

**1996 VALUATION ACTUARY
SYMPOSIUM PROCEEDINGS**

SESSION 20

**Quantification of C-3 Risk (vs. Risk-Based Capital):
Developing a Methodology/Table**

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**QUANTIFICATION OF C-3 RISK (vs. RISK-BASED CAPITAL):
DEVELOPING A METHODOLOGY/TABLE**

MR. MICHAEL L. ZURCHER: I'm from Lincoln National Corporation, and I'm the moderator. Our session will be different in a number of ways from your typical panel, and I hope these differences will make this session more interesting and beneficial for you. We have, perhaps, the largest panel in symposium history. Mike Smith, also from Lincoln National, is going to be addressing the original topic that was described in the program -- developing an approach to quantifying C-3 risk.

We've added a second topic to the program that the rest of our panel will be discussing. The National Association of Insurance Commissioners (NAIC), through the Academy's Life Risk-Based Capital Task Force, is exploring ways to improve the C-3 component of the NAIC RBC formula. As a member of that task force, I'll be providing you a high level overview of the progress to date on that project. We will then hear briefly from each of the other four panelists with their initial impressions of the task force's preliminary idea.

Larry Gorski of the Illinois Insurance Department will be providing a regulatory perspective on our initial thinking. Those of you who know Larry probably will recognize that he's not here in Reno. Larry will be addressing us through an audio cassette, so that's something a little different. Steve Sedlak from Nationwide will be providing perspective from a larger size company. Dennis Deeter from United Presidential will be providing a perspective from a smaller size company. Dennis is a last minute replacement for Don Fritz, who was listed in the program. Our third Mike on the panel, Mike Mateja from Chalke/SS&C, will be providing what probably can best be described as Mike Mateja's perspective. Now I'll turn it over to Mike Smith.

MR. MICHAEL S. SMITH: As Mike said, I'm going to talk about a methodology to calculate C-3 factors. There are three main ideas I want to get across in my presentation. The first is just the straightforward method, the way that Lincoln National has calculated C-3 factors for some time.

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The second is that C-3 is more than just a measure that applies simply to a liability category. One single premium deferred annuity (SPDA) may not have the same factor as another SPDA, depending on the assets or the strategies that underlie that SPDA. There's a strong interdependence, and I'll provide an example that I think demonstrates that.

Finally, I'll talk about the pricing implications of the C-3 calculations that I'm going to describe.

Before I talk about the specific methods for calculating C-3 factors, I think we need to step back for a minute and just talk about why we would want to calculate C-3 factors, and what our alternatives are. There are two different sources of factors that you can use to determine the amount of C-3 surplus you want to hold: the internal source (that I'm going to describe), and some kind of external formula. I think risk-based capital is the most commonly used external formula. Also, you can use rating agency formulas. External factors are almost exclusively based on a liability description.

There are also a few interest rate risk factors for assets. One rating agency does have a collateralized mortgage obligation (CMO) factor. I don't know if they call it C-3, but it does measure the volatility of market value in CMOs as one example. But there's no factor out there that captures the interrelationship between the two.

So why would you want to use external sources? There are good reasons to not go through the calculations I'm going to talk about. The main advantage is that it is easy to use the external factors. It doesn't require a lot of resources, and it keeps your focus on the external measures that constrain the amount of capital we hold. If, at the end of the day, you're going to hold $x\%$ of RBC, for example, whether that's 150% or 200%, then it doesn't necessarily make sense for you to go through the calculation. Also, it does give you an unambiguous application to pricing. There is just one factor.

In the program description, it talked about how you could price a product, calculate C-3, and then find that your product wasn't priced correctly because your C-3 had changed. It's a circular thing.

In the case of using an external formula, you picked a factor, and it's set and there's no further discussion.

There are two significant disadvantages. One is that you lose control of the amount of surplus. It is not uncommon for these factors to change significantly and not necessarily expectedly. The second is that I think it can result in an inappropriate allocation of surplus. If you want to manage your surplus carefully and recognize the risks that you're taking, you're leaving yourself open to someone else's view of the risks that you have. And that, I think, is the main argument for calculating your own factor.

So when we do our own calculations, the advantages are that you do maintain control, and that it recognizes your asset/liability management strategies, (which may be better than sort of an implicit industry average that exists in the outside formulas). What's really the bottom line is that the allocation of capital is more appropriate for the risks that you have assumed.

The problem is that it does take a fair amount of resources to do these kinds of calculations. Our experience has been that the main resources needed are computer time, and not so much human time. I guess that the latter part depends on where you're at right now with your existing models.

The other disadvantage is that you may wind up mismatched with the outside formula, and you still are constrained to hold some amount of capital that a rating agency or that the regulators have told you that you need to hold.

So, let's say that you have decided that the arguments about control and allocation of surplus are persuasive and you want to try and calculate your own C-3 factors. You need to start by deciding what question you want to answer when you're trying to calculate a C-3 factor. I propose this question: with respect to future *interest rate changes*, *what level* of funds does the company need to remain *solvent* with some relatively high *degree of certainty*? It's a little wordy, but it's about as succinct as I could make it and still be all encompassing.

There are four key ideas here that I've underlined, and I'll talk about each of those in turn. First, we need to model the interest rate changes that we are going to be quantifying. Second, we need to set a level of funds so that, at the end of the day, we can say we've met our target. Third, solvency is the yardstick we're going to use in establishing these factors, and that has implications for how we're going to approach it. And finally, we need to settle on a high degree of certainty, and that's a subjective judgment.

So, first, we'll talk about interest rate models. There was another session that I was not able to attend, but had, I'm sure, a lot of good ideas as far as developing or finding interest rate models. What we need is a generator that produces probability-weighted scenarios. There are plenty of vendors that would be happy to sell you their product. Or you could be adventurous and build your own generator. We at Lincoln National have had our own generator for several years, and that's pretty much what we stick with, although we have looked at outside generators, too.

I think the set of scenarios needs to pass what I call a "sniff test." The set of scenarios needs to seem plausible in light of history. Plausibility does not have such a clear-cut definition. You know a set isn't plausible when you see interest rates that go to 70% or 80%. And I have seen Wall Street models where the interest rates do just that. They go extremely high. There are reasons for them to do that because of the constraints placed on the models. But I think when you're setting surplus, you want the scenarios to seem at least reasonable, and everyone has their own definition of reasonable.

Without a lot of comment, I'll say that my view would be that arbitrage-free scenarios aren't required to do this kind of an analysis. That gives you some more freedom to develop your own generator. It relieves a lot of complications. Finally, you need to be able to develop hundreds of scenarios.

Next, I'll talk about the basic framework that we're going to use to do our quantification. We're going to use a projection of statutory income. There are really two reasons for that. One is that statutory income and statutory accounting is, at the current time, the true measure of solvency. That's where the bottom line is. If you're not solvent statutorily, then you're not solvent.

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The second reason is more of a practical consideration, and that is that statutory income is well defined. You often have cash-flow testing models that do the statutory income projection. So that makes it a little easier to make statutory income the focus. It's also a way to leverage your cash-flow testing models. Yesterday, at another one of the practitioner' forums, we talked about different ways to leverage. And I'm not sure the C-3 calculation came up, but this is another way that you can build on the models that you've developed if they project statutory income into the future. As a footnote, you will begin with assets equal to statutory reserves at the start of your projections.

So we have a few hundred interest rate scenarios. We have a statutory income model. Combine the two and run the model under the scenarios. I'm next going to take you through the algorithm that we use to convert the results of our projections into a C-3 factor.

Let's discuss this three-step process in detail. The first step is to accumulate the statutory gains that come out of the model, with interest, to each point in time. And the second step is to take the present value of those accumulated values back to the beginning of the projection. We need to talk about interest rates when we're doing the present values and accumulations. What we have generally used is the one-year Treasury rate, just as a simple decision. I don't know that it matters that much which interest rate you use, but we've picked the one-year Treasury rate for simplicity.

Once you have the present values, the final step is to find the minimum present value for each scenario, and we're going to call that $C(s)$ for the purposes of this presentation. This is the C-3 measure for the scenario. And I'll talk about the meaning of that in a minute.

So let's go back to the first step and look at it in a little detail. These formulas aren't particularly complicated, but I think it's useful to see it both in words and in formulas to make sure that I'm being clear. We take the accumulation at any point in time as the previous accumulated value taken forward with interest. You add the gain, which is assumed to be at the end of the year, and that's your end of the year accumulated value. You take the initial accumulated value to be zero. Gain is the statutory net gain in the context of this method.

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Accumulation Formula

For each scenario, calculate $A(t)$:

$$A(t) = A(t-1) * i(t) + G(t)$$

Where:

$t = 1, 2, \dots, w$;

$A(0) = 0$;

$i(t)$ is the one-year Treasury in year t ; and

$G(t)$ is the statutory gain, assumed EOY t

The next step is to calculate the present values. These formulas are pretty trivial, so I'm not going to go through them. I'm going to take you through an example in just a second so that those of you who feel initiated can, hopefully, duplicate how I arrived at the numbers in Table 1. There are a lot of numbers on this table, and I'm not going to take you through all of them, I promise. I'm just going to take you through the first couple years' worth. But I think it's helpful to think of it, also, outside of the formulas and seen an actual real life example.

Present Value Formulas

$$PV(t) = PV(t-1) / (1+i(t))$$

$$PV(0) = 1$$

$$PVA(t) = A(t) * PV(t)$$

On Table 1 going across, the first column is time (t). The second is the statutory gain, $G(t)$, that I've assumed. The third is the interest rate $i(t)$, and the fourth is the accumulated value $A(t)$. Then we have present value factors $PV(t)$ and the present value of the accumulations $PVA(t)$.

In year one, the gain is \$5, as I've assumed, and then the accumulated value is also \$5 because it happens at the end of the year. We take the present value, \$4.72, which is the gain of \$5 discounted to the beginning of the year at 6%.

In the second year, we roll the previous year's accumulation forward with interest to \$5.30. We add the gain of \$5 in year 2 and you get the \$10.30 shown in the fourth column. The present value of that

TABLE 1
Example

Given $G(t)$ and $i(t)$ from a scenario:

t	G(t)	i(t)	A(t)	PV(t)	PVA(t)
1	5	6%	5.00	0.9434	4.72
2	5	6	10.30	0.8900	9.17
3	10	5	20.82	0.8476	17.64
4	-10	8	12.48	0.7848	9.79
5	-20	10	-6.27	0.7135	-4.47
6	-10	8	-16.77	0.6606	-11.08
7	5	6	-12.78	0.6232	-7.96
8	10	5	-3.42	0.5936	-2.03
9	10	5	6.41	0.5653	3.62
10	10	5	16.73	0.5384	9.01

is \$9.17. So that's just an example of the first two steps and how we get to the PVAs. Again, I don't think this is particularly complicated math. The tools are simple, other than the statutory income generator (which, as we all know, involves numerous assumptions and very complicated algorithms).

The third step is to identify the minimum present value, which is in bold. The minimum present value in this instance is -11.08. The example is contrived to produce a negative present value; there's a reason for that, which will become clear in a minute.

We have this minimum present value, but what does it mean? What do we do with it? The way I interpret it is that if we hold the minimum present value, or $C(s)$, at the beginning of a scenario, (that is, $A(c) = C(s)$), then you ensure that for this scenario, your accumulated statutory gains will never be less than zero. We've taken this as a proxy for solvency under this methodology. For those of you who are more mathematically inclined than I, I did try and express this in sort of a formula; For all t , $A(t) \geq 0$, if $A(0) = C(s)$.

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Chart 1 is a visual example, with initial surplus equal to the minimum present value. The bars are the gains for each year that I've assumed. The dotted line is just a graph of the accumulated gains (without surplus) that are calculated in the example. And the solid line shows the impact of adding surplus equal to the minimum present value.

You can see that while the solid line reaches zero (also when the dotted line reaches its minimum), it does not fall below zero. The key thing to remember from this is that we've taken this as the definition of solvency: the accumulated gains never fall below zero.

So we have a group of C-3 measures that are specific to each scenario, and we rank all of those from best to worst. And for each one, you calculate the percentile ranking of the scenario. Usually, and in the work we've generally done, the scenario weights will be equal. That makes the percentile ranking simple. If you're going to use a set that is based on stratified sampling or grouping, then you have to be just a little more careful.

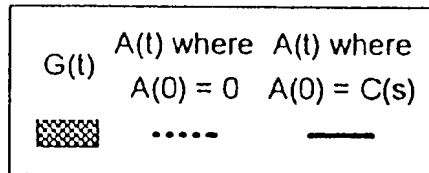
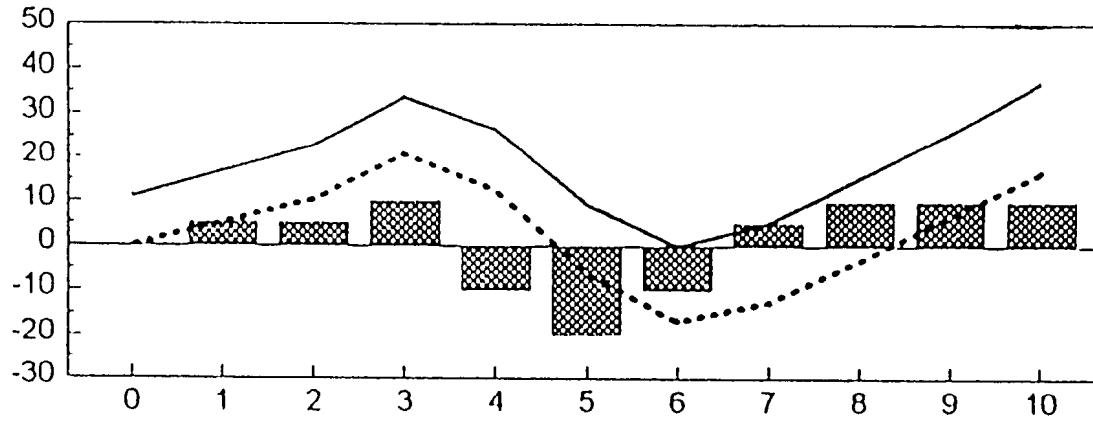
The final issue to deal with is what degree or level of certainty do you want? And then, based on that level of certainty, you choose the C(s) at that percentile, and that's the amount of surplus you would need to hold for that particular block of business. In choosing the percentile, there are a couple of things that we think about. One is that it needs to be fairly high, and we've always viewed fairly high as being something over 95%; whether it's 96%, 97%, or 98% is a subject for you and your management to discuss.

The other thought I'd leave you with is that you have to consider the independence of the other risks. If you choose the 99th percentile on all of your risks, then to the extent they're independent, basic probability theory would tell us that you now have an extremely high degree of certainty that you'll be solvent.

And there's the question of what you truly want to hold. Going back to my earlier point, maybe that's what the rating agencies think you should hold. But is that truly an appropriate allocation of surplus?

CHART 1

Gains and Accumulated Gains With and Without Surplus



Once you pick the C(s) at the selected percentile, if it's greater than zero, then that implies there's no C-3 risk for that block of business. You don't need to hold any additional surplus based on our definitions, to remain solvent.

When we want a factor, we just divide the minimum present value by reserves. I think that's most common. You will determine the basis you want to use to calculate the actual amount of surplus that you want to hold. You also need to change the sign, since you don't want negative factors.

I've illustrated the methodology that we use in this simple example. I'm going to show you the results of a more realistic example. What I did was develop, using one of our modeling tools, a simple block of SPDAs. They've been issued over the last six years. They're vanilla products. There's no bail-out and no free partial withdrawal. The crediting strategy is a 50/50 blend of market rates and portfolio earned rates. The lapse is a typical interest-sensitive lapse assumption. The surrender charges grade-off over seven years. Some of the block is reaching the point where there's no longer any surrender charge.

And to add a little spice to the presentation, and to help me make my second point, I built two different asset portfolios to underlie this liability block to illustrate how varied C-3 factors can be depending on what your asset makeup is. The first portfolio consists of only noncallable bonds. I think the spread is more or less equivalent to A-level corporate bonds. They are all coupon-paying bonds, no zeroes or anything fancy. Portfolio A uses a laddered maturity of three-, five-, seven-, ten- and thirty-year bonds.

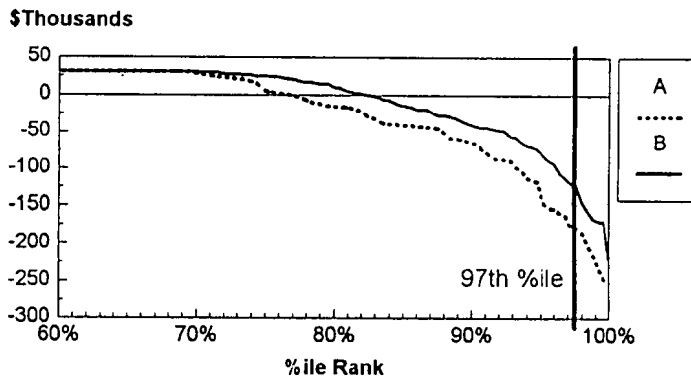
Portfolio B was a barbell where I used three-year and thirty-year bonds, thinking that this would give me fairly different results, and it did. But to make it a little more interesting, I set the weights on the second portfolio so that the duration of the second portfolio was the same as the duration on the first. The duration was about 5.3.

Given those assumptions, I ran 250 random scenarios from our generator, with equally weighted probability. I used the method that I described before to calculate the C-3 measures for each scenario

and ranked them. I'm going to show what the result was of taking those C-3 measures and dividing by the reserves and coming up with actual factors.

In Chart 2, the solid, top line is the result under Portfolio B. The dotted bottom line, is the result under Portfolio A. What that tells us is that there's more C-3 risk under the laddered maturity portfolio here. Now, before I go any further, let me say that this does not mean I advocate barbell investment strategies. It really relates more to the way that I set up the initial ladder. There probably weren't enough short-term assets included in Portfolio A.

CHART 2
Results
C(s) for Portfolios A & B



The point I'm trying to make is that depending on the assets that underlie your liabilities, you can wind up with very different C-3 levels. That's important, particularly when you consider how C-3 is generally calculated in formulas that come from outside sources. And now we see the result in terms of a factor that is maybe a little more tangible, a little more like what we're used to seeing.

The slope of these results is consistent with what we've seen in a lot of real blocks of business. So these pictures are not atypical at all. When you look at the choice of percentile, it obviously

makes a pretty big difference (Table 2). So you need to think carefully about that and what it is you're trying to do.

TABLE 2
Results
C-3 Factors at Selected Percentiles

Percentile	A	B
96%	2.81%	1.68%
97%	3.09	2.12
98%	3.35	2.63
99%	4.07	3.06

And that leads me to a point about judgment. When you're setting factors, there are a number of things to consider. First, you may have existing allocations between product lines. And when you choose new factors, you want to think about how it fits in, and does the whole picture make sense. You also have to factor in the outside constraints. If you model a block of business and your model tells you that you have no C-3 risk, while the RBC tells you that you need 3% of reserves to be held, then a compromise may need to be made.

I think this demonstrates, at least given our methodology, that choosing different assets can give you pretty different answers in terms of C-3 risk for a simple block of SPDAs. I've shown you only an asset portfolio difference. The factors can change quite a lot depending on product features, particularly interest-sensitive product features like bailout and withdrawal provisions. Factors also vary by strategy approaches, if you're more or less market sensitive in your crediting rates. And your policyholder lapse assumptions can also drive that.

There are open questions that I need to point out. I'm not going to have answers for a lot of these questions. These are things that we struggle with as we do these tests periodically. Should movements in interest rates affect your C-3 calculation? It is true that when interest rates change

significantly and you redo the calculation from one year to the next, you'll come up with very different factors. And it's not entirely clear that that's the right approach.

It can make management and pricing very difficult when your factors are moving 100 or 200 basis points. But, yet, maybe that is the right answer, because that's really where your risk is now. One approach that we've talked about is to use a historical average curve as your starting point to help things settle down. That's pretty easy to do now, but, if and when interest rates go to 10% or 12%, I don't know that we'll be quite so tempted to do that.

Another question is one of profits-released models versus profits-retained models. The method I've shown is a profits-retained model. We assume that all profits are available to fund future losses. You can argue, pretty convincingly, that maybe that isn't quite as realistic as you might want it to be. So you could do some kind of modified profits-released model.

There's a question of terminal values. When do you stop the model? What do you do when the model finishes? How long do you want to run the projection? Do you calculate some kind of market value of assets and liabilities at the end? Do you just surrender everything? Or do you just ignore it? From a practical matter, if you go out far enough, the discounting that we do tends to make that not such a big deal, but it can be. It's something to at least keep in mind.

So, in summary, the C-3 factors that we calculate do depend on the design of the product, the assets supporting the product, customer behavior, and the management strategies that are used to support the product (whether you use hedges, or your ability to asset/liability match, crediting strategy, other items of management and control). Remember that externally produced factors only capture the liability part.

I think of the pricing process as it relates to C-3 risk as circular. You start out with a product and you overlay strategies that affect the C-3 measure, which produce new C-3 factors. You redesign the product, you change the spread, which maybe affects the strategy, and so on. And that implies a fairly long, and maybe tedious, interactive process.

As a practical solution, if you're going to try this on a new product, you want to settle on a simple investment strategy and a simple management strategy. At that point, the other two things fall out. And you break the cycle. If you use an external formula, obviously, you break the cycle by just picking a factor.

And, again, it does take significant time and resources to do this. But our experience has been that we've gotten to the point that after doing this for several years, we can use judgment to short-cut a lot of the labor-intensive part.

MR. ZURCHER: In October 1995, the Academy Life Risk-Based Capital (RBC) Task Force initiated a project to explore ways to markedly improve the NAIC RBC C-3 risk component. This component, like all external-to-the-company risk capital formulas, and many internal formulas, has some glaring deficiencies. The task force first established some guidelines to help direct the project's efforts.

First, we felt we should attempt to develop an idealized way to calculate and measure C-3 risks, and then, use simpler methods if we must. I think, as we go through the framework that we've preliminarily come up with, you'll see that our framework reflects this idea.

Second, we felt it was imperative to recognize the relationships between assets and liabilities consistent with what Mike Smith just presented. Rather than view each side of the balance sheet independently, we had a desire to incorporate data developed from asset adequacy analysis cash-flow testing as the basis of the C-3 measure. Again, we wanted to leverage off that work, and ultimately help limit the amount of additional effort that would be required to assess the C-3 risk. As a starting point, the task force felt that all companies should perform C-3 testing if they sell certain types of interest-sensitive products.

What is the current status of the project? Well, first, we've identified a conceptual preliminary C-3 testing framework that's based upon the application of the models that have already been developed for asset adequacy cash-flow testing. This is, clearly, a work in process; it's very likely any ultimate

changes to the calculation will be quite different than what we're going to look at today. And I'll be talking a little bit more about that framework in just a minute.

We still have a lot of questions related to how to treat those liabilities and assets with interest rate risk that will not be subjected to the C-3 testing methodology that we come up with. The same types of questions really exist in terms of the formula that's used today and where no testing is performed. So, we're really not looking at something in this respect that's any different than where we are currently.

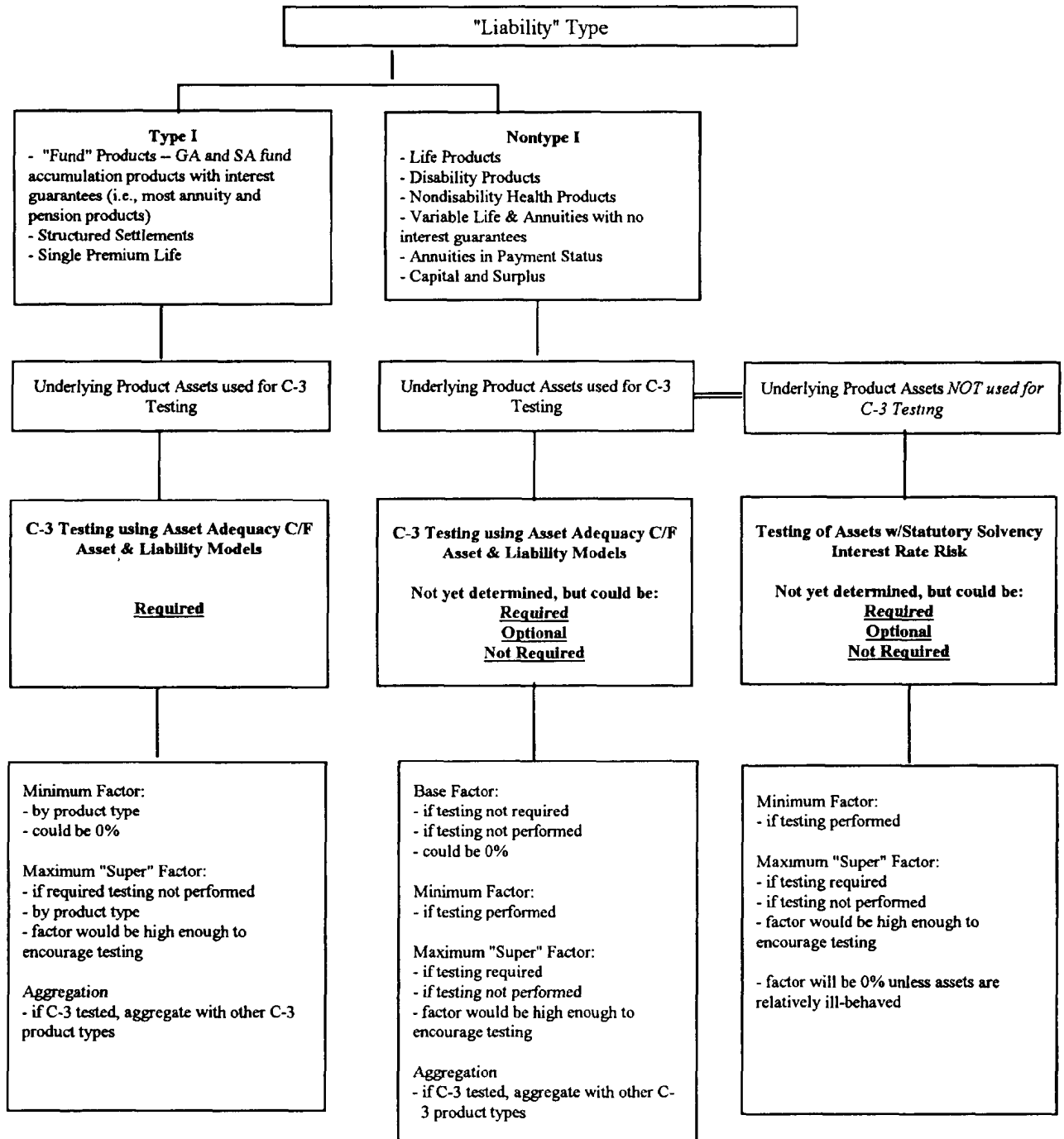
We need careful consideration of the balance between things like the benefits of the work product that you'd prepare as part of this testing versus the effort that is required, the autonomy of any assumption setting versus some type of standardization of those assumptions, and practicality issues versus theoretical correctness type issues. The implementation of any changes to the formula would be targeted probably for 1998 year-end reporting; and there's a very good chance that anything we come up with would probably be implemented in phases.

Our current view of what a testing framework would look like is illustrated on Chart 3. Before I go through this, I would suggest that the key point to take away from today's presentation regarding the task force's current thinking is that certain types of products would be required to be C-3 tested using an application of the asset and liability models that valuation actuaries have already created for asset adequacy cash-flow testing. We've called those products that would have to be tested Type I liabilities. Type I liabilities would generally consist of general account and separate account fund accumulation products with interest guarantees. That would encompass a large share of annuity and pension products.

Under the framework, C-3 testing using asset adequacy cash-flow models would be used to establish a C-3 factor. For these products, if the required testing was not performed for any reason, a maximum "super" factor would be used for that particular product, and that factor would be set high enough that it would probably encourage C-3 testing to be done. There might be some minimum

CHART 3

One Concept of a C-3 Testing Framework



C-3 RBC = For C-3 Tested Product Types: C-3 Factor x C-3 Tested Reserves
 + For NonC-3 Tested Product Types: C-3 Factor x NonC-3 Tested Reserves
 + For NonC-3 Tested "Risky" Assets: C-3 Factor x NonC-3 Tested Assets

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factors established such that, for any given product type, the C-3 factor in a regulatory sense would not be below that minimum level. Of course, some of those minimum factors could be zero.

The task force believes that any products that are C-3 tested can be aggregated with other C-3 tested products to determine an aggregate risk-based capital factor. If one product type performs poorly in a given interest rate environment, while another performs well, the aggregation of the two could result in lower levels of required capital. We think that's appropriate.

Nontype I liabilities would really be everything else other than Type I, including things like life, disability, variable products, annuities in payment status. It's really not clear to us yet whether or not these products would need to be tested. But testing would always be an option for these products, in which case, the results could be aggregated to come up with a factor. If the testing was not required and not performed for these type of products, there would probably be something like a base factor that we have today, which is just applied to a given liability type. Again, for some products, this factor could be zero, as it is today.

For those assets with statutory solvency interest rate risks that have not been used as part of the C-3 testing, some other form of testing might be required, or, perhaps, just the base factor would be used. This is different from the current formula where there is really no C-3 factor for any type of assets. The type of assets would be those that generate variable cash flows under different interest rate environments. The total C-3 RBC capital would, thus, be the sum of the RBC you get from the C-3 tested product types, those products that aren't tested, and any assets with C-3 type risk.

Here is what the framework might look like in terms of its specifics. We would hope that the framework would capture the net optionality of liabilities and supporting assets under a semicontrolled set of assumptions. In other words, the asset and liability cash flows should be allowed to offset the risk of one another rather than measuring those risks separately, like Mike Smith mentioned in his presentation. We feel that's a key to this whole process.

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We believe the C-3 measure should be established in the same context that is used for determining regulatory solvency. Again, as Mike Smith mentioned, that's statutory accounting, and not a market-value basis or an economic-value basis. This context is consistent with the approach that, at least in the NAIC RBC formula, has been used since the beginning of the establishment of those factors. We also feel that the profit margins in the business should be recognize as available to lessen risk. Until you eat through your pricing margins you're not really subjecting the company to solvency risk; therefore, you ought to be able to recognize those margins.

The assumption sets used for testing, we believe, should be those already created by the appointed actuary for asset adequacy testing. These assumptions, such as mortgage-backed prepayment speeds, policyholder behavior assumptions, and reinvestment strategy assumptions, presumably, have already been made in accordance with the Academy's Standards of Practice. I think, generally, the regulators and, perhaps, even more so the rating agencies are less than comfortable with the appointed actuary making assumptions like that. They think that they are, perhaps, gaming the system so to speak. To permit the regulators and rating agencies to more easily review and interpret assumptions, you need to establish a standardized set of reporting requirements to allow them to compare these types of assumptions, at least on a relative basis.

Having said that, some standardization of assumptions may be necessary, such as the scenario set that would be used, and, perhaps the disinvestment approach to name two. Also, we would likely look towards a shorter testing horizon than is used for asset adequacy testing; something like ten years might be appropriate. A shorter testing horizon would lessen the time required to perform the tests. Also, that type of test horizon or valuation horizon is consistent with the development of other factors over time in the NAIC formula, such as bond factors and mortality factors.

The scenario set would be stochastic based, and the same set would be used for all companies and for all product lines. That, obviously necessitates a new scenario set to be created each year, and that would probably be something that would be promulgated by the NAIC.

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The number of scenarios that would have to be tested is, at this time, uncertain. It probably would not be more than 100, but, undoubtedly, more than seven. As Mike Smith mentioned, you can develop scenarios that have equal probability or are stratified in some way that have probability weights assigned to them. These are types of approaches we are considering.

Mike did a good job walking through the types of C-3 measures, and ultimately, how a C-3 factor could be calculated. I won't spend any more time on that other than to say that you can expect a similar approach to be used for the NAIC factor. Again, the approach of looking at the greatest or highest minimum over a period of time is consistent with how we have historically set factors for bonds, mortality, and the recent changes to some of the mortgage factors.

Mike came up with a particular number that then became the C-3 factor. We could see that process being followed, but after you come up with that factor, it could, perhaps, somehow be normalized or converted to the actual C-3 factor. It's not clear how that would be done, or what approach would be used, but it may be something different than actually coming up with a factor and being done at that point.

Another point to mention is that we strongly feel that any method we come up with should take into account interim results rather than just looking at an endpoint result. Mike Smith focused on statutory income, but there are probably other interim measures, some type of cash-flow measure for example that could be used.

With respect to aggregation, we feel the actual factor developed from the aggregation process should be representative of all products that had been tested. The loss years of one product should be able to be offset by the gains from other products. In doing so, though, the margins used in the process should be those margins that are actually available to the company, and not margins that, through contractual obligations, will ultimately be paid out so someone other than the company's shareholders.

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Clearly, as we get into the testing process and what might be required, there will be conditions in which, because of the materiality of a given block or blocks of business, testing would not be required. A lot of thinking still needs to be done in this regard.

We have quite a few other challenges to overcome before any of the changes to a C-3 methodology, such as I've outlined, could really be implemented. First, the results of any form of C-3 testing must be perceived as being credible not only by the actuary doing the work, but by management and certainly the regulators and the rating agencies.

I feel strongly that if all this work is performed, it has to be done well enough so that the rating agencies have to consider the work rather than saying, "It's something that the companies have done to 'game the system,' and we can't use it." Whatever we do, I think it's important that the rating agencies buy into the process and are willing to use it as part of their rating process. The process must be used by regulators as well. If we can develop this credibility, it should negate the use of the less sophisticated approaches that are currently used in RBC formulas. And the credibility of the results, in part, will be based on the credibility of assumptions that the actuary will have made, and the communication of those assumptions.

As we evaluate any change to the process, there are, clearly, many cost/benefit considerations. Will the process appropriately differentiate weakly capitalized companies, which is the stated purpose of the NAIC RBC formula? Focusing any type of C-3 testing on Type I products would be a great improvement over where we are today.

I've already mentioned the question of how to treat assets with interest rate risk that have not been C-3 tested. There will be questions about which type of assets should be evaluated, how to quantify those risks, and so on.

If all this work is performed, it's very unlikely that C-3 testing could be completed within year-end reporting time frames because of resource limitations. It's not clear how much of a deferral beyond the present deadlines, if any, the regulators might accept. But it's likely that they'd have to accept

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something. Also, companies currently test asset adequacy, or complete their asset adequacy testing, based on different valuation dates. Some people might use a September time frame, others use year-end data. If C-3 testing is built from these asset adequacy models, then it would likely require multiple sets of interest scenarios because of the different starting points.

There's likely to be some professional considerations that have to be addressed. I hate to get into these, but would some form of C-3 opinion be required? Do we need to have an RBC actuary designation? You could then put another title behind your name. There likely would be a need for a Standard of Practice, and possibly a release of a Practice Note.

Some have suggested that there's a need to include new business as part of this analysis. Doing that would be inconsistent with current asset adequacy testing and the way other risk-based capital factors have been developed.

It's not clear that including new business would lead to a more or less conservative RBC result. Clearly, there will be the same small company issues that already exist related to asset adequacy testing that would have to be dealt with. And, again, with the idea of using interim results, there's a question of whether all company models have interim result capabilities.

We'll need an interest rate generator. What will be its source? How many scenarios? Will they be condensed?

We have to make sure that the margins that we are considering are only used once in the development of the RBC factors. If mortality margins were considered in setting the C-2 factors, they should not be available to support C-3 risk.

As I said, we're still in our initial phases of thinking about this. The task force has not even formally exposed some of these ideas to the regulators, although that process will start this month. We really would appreciate hearing your thoughts and comments. And if you want to share your ideas, Gary Hendricks at the Academy of Actuaries would be the person to send something to via fax or mail.

That concludes my brief overview of some of the thinking related to the C-3 approach for the NAIC. We're going to now hear some different reactions to and perspectives on some of these ideas, and we'll start with Larry Gorski, who has prepared some tape recorded comments.

MR. LARRY M. GORSKI: I am the life actuary with the Illinois Department of Insurance, and have been involved with the NAIC in developing the life risk-based capital formula since its inception several years ago. The risk-based capital formula is one of the most important components of the current regulatory framework. It will probably become an even more important part of the equation in the future as other regulatory tools and developments become dependent upon the results of risk-based capital.

Risk-based capital was conceived during a time when all eyes were focused on credit-related issues. We had just gone through the junk bond crisis and were starting to feel the impact of problems in the mortgage loan and real estate areas. It was only natural to focus the attention of risk-based capital on credit issues. A significant amount of thought and research went into the development of the asset risk or C-1 component of the current risk-based capital formula. On the other hand, a simplified, less rigorous approach was taken with respect to the interest rate risk or C-3 component of the formula.

A major shortcoming of the C-3 component of the current formula is the fact that it only considers the amount and general characteristics of reserve liabilities. It does not consider the relationship between asset cash flows and liability cash flows under different interest rate environments. At a minimum, any rigorous scientific analysis of the interest rate risk component has to consider that relationship.

The risk-based capital formula is now in its second stage. Modifications have been made to the mortgage loan risk-based capital evaluation methodology and risk factors, and other changes are on the horizon. The time is right to consider improving the C-3 components of the formula.

Some of the practical issues that need to be resolved are: (1) finding ways to balance the need to analyze asset and liability cash flows to properly quantify the C-3 risk and the historic exemption from

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cash-flow testing that has been granted to small companies; (2) the constraints or degree of freedom given to the valuation actuary in setting assumptions for the purposes of determining risk-based capital charges or interest rate risks; (3) the number of scenarios to consider when testing; (4) standardized methods for interpreting the results of cash-flow testing so that uniform and consistent risk-based capital charges emerge from the process; and (5) the time horizon for the testing period and methods for determining the end-of-period values.

I would like to share my thoughts on some of these issues. I am sure that there is at least a handful of actuaries in the audience who represent or work for small companies, who are tired of hearing me raise the issue of small companies and Section 8 Actuarial Opinions. I guess they will just have to bear with me one more time. There is no reason for exempting small companies from performing a more rigorous analysis of interest rate risk for the purposes of determining their company's risk-based capital requirements. Small companies can legally sell the same products as large companies, and they also can make the same investment decisions. A policyholder expects and deserves the same level of solvency protection from a large company as from a small company. While the cost (the guarantee fund assessments) for a small company solvency may be immaterial, the cost to the small company policyholder is not. If a small company chooses to compete in the interest-sensitive markets, it should be subjected to the same requirements as large companies.

When it comes to the issue of assumption constraints or freedom of choice, I have to admit that I have wavered in my views. I feel that it is significantly more difficult to develop standardized policyholder behavior assumptions and mortgage prepayment assumptions than it is to develop default costs for bonds. My initial inclination is to give the actuary complete freedom when making choices in these areas. However, this initial inclination is tempered by the realization that statutory risk-based capital is not designed to be used to rank companies, nor for companies to make capital allocation decisions, but it is a tool to simply differentiate well-capitalized companies from poorly-capitalized companies.

With that in mind, my current view is that standardized assumptions for certain key variables should be developed in order to ensure a consistent and uniform evaluation of interest rate risk exposure.

When it comes to the number of scenarios to be tested, I firmly believe that the number should be significantly greater than the New York seven. Going further, I believe that the scenarios should be stochastic in nature. I am too familiar with the ability of Wall Street to develop securities that perform well in certain scenarios and poorly in others; we should not place reliance on the results of testing that is limited to a small number of deterministic scenarios.

I believe that the NAIC could require a specific methodology to be used for generating random interest rate paths, and simply reset some of the parameters each year as the economy changes. For example, the NAIC could set the initial yield curve, the volatility assumption, and any assumptions for mean reversion, on an annual basis.

The basic idea that I had in mind when I first suggested improving the interest rate risk component of the risk-based capital formula was that risk-based capital charges should vary inversely with the results of reserve adequacy testing. I have no preconceived notions as to minimum RBC charges for interest rate risk exposure. Significantly redundant reserves could, in fact, result in zero or minimal risk-based capital charges for interest rate risk.

Obviously, this is just a kernel of an idea. Much fleshing out of the idea is required, and that is what is taking place at the Academy Task Force meetings. The idea places significant reliance upon the work being done by the valuation actuary. One difference though is that in testing reserve adequacy, the actuary focuses on the ability of assets equal to reserves to ultimately meet all obligations of the company. In setting risk-based capital charges, emphasis will have to be placed on interim results. The consideration of interim results is one that divides the regulatory actuarial community from the industry actuarial community in any discussion of asset adequacy analysis. I hope that doesn't become an issue when discussing interest rate risk evaluation for risk-based capital purposes.

The project will utilize significant industry and regulatory resources to complete. The NAIC life risk-based capital working group will be meeting via conference call in mid-September to discuss this project. The purpose of the call is to get some sense of the regulatory desire to move ahead with the

project. I don't want this to be a Larry Gorski project. I want this to be a NAIC/American Academy of Actuaries project.

The fact that at least one rating agency is attempting to integrate into their capital evaluation process an analytical evaluation of interest rate risk gives me confidence that others will see the importance and need for this project in the same way that I do. Thank you for giving me the opportunity to share my thoughts on this subject.

MR. STEPHEN A. SEDLAK: I'm here to give the large company perspective. Actually, what you're going to get is not the large company perspective; you're going to get my perspective as the appointed actuary for a large company.

I have three separate groups of comments here. The first is general. Many of these issues have been touched on already. I think there are some great advantages to this new proposal, and probably the biggest of these is that it fixes actual or perceived deficiencies in the current formula. For example, having no actuarial opinion costs at most 1% on a company action level basis. That's a very tiny cost when you consider all of the different asset/liability mismatches and other things that could be buried in a particular block of business where no asset adequacy analysis has been made.

The proposal recognizes more than just product type. Product type is not a terrifically all-encompassing discriminator of your risk and your capital adequacy. I think that even with an opinion, you're still likely to have a wide variety of risk as a result of the complexity of many product types and asset strategies.

Another advantage is that the proposal uses the valuation actuary. I think this is a natural way to move, given where we are with the valuation actuary concept. The actuary puts a lot of work into performing cash-flow testing. The actuary is in a great position in this regard to further generate a C-3 factor that's related to the true asset/liability mix of his or her company.

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My next group of comments has to do with cost. This is going to cost something. From a large company's standpoint, it's not going to be very material. We're doing this already. This is just an add-on, sort of another little refinement. Another cost, which was referred to, is time-related -- the ability to get this in along with other required work.

I think we can get around that somehow. I don't think there's a particular magic that we have to attribute to March 1st. I think we could do the whole valuation actuarial job by April 1st, but that's my personal opinion. In this regard, we perhaps have an opportunity to open that door and explore it, at least in this limited context.

There is also an offset to the cost. I don't know if anyone has seen it, but there's capital cost associated with target surplus. This is, in a way, a form of target surplus. I know that Larry Gorski said you don't use this as a capital allocation formula, but to the extent that target surplus represents requirements which were imposed by the outside world and which utilize your capital, you probably have to recognize it in some way or another if it actually predominates. And, assuming that is the case, a related type of formula also applies.

I'll just give you a little example as to what this capital cost can be. It's not rocket science. Let's just say that you have \$10 million of SPDAs. In today's world, the difference between having no actuarial opinion and having an actuarial opinion, would get you a 1% cost on a company-action-level basis.

Now, let's discuss capital cost. If your cost of capital is 15% (and that's probably pretty high, but it's going to make this example come out), and you're able to earn a return on capital of 5% after taxes, that's a 10% capital cost. If you're trying to maintain your capital at something like what the rest of the industry looks like, that's a factor of roughly two-and-a-half. The cost on that comparatively tiny block of SPDAs is \$25,000. So if you can get rid of that with an actuarial opinion, it's actually a good thing. You can actually offset some of the cost.

Another comment here. This is technology. This is, in a very real sense, something that's coming that we have to deal with. It's like a computer. I don't think anybody in this room would think of

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operating your actuarial area or your company without computers. This is, in a way of speaking, software to run on these computers. And I think if we look at it more in that regard, we'll tend to look a bit more favorably on this kind of a concept for determining the C-3 part of RBC.

My final group of comments lies in the area of self-interest. And there are at least two dimensions. I'm going to give you two. One is guaranty fund costs. We all have to pay them. To the extent this better assists in determining weakly-capitalized companies before they become a problem, we will reduce the guaranty fund costs.

The next item is pricing and competition. Tillinghast, about five to ten years ago, did a study on life insurance pricing. One of the things that the study produced was that roughly 50% of the companies didn't recognize any target surplus in their pricing. Another thing was that 50%, not necessarily the same 50%, did not recognize federal income taxes though the 1984 Act had then been passed.

We've got to compete with these people. That hurts. That's a very difficult thing to do. Today, if you're not using cash-flow testing in your pricing, you're not reflecting optionality. It doesn't come onto the radar screen. In addition, I think that you're not complying with Actuarial Standard of Practice (ASOP) 14 in spirit. Finally, you're not recognizing the fact that you may have a very broad risk tail as compared to the fairly arrow spike that you see when you do so-called best estimate or most-likely pricing.

MR. DENNIS A. DEETER: I'm from United Presidential Life Insurance Company (UPI). Mike Zurcher mentioned at the onset that Don Fritz, who's our chief actuary and our appointed actuary, was originally scheduled to be here to give some comments from a small company perspective on the status of the project. Don had to change his plans at a relatively late date, due to some pressing company business. So, late last week, I was called to fill in for him. As a result of that, these comments will be limited pretty much to the process in general.

I think Don's change of plans is indicative of a way of life, at least at our company, and maybe in yours as well. That is, we need a high degree of flexibility. At UPI, flexibility is a must, and

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sometimes our routine is that we have no fixed routine. So from our small company perspective, we have to be excessively aware of our need to be constantly on the move and have a willingness to shift resources and not spend as much time as maybe we would otherwise like to in a given area. For example, we may have to change plans and not attend the Valuation Actuary Symposium.

Regarding the C-3 project, we have to look at this requirement and be fast on our feet in light of some of the considerations that Mike Smith and Mike Zurcher mentioned earlier. You will recall that in Mike Zurcher's presentation, he mentioned the need for further consideration of the balance between the work product benefits and the effort required. Another consideration was the standardization versus the autonomy of assumption setting. Now, from my view, as a small company actuary at UPI, these considerations pose at least some potential for a measure of tension between an environment where flexibility is necessary versus the possibility of a final C-3 methodology that will necessitate, once again, allocating a fixed resource dedicated to a certain project for a certain period of time.

So, in the area of cash-flow testing, at least, we at UPI have been able to allocate a resource for a period of time. And so far, our management seems to be fairly comfortable with the work product benefits balanced against the additional cost of the resource that's allocated. So, in the C-3 framework, I believe that in the final methodology, whenever it emerges and whenever it's approved, you need this to maintain that same criteria of good balance. So I consider this, obviously, pretty important.

The second consideration is the one mentioned about standardization of assumptions versus the autonomy of assumptions. Standardization will entail probably the external source of the C-3 factors. From a small company' perspective, at least, I can appreciate the advantages here. It's easy, as Mike Smith mentioned, and it keeps our focus on the external measure. That's something to be recommended, from my standpoint, but, you need to balance this against having it be reasonable, and having to avoid the potential disadvantage of yielding to outside control.

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With respect to the autonomy issue, the disadvantage that jumped out at me is the one of the allocation of significant resources and time in developing these. This is striking, especially in light of other projects that are going on that make equal claim to the time and resources of the small company actuary. So we're in the difficult and maybe uncomfortable position of wanting to control the process as much as possible while being reluctant or, in some cases, unable to allocate the appropriate resource to get it done.

As the process and the project continues, my hope is that the balance between these issues will be kept in mind. I'm, of course, lobbying for that. And there's another point that, from my perspective of a small company, is really important. As a small company, we need to persuade our management every day that the benefits that we're getting out of a project are going to be worth the cost. So the ability to persuade will be helped in no small part by a methodology that turns out to be relatively straightforward, pretty much easy to adopt, implement, and still capable of producing meaningful results. It's no small task, but I'll trust that it will get done.

MR. MICHAEL E. MATEJA: When Mike Zurcher first asked me to join this panel, he actually asked me to represent a consultant/vendor perspective. I eventually unloaded on him with some of my long-held beliefs about C-3 risk and I think that was why he said that I will represent Mike Mateja's point of view.

I think the consultant or vendor perspective is a relatively simple and straightforward one. While the details of this initiative are lacking, it seems pretty clear to me that there's an opportunity for plenty of complexity and confusion to result as a direct outgrowth of this effort. And, as you all know, consultants thrive on complexity and confusion. I would say that, on behalf of all consultants, this will probably be a good thing.

Now, the confusion and complexity may be a reasonable price to pay, and it comes down to the question of results. Do you get a comprehensive solution to the issue? That caused me to ask myself, what's the issue? What's the problem? From a regulatory perspective, and Larry Gorski was

the articulator of that, it's clear. Larry is worried about solvency, and rightly so. He's being paid to worry about that, and everything that he does is framed in that context.

What I think we need to do is persuade him to look at this from a company perspective as well. And this is really where I get into my own views on this. Dealing with C-3 risk is something that I worked at pretty hard several years ago as chairperson of the Combination Risks Task Force and a member of the C-3 Risks Task Force. I came out of that work with a conviction that C-3 is a very, very elusive risk. It doesn't lend itself to what I would call simple solutions and quick fixes, as witnessed by the efforts at Lincoln National to come to grips with it. Now, if all of us have to roll up our sleeves and present that kind of a solution to the problem, we have our work cut out for us. It might take that in the end.

But what are we after ultimately? I think Steve Sedlak alluded to the capital implications of C-3 risk solutions. There are two dimensions to that; both the capital that is embedded in the reserves (to the extent that you have to hold more than fund values or policyholder funds), and the surplus component related to that. Further, in all the work that we did on risk management, we always discussed the two-prong formula of reserves, plus surplus, plus the earnings component as a credit, which I also heard mentioned here.

I'm not sure how your models are working, but to the extent that you're holding a reserve that is in excess of a policyholder fund, which is required under some of the formulas, the capital implications of this action are important. And this is where the company's point of view comes into play. We're no longer competing with each other. We're competing with banks, mutual funds, the whole financial services marketplace so that this, somehow, has to be a more comprehensive solution to the problem of C-3 risk.

It has to differentiate between companies that are really doing it right, and there has to be an incentive for other companies to want to do it right. The only thing that the regulators have held out, historically, is what I would call the club: hold 5% more than the policyholder fund value. And you ask, why 5%? Because that sounds right. It lacks the substantiveness of a theoretical analysis. I

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think there's a basis for holding less than the policyholder fund if a company is really working hard at managing that risk, and can demonstrate that it is. You can get that out of the earnings for one year. If you're looking to get a 0.5% margin, you can hold 99.5% of fund value off the top of your head.

I could wax on right through the end of this session about other details. But, in substance, those are the kinds of things that I'm thinking of. C-3 is very elusive. It's a very complicated risk. Quantification doesn't lend itself to the simple formula, which is really what we started with. This was by design, since we had to use the information available in the statutory annual statement for the first iteration of the RBC formula. We need a greater theoretical discipline of the sort that I hear being talked about.

This could be a very complicated issue in terms of how to ensure consistency in quantifying C-3 risk in this regard. This is going to require models. We've looked at a lot of models at SS&C/Chalke, and I can tell you that not all models are created equal. When we take a look at what a company does, answers as to the level of risk generally change, and they change materially.

Finally, I'm very skeptical about efforts to be precise in dealing with the extremes of risk. I've played around with catastrophic risk a lot, and when I see surplus requirements changing by multiples of two or three, depending upon what the assumptions are, I keep saying to myself, I must be realistic about what I can achieve. I would suggest to this group that you need to be very practical in this area.

And in the end, what you need to do is focus on the result that you need, which very simply is that you're doing a good job managing C-3 risk. I want to hold lower reserves, first off, and lower surplus embedded in those reserves. I want to get some credit for surplus in reserves. I want there to be incentives that would make it worthwhile for me to make the effort to manage the reserve. And then my RBC should be set given my risk management capacity and reserves. And if I haven't done the job, then both the reserves and the corresponding RBC should be higher.

