned about how that might happen again. We'll discuss the modeling and prediction of that, but there still aren't a lot of losses in the experience.

One of the insurers' reactions is to start gathering data and monitoring risk, in order to know their risk internally, and to buy reinsurance. Insurers are retaining more risk. The increase is there as expected. You go from retaining $100,000 to retaining $10 million. Some people are retaining $50 million. Life warranty is usually retaining $100,000 per risk; for 10 deaths it would be $1 million. Now they're going to $10 million and you need 100 deaths on that accident. So it's

become a greater concentration in order for an individual insurer to have a collection. For the most part, insurers are retaining the NCBR risk. People are looking for solutions, but there really isn't a cheap solution that's providing good value right now.

Some insurers retain all the risk. As I said, you can get prices, so there's not unlimited capacity. At certain points, people are starting to pick where they feel good. Some people are buying it just to be able to tell the analyst that they do have CAT cover, but the analyst doesn't follow up by asking if you have CAT cover in excess of $10 million. Where does the CAT cover kick in? A lot of people just have CAT cover.

Insurers are retaining the risk. The increased cost of CAT isn't being passed on to the consumers at all, especially in the group market or, I believe, in the individual market as well. In the group-life market it's more competitive than ever. Even though the increased cost of insurance, or the increased cost of the risk to retain it, has gone up dramatically given the new information, it is not being passed along to the consumer at all. People are still looking for alternative solutions.

You can still get the traditional CAT on a treaty basis or on a facultative basis. It's expensive and it can have exclusions. Some people are trying to buy facultative, so depending on the size of your company and what you write, you might manage your exposures and then buy CAT coverage on specific risks where you really do understand the concentrations.

Another alternative solution is financial insurance. All you're really doing is retaining the risk, and you're just smoothing out the losses. That's really self-insured, but it's a different way of managing your earnings. Some companies are looking into securitization as an alternative, but given the lack of incidence, it's extremely hard to price. Aggregate stop loss is a possibility. By looking at your whole block, you're trying to cut out some of the volatility. Reinsurers could give you a better deal by doing that because you might have good experience in your other lines of business. The individual CAT is going to kill your accident and your life operation, but if you have different operations that really aren't impacted by that, you can combine them with an aggregate stop loss and smooth things out.

There is a market for quota-share reinsurance—accidental death (AD) carve-outs. The capacity could be $20 to $40 million per occurrence. This involves looking at all of your life exposures and doing a quota share on the accidental piece. It could be on a life policy, a stand-alone accident policy or on a rider on a life policy. It is coverage for any accident that causes a death. To price it, you look at the block of deaths on the total portfolio that caused a payment, and then you do a quota-share. For a smaller company, that's a really good option because you can get a big line—$20 to $40 million of terrorism—and everything is included. They follow the fortunes for that cover.

Pooling of risks is another alternative. The SPRA pool is not a managed pool.

Everybody gets charged based on their exposures. A lot of companies, if they have high concentrations—metropolitan areas, big buildings, East Coast or California—believe that that it's a good buy for them and a good place to be. But the smaller Midwest companies, as I said earlier, aren't doing it. Even on a lower layer where it's not going to be a tourism-type event, if you're a smaller company and a plane goes down with 100 people, the chances of a small company having five people on that plane are certainly not as high as someone who has a large block of business. The bigger companies are better off having that even for the random events, because they're likely to have more CAT losses. With a SPRA where they pass them at a low level, small companies end up paying the large company claims. If you're a large company, a SPRA is something to consider.

Some people are looking at "buying cooperatives" or pooled exposures. One of the ways that came about is that reinsurers price on a rate-on-line basis, so it's a capacity charge. If I have company "A," and they're a small company, let's say it's going to cost me $5 rate-on-line, so $5 for every $100 of limit I buy. Company "B" is also $5 per $100. If company A buys company B, and I only need the $100 of coverage, I'm not going to pay $10. I'm going to pay somewhere between $5 and $10. If you can manage your exposures so you really don't need more than the $100 (maybe you only need $150), they're probably only going to pay $7.50 for $150 instead of $10. That's one of the things that has started. It has to be a managed pool and exposures have to be monitored so that if there are duplicates, there will be enough coverage when coverages start stacking up in certain geographical areas.

A final alternative solution is no catastrophe protection. There are other considerations, such as the government backstop Terrorism Risk Insurance Act (TRIA). One of the problems with that on the property and casualty (P&C) side was that when it was passed, they had to do a study for life. They had to answer a couple of questions, and the first question being, was pricing dramatically affected? The answer to that was "yes." The second question was, was the price to the consumer affected? The answer to that was "no." So, it's going to be very hard to convince the government to step in when the consumer isn't being impacted at all.

The last thing is per life. You can change the way you buy reinsurance, lowering your retention, thus reducing the need for CAT insurance. That is something to consider, but it's a zero-sum game. The reinsurers understand what's going on there, so they'd have to add a bigger CAT risk for themselves in that lower layer.

The next topic is CAT modeling. George is going to speak more on this, so I'll be brief. On the life side we're seeing modeling exposure, not loss experience. There isn't loss experience out there. It's very hard to project future losses, but it's really coming in handy to map exposure and see where the concentrations are.

The property CAT models have been in existence for years. They have a lot of experience in developing the model, and they also have a lot of experience for

assumptions underlying the model. Some of the people that we deal with are RMS, AIR and EQECAT. One of the key things in the modeling is it's always going to be based on your assumptions. A lot of assumptions from what I've been told have been based on the Delphi method. You're sampling experts and you're trying to project where the next loss is going to be and the impact it's going to have, but it really is a person's opinion. I know the last time we were involved with a seminar, people were talking about all the different things that could happen, the different possibilities and what's on high alert. The next thing we heard from the state department was that gas stations were a target, and I don't think anybody was modeling gas stations as the next target and worrying about their life concentrations at gas stations.

Chart 1 is a national-exposure map by county. As you can see, I would say the majority of the companies other than regional companies are going to fall into this. High Northeast exposure exists. There is also high concentration in the capital of almost every state and in southern California. We also will develop models to get the number of people, or the volume within a certain radius of different buildings, so the companies we're dealing with can see how much exposure they have. We've put together a couple of special reinsurance programs where, for a certain state's area, even for building locations, that exposure is covered, and that's all that's covered. The company decided that the majority of the rest that they were concerned about was in this one location. They didn't want to pay a certain rate-on-line for the whole block of business, so we narrowed it down to where their exposure was, and that's where we concentrated to get a cover.

In summary, rates are going to remain high for a while, and there's nothing we can do about that. New capacity isn't jumping into the market. You did get some Bermuda capacity, which is a lot of P&C companies, but I would classify them as opportunists that are looking for a sale thinking they can get a high rate. Insurers are going to continue to retain a lot of risk. I think that one of the good things that will come out of this is that the data is going to be a lot better coming in to manage the risk. People refused to bring the data in before because it wasn't important. Now they say you need it. As a result, insurance companies in general will be able to manage the risk that they weren't able to manage in the past.

Modeling is going to continue to develop. I think the P&C area has seen that nothing really existed nearly a decade ago and now what they have is just outstanding. Reinsurers really feel comfortable rating risk off these models that are being run out of P&C operations.

Insurers should continue to gather, model and monitor concentrations. Insurers should really think about what perils affect their companies. I think some people are forgetting that airplane crashes, fires and mining explosions really do happen. They are important in either managing your earnings, or, if you're a smaller company, they could have a major impact on your surplus. You have to think about the different potential loss scenarios that are out there. I think that given what

happened on 9/11, anything is a possibility now. I think you need to see that so that when you're managing your business, you understand what could happen.

Insurers should also determine the loss/pain threshold for their companies. Some people now are looking at what their surplus position is. One of the companies would say that their surplus position is $100 million, and they'd feel comfortable if it went down to $80 million. But after it goes down to $80 million, they don't want to go to management and ask for additional capital. That's how they pick their retention. This is when they're going to get called on the carpet in corporate, so that's how they determine the level. But for other companies that are dealing with month-to-month earnings or quarterly earnings analyst meetings, you have to be aware there are a lot of issues besides staying in business. You still have to manage your earnings and that kind of thing.

Insurance companies should buy reinsurance that makes sense. A lot of people used to just buy whatever they had before, and you just can't do that. Some people that bought whatever they could after 9/11, and a year later they're regretting the buy. They overpaid for insurance that provided little to no value.

**MR. TIM J. MCGRATH:** I'm going to look at it from a product-line perspective, and the product line is COLI. I'll be looking at CAT markets from a COLI perspective, pre- versus post-9/11. Before 9/11, were rating agencies or chief financial officers (CFOs) concerned about concentration risk? It was rare. After 9/11, I'm sure most of you in here that have responsibilities on COLI lines got calls from your CFOs asking what exposures your companies have. The same thing goes for all lines of business.

Few, if any, companies had established location retentions prior to 9/11. After 9/11, about half the COLI writers have. If they're in the jumbo market, then it's a higher percentage. The majority of reinsurers in the COLI market and retrocessionaires have also established location retentions.

Before 9/11, working address was a non-issue. It got laughed off. After 9/11, for a short period of time, it did get laughed off, but that's come a long way. It's essentially mandatory in larger cases now, and, essentially, the more information the better the theme. From a CAT-cover perspective, Pat gave you much more than detail. Essentially, the key point there from a COLI perspective is that it's not a backstop any more—you have to manage the risk. On the reinsurance front from the mortality risk and premium side, it was competitive terms before 9/11. That's remained the same, but the piece that has changed is the information needed to manage the risk. That is the key to maintaining the optimal amount of capacity and the reinsurance terms.

Chart 2 is a very back-of-the-envelope, simple example as far as establishing a location-limit retention. It is being further refined by companies as time moves on. You have to establish the maximum loss that you're willing to accept. In this

example, it's $50 million per location. Definition of location can change, and I'll get into that in a minute. Looking at this example, I see an expected loss rate of 70%. You're going to have survivors. You're going to have people that are out of the office for various reasons. In this example, I set the CAT recovery to nothing, resulting in a location retention of $70 million. The next phase of that would be taking it into much more detail in the modeling phase, which George is going to get into and really refine your process.

You're going to also want to consider other lines of business with simultaneous risk. Are you going to have separate retentions or aggregate retentions? It's going to be key to communicate and to have an owner within your organization manage that process for all lines of business. Your retention limits may vary between city, suburb and rural. You may look at buildings differently, whether they are high-rise or a campus-type setting. If they're a campus, how far apart are those buildings? On the zip code side you may look at a range from five digits to nine digits, as far as analyzing your block of business.

In the COLI reinsurance market, similar to the traditional life reinsurance market, approximately 60% of the mortality risk is reinsured. This means that, just like in a traditional life reinsurance market, direct writers, reinsurers and retrocessionaires really have to work together in sharing information. That will allow for the maximum amount of capacity to be put together on these cases and also to keep the pricing where it is.

As far as establishing the information chain, it all starts at the top with the direct carrier. Working and educating with the producers up front is key. Shortly after 9/11, the initial response was, "We can't ask the producers for that." That quickly changed as they got more pressure on the issue both internally and from reinsurers. Where producers are educated on the issues and where the producer presents that up front in the sale, the process becomes much more efficient and the information is gathered pretty effectively. In the larger cases, you need the work address of all participants. The common theme is the more information, the better. A fallback from the complete work address is five-digit zip code. Again, the larger the case, the more important the information is.

There are the same issues on the reinsurer side, but they're magnified to a degree. The reinsurer can receive the same case from multiple sources, and it's even more important for the reinsurers to be able to track that risk. Most reinsurers have set a location-type retention limit in the $50- to $100-million range. As I said, pricing hasn't changed. The big challenge now is on the reporting side. The first step was getting the issues out there and getting the producers to gather the information. Now it's actually come to the point of transferring that information from the direct writer to the reinsurer, and, in turn, to the retrocessionaire, if applicable. That is something that, in all cases, a corporation name or some type of identifier is required. It's being worked on with TAI, which is the predominant life reinsurance administration provider. I had a similar presentation a couple of weeks back at their

annual meeting in Chicago, and they are currently working on adding particular fields to address this issue. They're being very cooperative in that way. There could be a field for the corporation where it could show its corporation one, two or three. Then there would be a separate feed that would translate that one, two or three into the actual name of ABC Corporation. In larger cases, the working address is something that is a challenge to get into administrative feeds. That's a separate mapping that would need to tie back to the primary feed. Right now, it's a one-time request at issue. Things change. People move around. That's not expected to be tracked right now, but we do have one client that has been successful in going back to their producers on their jumbo cases once a year. They have successfully gone back to the HR area and received updated working address information on the census. That could be a trend that we see going forward.

In experience-rated cases, there historically wasn't much reinsurance on COLI cases for experience rating. That has changed, because if there were a catastrophe, the experience-rating mechanism may not work to the extent it was designed for. In-force activity is something that's increased as well. After 9/11, people stepped back, and CFOs asked what their exposure was. A lot of people said they were working on it, and they identified cases that they had concerns with as far as their concentration. They reinsured, and, correspondingly, reinsurers did the same thing and retroceded some risk as well.

Chart 3 is a simple example of how more information produces a better result. I have a case where the COLI case is sent to the reinsurers. This would be a typical pre-9/11 scenario. The direct writers retain 20% of case, so $100 million at risk. The reinsurers establish that location retentions are $100 million. In this scenario, they have to assume the worst—that all the risks are located in one building. This could be a possibility if COLI is typically the executive group; they could have their executive headquarters. You have a scenario where nobody is happy. The producers have the biggest frown, and there is probably yelling as well..

Chart 4 is a scenario where you have additional information. What does it mean? You have a downtown location that shows that you have 100 lives with 40% of the risk in COLItown. The remainder of the risk lies 20 miles away in two separate locations that are 1,000 feet apart. In this case, reinsurers were able to take all the risk, and everybody's happy. Some people may look at that and ask, "Are we getting to a world where we're going to have to draw and take pictures and all this stuff?" It's not getting to that place. We did have a case late last year. It was a jumbo case. It was over $1 billion at risk in a five-building campus setting, and the initial response was they couldn't line up what they were looking for. The direct writer was aware of the issues and immediately worked with the producer. The corporation submitted a schematic overhead shot of the office, and they listed how many lives were in each building and how far apart the buildings were. The risks were spread out in this case. The capacity was lined up just like that. So for those jumbo cases, it's true that the more information, the better.
Last October, I did a quick survey for a presentation that was going to be done at

the national COLI directors' meeting. Seventeen of the top COLI writers responded regarding what they were doing relative to concentration risk. At that time, seven had established location retention limits. All of those were by building with a $50-$200 million range. Two broke it down further by campus, and another two broke it further by zip code. If we refreshed this survey and looked at it in May 2003, I think more than 10 companies would have established that. I think that in a short time everybody is going to have further requirements. At that time, six companies had developed essentially a spreadsheet as their database to track the risk.

From ING Re's perspective at 9/11, our situation was that we were a sizable player in both the COLI and the group-life-reinsurance markets. There were similar issues, with a fair bit of cross-over risk. You had a significant need to effectively manage that risk. So the first step was to establish the location retention and simultaneously look at the in-force block to find if there were cases that caused immediate concern that would require retrocession. We did identify a few of those. At the same time, we were working with clients and the industry on educating and communicating what the issues were. That took a fair bit of time, but it turned around pretty quickly, to a point where now everybody understands the issues. It's come a long way, but it still has a way to go. Treaties have been modified to include that, from a case-size perspective (for larger, jumbo case) location information is required, as well as a facultative trigger so that cases beyond a certain size would require facultative approval as opposed to automatic. On the administrative front, I talked briefly about that as far as we would require the corporation identifiers. We also need to step back and look at how we are going to manage this risk on a going-forward basis.

We are just wrapping up development of a database that will track the demographic details of the groups and include as much information that we have as possible. It could be as simple as the name of the corporation; it could be as complete as the complete address for all lives as far as working address. From that, it has the ability to track the term-year exposures based on landmarks, zip codes, earthquake zones, metro areas, etc. This would then come into the next phase of getting that information and then turning it over to the modeling side to look at different scenarios and see what your exposures are. You're going to look at the ability to establish location retentions that vary by city, building, zip code, state, etc., and look at something that will really be a tool to help manage risk.

To wrap up, the key for the whole thing is information and communication. From the COLI side, it's come a long way since 9/11. Now the challenges are on the administration side and getting information transferred. There are a lot of hurdles ahead, but I think we've made a lot of progress, and it can be effective in managing this going forward.

**MR. GEORGE E. DAVIS:** Pat gave a good reading on how the marketplace has been operating and reacting over time. Tim addressed how that information gets used in the modeling. Of course, that sort of becomes the explanation as to why an

FCAS is addressing an SOA audience. As Pat said, the catastrophe modeling has been used in the P&C industry for a long time. The hurricane model, which was the first one brought to the market, began development as early as 1980. AIR, which used to be called Applied Insurance Research, was formed in 1987 after that hurricane model had been more developed and was starting to be used. Shortly after that, it broadened out to include earthquake modeling and, not too long after that it started to deal with severe thunderstorm peril. We had plenty of examples of severe thunderstorm perils earlier this month—the combination of straight-line-wind events, tornadoes and hailstorms. It now has developed to a point where basically all of the reinsurers use our model. The reinsurance brokers all use the models.

A broker who was very knowledgeable about our modeling came to us after 9/11 and said they had the same kind of issues in the life-insurance area. What could they do to apply the models in that area? Indeed, there has been a remarkable response and call for doing that sort of thing. That's kind of what led me here today.

I had quite a challenge figuring out, in preparation for this, what material to present. Obviously, I made some choices about that. I don't mind if any of you interject with questions. I'm happier to talk about what you want to talk about more than what I want to talk about.

Obviously, it was the World Trade Center tragedy that sparked a lot of the activity that we're talking about. There was a tremendous number of fatalities, as well as losses across all lines of business. A lot of companies were surprised to find that all the different sources from which they had exposure were affected. Obviously it wasn't a single building, but the scale of that affected a wider swathe. That's the trigger for a lot of what we've done here.

Earthquake peril obviously was recognized for a long time, but not really addressed from a life-insurance point of view. It seems that once we start thinking about it and thinking about the peril of terrorism, then we think that there's the earthquake possibility too. While Northridge was huge in terms of property loss, it wasn't so big in terms of human loss. Part of the reason for that is that it was a night-time occurrence. We've done some modeling on that just from the workers' compensation point of view, recognizing that if that were a daytime event, it would have been more significant (Table 1). We've also looked back at the San Francisco earthquake of 1906 and how significant that would be if that were to occur today as a daytime event with the current exposures (Table 2). This is what is getting people's attention. From an earthquake point of view, it isn't just California, although that's the one we think about most of the time. The New Madrid area in Missouri actually was the source of the largest earthquake in history in the continental United States. It has a considerably longer return period than many of the California locations, but if it occurred today, there would be far more damage from that than we have seen and can anticipate in the California areas. Part of that

has to do with how California construction has responded to the expectation of earthquake events, whereas the central United States has not.

Table 1

| Injury Severity | Simulated Claims | Simulated Loss |
|---|---|---|
| | | |
| Minor | 8,220 | 6,633,540 |
| Moderate | 1,633 | 134,647,388 |
| Life Threatening | 433 | 326,292,208 |
| Fatality | 433 | 66,890,163 |
| Total | 10,719 | 534,463,299 |

Table 2

| Injury Severity | Simulated Claims | Simulated Loss |
|---|---|---|
| | | |
| Minor | 33,074 | 26,686,128 |
| Moderate | 9,420 | 776,720,000 |
| Life Threatening | 3,253 | 2,451,074,048 |
| Fatality | 3,253 | 502,471,323 |
| Total | 49,000 | 3,756,951,408 |

I'll get back to the terrorism peril. We have, as part of our work, created a database identifying over 300,000 locations that we see as being potential terrorist targets. The more likely potential terrorist targets obviously do not include all the gas stations in the country, but there is dispersion. Basically every state has some of these locations, and then, of course, there are concentrations of the target locations also. It is compiled with the input of a panel of experts, and those experts collectively have many years of experience in dealing with terrorist organizations, as anti-terrorist work is basically what their background is. That's the input that we used in processing that through the Delphi approach to sift that out and make it sensible and consistent.

With the terrorism risk, we have both reinsurers and primary companies that are trying to analyze and to get a handle on things in ways that they haven't in the past. I'll talk about what I think of as three levels of analysis. The first level is exposure concentration analysis. Once you have a handle on that, the second level is looking at what could happen—the scenarios, or, if you will, a deterministic analysis. Then the third level would be taking it to probabilistic analysis, which can give you a different kind of perspective on the risk that you're facing. It's also important to look at things across lines of business, again, as it was realized as part of the World Trade Center event. We even have companies that are writing both life and P&C exposures. They want to know what the impact can be to their corporations out of an event, recognizing that part of that impact will be in their life portfolio, and part will be in their property portfolio.

Tim talked about needing the data, and, indeed, there are requirements for this. Obviously you need to know the number of people insured, but you also have to know where they are located. We're very much focused on the impact, the losses and the casualties as driven by the damage to buildings, so it's important to know about the buildings themselves and the types of construction. Building age is a factor because of different building standards. The number of floors in the buildings is an important consideration. If you're talking about groups of lives, the time of day and where those people are at the time of day become considerations that we have to work with. Obviously, the benefit levels are another dimension.

Just from the exposure point of view, and Pat showed some of this also, there is an awful lot of attention now to understanding where the exposure is. Various tools are rapidly being deployed to get a handle on exposure. One tool starting looks at a state level, then breaks it down to zip code, and then it even further. Parts of those tools also incorporate rules that a company may want to apply. Tim has described some of the rules that his company is implementing now. There are rules that can be defined in terms of zip codes or distances from a potential terrorist target. Those can be defined in terms of number of lives or amounts of insurance exposure. There are a number of ways for those to be defined and for those rules to be implemented.

Manhattan is obviously at the top of the charts as far as the terrorism risk. That's why it's often seen within examples of these kinds of analyses. This is one understanding where the concentrations of employees are, and also then looking at it in relation to where those landmark locations are.

Again, the second level is the deterministic or scenario analysis. We did an analysis looking at the total industry and a particular scenario of a truck bomb. We looked at all of the buildings that were in the proximity to where that bomb was presumed to detonate. We drew from a database that we have access to with commercial building information. These are the kinds of scenarios you don't really want to see the outcome of, but they're pretty significant. Then there are potential terrorist targets at various locations. We're looking at a scenario for such an event, a subset of the lives that are exposed. Therefore, we can infer from that what kinds of casualties can be anticipated.

While the property risks historically have been the ones that have been modeled for these various perils, as I mentioned earlier, that's now been extended. The terrorism peril has been added, and the way that those perils are applied has also changed. They're being applied now to workers' compensation exposures, as well as life, and accident and disability exposures.

Similar to the earthquake events, we have constructed the terrorism events around that database of potential terrorist targets. We've constructed expectations based upon looking at specific terrorist organizations. We are primarily looking at terrorist

organizations, not what one company calls just the "kooks" out there. There are a shocking number of terrorist organizations that are organized and functioning. We are dealing with both international and domestic terrorist organizations. That's become very important in the P&C area because of the language of TRIA, but we're able to look at both parts of that. They include the Islamic organizations, but there are any number of other international organizations that are considered also. Around each organization, probabilities are calculated based upon the knowledge of that organization and what their objectives are, what their MO is and what their likelihood is of trying an event. The likelihood of their succeeding in carrying off an event also becomes an application of the probabilities of the various types of attack and the probability of those attacks having an impact, so there is a big set of probabilities. We often get asked whether we had to change our probabilities based upon what happened last week—if the color level has changed from yellow to orange. We do stay in touch and continue to review the information and the situation. We do not, we have found, need to change the underlying probabilities. The underlying probabilities have been established based upon the expert opinion looking at what can be expected over a longer period of time. Those don't have the volatility that you might imagine.

Taking those potential events and probabilities of the events, we then turn to the engineering part of it. What can that kind of an attack generate in terms of loss to a building? That is actually a very well developed science. It's been studied at least since the 1940s. There's a great amount of Defense Department research that's been done. Because of the role that we're playing in the insurance industry, we have been granted access to and use of some of the models from the defense agencies, including both the conventional weapons and NCBR. We have damage models that are related to both conventional and non-conventional weapons. We translate the event into the damage to the buildings, and then we pull out the research to translate the damage to the building into the damage to people in those buildings. How many employees do we expect are on the site of those buildings at the time? We factor in the insurance coverage parameters of determining the cost of those injuries, and that is what comes together to be the insured loss calculation.

The injury levels are worked in different layers of severity. There are probability distributions around the severity of the injury. With application through that process, we come to distributions on the counts of injury and the cost of the injury. We end up out of the probabilistic analysis with the distributions, again, the total injuries in terms of number of people and the distribution in terms of the dollars of loss.

Both Tim and Pat talked about how cheap and available the reinsurance was before 9/11. The swing of the pendulum after 9/11 resulted in prices through the roof, if you could get the coverage at all. I agree with Tim's message earlier. The point here is that the more information you can provide, the better. We have been told by some of the intermediaries that we're working with that this can make a difference. For example, the $25 million that the price goes to, by providing better

data and by applying the modeling, the reinsurer can be more comfortable with what exposure they have. It's not just the understanding of where the exposure is. This was illustrated by the picture that Tim displayed where some of the exposures were 20y miles away, whereas other exposures were separated by just 1,000 feet. This is additional information based upon the full probability modeling of those exposures.

I'd like to come back to discussing data, because the data is so important. We find that often the company can state the number of people they have insured, and they're getting better at knowing where they are. That actually has been a problem too. Obviously, knowing about the benefits related to each company is also important. This other information is necessary to the analysis, and if the company has that information, we will use that specific information. But if that other information is not available, we've constructed and used a database of exposures for many years. We can then use our default assumptions because we know the distribution of construction type and density of building. Density is a very important factor to this peril, as well as height of buildings. We have information about that, even down to different industries if you know what industry your insured group of employees is in. Within a state, we know where those industries are located, because they're not going to be distributed throughout the state. That wouldn't make a whole lot of sense. We are often drawing upon those kinds of default assumptions.

Yes, things have changed hugely. There is new data being expected by reinsurers, and it's becoming available. It certainly is a challenge. There's a real parallel to what happened in the P&C area. Even though the hurricane models themselves were pretty well developed by 1987, they were not widely used at that time. The trigger for that was Hurricane Andrew in 1992. The same thing happened—companies were realizing they didn't really know where their exposure was, and they didn't have that address information. Very quickly after that, companies drastically improved the quality of address information that they had with respect to the property exposures. You might say it's strange that they didn't, at the same time, figure that out for workers' compensation. I think it was the fact that their only reporting requirements for workers' compensation were what state it was in, what classification it had and what the payroll was. That was the extent of the information even up to 2001. I think you have similar kinds of things happening with life insurance. The scramble is on now to get better information, and there are new techniques that are being applied. The more that the data is improved, the better it will be. The other part of the message is that lack of information carries a high price. That's what creates the motivation now. It's worthwhile to get that data. Things are changing quickly, both with reinsurers and with primary companies. That's the story in a nutshell.

**FROM THE FLOOR:** This question is for Tim. You were talking about case-by-case reinsurance for COLI, and I'm wondering how that is structured. Is it quota share or CAT cover on that case? If it is CAT cover, how are reinsurers and others pricing

that?

**MR. MCGRATH:** The case-by-case deals would be quota share. Most of the COLI reinsurance is quota share to begin with, so it would be a quota-share structure. The retained-quota-share percentage would be up to the ceding company's determination based on their comfort level and what they can line up in the reinsurance market.

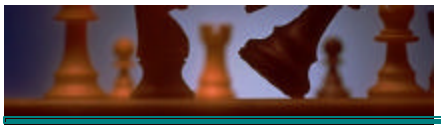
**MR. ALLEN R. PIERCE:** Most of the discussion, particularly about the CAT coverages, centered on terrorist events, earthquakes and those sorts of things. I wonder if anyone on the panel would be able to comment on another risk that some people are beginning to be concerned about, particularly with the SARS situation. I'm referring to protection or coverage for epidemic types of scenarios, maybe like a 1919-flu-type scenario.

**MR. DAVIS:** The closest that I would come to that is dealing with the biological part of NCBR. We've been looking at some aspects of that, but not at medical epidemics like you're mentioning.

**MR. PIERCE:** Is the availability from a reinsurance standpoint for that type of coverage difficult to find as well?

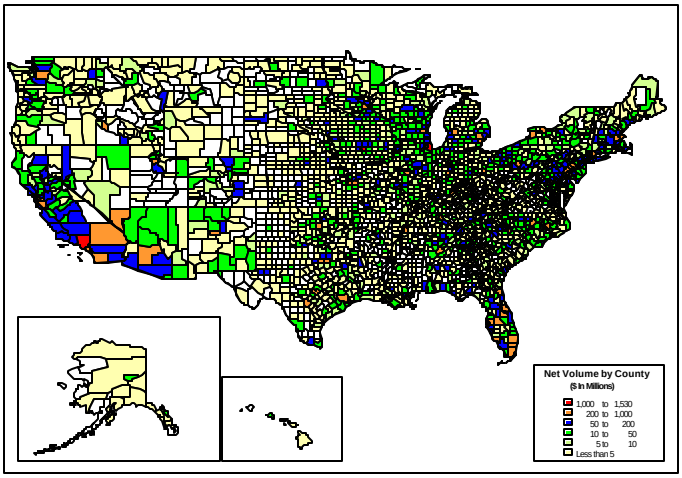
**MR. SHANNON:** To answer your first question, different people have looked at procuring that type of coverage for different things. We spoke to some people about the West Nile virus. One of the problems with that is the open-endedness of the reinsurance arrangement. When did you get that type of disease and when are you going to die from that disease? Is it going to be risk attaching or losses occurring? People aren't scared yet that the size of the event is going to be enough that they're desperately searching for reinsurance, and the reinsurers, given the complexity of the reinsurance agreement and terms, aren't really pushing it.

Chart 1



## Catastrophe Modeling

National Exposure Mapping by County




8

Chart 2

## Location Limit Retention: Setting

- Max loss that line of business/company will tolerate
- Net of mortality risk reinsurance
- May or may not be net of cat cover
- Example
  - a. Max Location Loss = 50MM
  - b. Expected Loss Rate = 70%
  - c. Cat Recovery = none
  - d. Location Retention = (a-c)/b = 50/70% = 70MM

ING Re

Chart 3

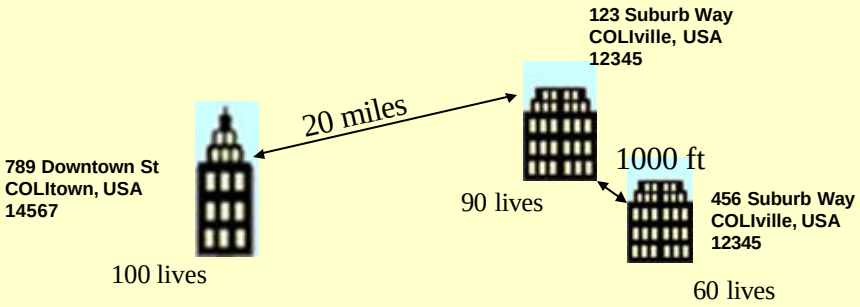
## Reinsurance Capacity: More Info = More Capacity

- Info to reinsurers:
  - 250 lives @ 2MM NAR/life
  - located in 3 buildings (unknown distribution/location)
- Direct writer retains:
  - 100MM (20% of case)
- Two reinsurers:
  - 100MM each (location retention/assume all in one)
- RESULT: Corporation, producer and carrier frustrated as struggle to put capacity together.

ING Re

Chart 4

## Reinsurance Capacity: Additional Info




Result: Capacity lined up – all parties happy!

ING Re