

1988 VALUATION ACTUARY  
SYMPOSIUM PROCEEDINGS

PRESCRIBED AND ADDITIONAL SCENARIOS:

THE NATURE OF SOLVENCY TESTING

DR. ALLAN BRENDER: In this session we will discuss the complete solvency testing process and the route by which the valuation actuary arrives at conclusions and prepares a solvency report. My task is to discuss the selection of scenarios that should be tested and to describe the results of the testing we did on a model company.

We have talked primarily about prescribed scenarios at this symposium. Your first question might be "How many scenarios do I have to use; are the prescribed ones all that is required?" I want to address this question first.

You will notice we chose the word *prescribed* and not the more common *required*. If I ask for the opposite of *required*, you are likely to respond with *optional*. That is what we want to avoid. It is not optional to test additional scenarios beyond those that are prescribed. Testing additional scenarios is necessary, indeed it is the major part of the solvency-testing process.

If that is the case, what is the purpose of the prescribed scenarios? The purpose is twofold. First, these scenarios provide a uniform set of tests which will be carried out

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on all companies. Under certain circumstances, they could be useful for purposes of comparison, particularly by actuaries working on more than one company or by regulators. I will not get into the issues of who will see the results of these tests, and I do not propose this ability to compare as the main reason for having prescribed scenarios. Each prescribed scenario assumes a change in experience, usually unfavorable, of a single factor, which is commonly recognized as being important to the operations of a life insurance company. The main purpose of the prescribed scenarios is to provide the valuation actuary with standardized tests of the company's sensitivity to changes in these important factors.

Think of what your dentist does when you first get into the chair. She pokes around looking for areas of sensitivity; once she finds them, she goes to work to find the decay and clean it out. Prescribed scenarios, then, are for poking around, doing preliminary testing and investigation; additional scenarios are for the detailed study of troubled areas once the areas of sensitivity have been found. It is here that the real work of solvency testing is done. The quality of the actuary's solvency test will depend crucially on the additional scenarios which are chosen to be tested.

It will be up to the valuation actuary to choose the additional scenarios. The Committee on Solvency Standards of the Canadian Institute of Actuaries (CIA) did not feel that it could possibly specify a set of scenarios, which would encompass all possible

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areas of sensitivity for all companies. We assume the valuation actuary is in a much better position than ourselves to know a company's strengths and vulnerabilities. All we can hope to do is to give actuaries guidance as to what is an adequate job of solvency testing. Some of that guidance will eventually be spelled out in professional standards adopted by the CIA. We have not begun to draw up these standards as yet; so I'd like to discuss informally the choice of additional scenarios.

When we look at the prescribed scenarios, we immediately recognize that they are unrealistic because it is rare that only one important factor will change while others remain at their expected or best-guess values. Indeed, the factors which vary in the prescribed scenarios are not mutually independent and will often move together. For example, lapse rates in many cases are linked to changes in interest rates; changes in interest due to inflationary pressures will also affect expenses. So, an easy and important way to build additional scenarios is to combine prescribed scenarios.

Our preliminary poking around with prescribed scenarios may reveal a particular sensitivity to a single factor. It would then be reasonable to extend the relevant prescribed scenario into a whole family of additional scenarios in order to fully understand the nature of the sensitivity. For example, concern about Acquired Immune Deficiency Syndrome (AIDS) would lead one to study a number of variations on the first

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prescribed scenario which assumes mortality increases by 3 percent per year for five years.

Recall that the test we are proposing involves satisfaction of a minimum capital and surplus requirement. However, that requirement is explicitly not meant to cover all contingencies. The Canadian Life and Health Insurance Association (CLHIA) circular, which sets out its surplus test formula, lists a number of risks that are assumed not to be present and are not covered:

1. excess of loss, catastrophic accident, or similar insurance coverages;
2. unusually high retention lists;
3. lack of diversification in assets or liabilities;
4. forward commitments, which operate as options to borrowers;
5. options to policyholders to make future deposits at a guaranteed minimum interest rate;
6. principal repayment options under bonds, mortgages, and preferred shares;
7. severe mismatch between assets and liabilities;
8. currency mismatches;
9. atypical mortality exposure; and
10. unrecognized loss of intrinsic value in stock investments.

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It is not difficult to list others. All of these mentioned and especially those, which the actuary has reason to believe are particularly important for the company in question, could form the basis for additional scenarios.

Questions of interest-rate risk, the so-called C-3 risk, have received much attention of late, particularly in the United States. Canadian companies are not immune from this problem, and one can imagine a wide variety of additional scenarios, with varying yield curves combined with changes in lapse rates, principal prepayments, policy loans, and shareholder dividends on the company's stock investments. I remind you that all the scenarios we have presented use a yield curve of constant shape, though the initial level has varied. One should also vary the shape.

Finally, one can and should test possible changes in management's plans. This includes changes in market segment, the introduction of new products or the shutdown of existing lines of business, alteration of investment policy, revisions of policyholder dividend scales, and corporate diversification. For example, one of the additional scenarios we tested on the Solvent Stock Life Insurance Company was a proposal to triple group new business by cutting rates by 10 percent.

The possibilities are almost limitless; which leads us to the natural questions: How much testing should we do? How many scenarios are enough? I don't have a magic

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number or an explicit answer. Perhaps the best advice when thinking about a possible scenario is: If you think it might happen, test it! I'm sure that in writing our standards the committee will find some fancy legalistic and professional-sounding way of saying just this.

Another answer to the question of how many additional scenarios should be chosen -- one which sounds facetious but isn't entirely so -- is that you should continue testing until you have driven your company insolvent, in the model, that is, and not through the cost of interminable testing! It is important to know what the limits are -- how far one can go in a certain direction or how much experience can deteriorate before the company is in real trouble.

Does the company have to pass each scenario before the actuary can write a good report? The answer is No! Remember that the primary function of the actuary's report and of the entire process we are proposing is to give early warning of possible trouble ahead. It is important to explore the areas of potential difficulty in order to be able to plan explicitly how to avoid them.

All of this testing sounds pretty negative and pessimistic. Must we only test adverse scenarios? Again, the answer is No! Once you have uncovered a problem, which requires early warning, it is reasonable to investigate ways of avoiding the problem. By

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all means, test possible corrective actions and make recommendations on the basis of these tests. Management and the policyholders will be well-served if you do. As an example, one of the tests we ran after coming across several unfavorable scenarios for our model company was to see whether a reduction in shareholder dividends could materially ease the company's difficulty.

Let us now turn to the additional scenarios we ran and the results of those tests. Formally, each division of the company ran a set of eight uniform additional scenarios. One division ran a few more. It was our corporate actuary who combined these ingeniously in many interesting ways to produce more than eight additional scenarios.

The first of our additional scenarios was based on the mismatch test required of appointed actuaries in the United Kingdom. This assumes that, in the first projection year, we suffer a 25 percent drop in equity values and a default of 10 percent of industrial bonds and all mortgages. We do suffer indeed; the 1992 free surplus ratio is -5.9 percent, and we cannot meet the CLHIA test.

The next additional scenario is a combination of two prescribed scenarios, the first in which mortality increases by 15 percent, and the second in which morbidity increases similarly. Again, we are in trouble as the free surplus ratio is -39.1 percent; this should

be compared to the ratio of -33.8 percent in the first scenario, deteriorating mortality. It may help to recall we only have sensitivity to morbidity in our group health line.

Our next two additional scenarios are a combination of prescribed scenario 3 (unfavorable changes in withdrawals) with scenarios 4 and 5 (changing interest rates). This is a relatively simple look at the disintermediation problem. In the increasing interest-rate case, the free ratio ends up at 55 percent, as compared with 35.1 percent for increasing interest alone, so the combined effect is quite favorable. The combination, in the case of falling interest rates, produces the worst result we found; the free ratio drops to -131.1 percent.

We then decided to test the effect of changing our investment strategy. The next three scenarios involved a strategy, which limits the terms of all new bonds to five years. The results are not surprising. If interest rates increase, the free surplus ratio increases from 35.1 to 43 percent; for level interest rates, the new policy increases the ratio from 19.7 percent in the base case to 23.2 percent, which may be an indication of overall asset/liability mismatch. Finally, when interest rates fall, a short investment policy is clearly a mistake, which we already knew, as free surplus ratio drops from 5.6 to -6.3 percent.

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Our corporate actuary then decided to see whether we could take any remedial action to ease things in the worst of our scenarios. In particular, what would happen if shareholder dividends were stopped? This action would help to some extent. In scenario 3, unfavorable withdrawals, the ratio would be improved from -64.9 to -40.7 percent, while in the worst of all scenarios, bad withdrawals and falling interest rates, cutting off dividends would only move the free ratio from -131.1 to -112.2 percent. A measure of the worth of shareholder dividends in good times is found in the base case, when the ratio rises from 19.7 to 47.2 percent. So, cutting dividends helps a bit but won't really save us. These scenarios are a bit optimistic since, if things started to go wrong in real life, we probably would not take action on dividends until the second or third year.

We finally turned to a rather more intensive study of our new sales. Each division had submitted a scenario in which all new business was cut off. These were combined, one at a time, with the base case for each of the other divisions in order to measure the new business strain introduced by each division separately. What is most notable is the strain introduced by each of the annuity and the guaranteed individual divisions. There was some concern about the guaranteed individual division and, in particular, with the Term-to-100 product. Therefore, finer tests were run.

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Results:	<u>Line</u>	<u>Free Surplus Ratio</u>
	group health	31.1%
	annuity	62.6
	group life	23.5
	individual guaranteed	46.9
	universal life	26.2
	participating	25.4
	base	19.7
	sales level	38.1
	sales up	2.2

We next looked into a few possible strategic decisions. What would happen if the group division (life and health) decided to buy business, in particular, to reduce prices by 10 percent and thereby triple its new sales? By itself, this would reduce the free surplus ratio from the base 19.7 to 11.8 percent. If this were done at the same time as the rest of the company was doubling its real rate of sales growth (scenario 7), we would have trouble as the free surplus ratio drops from the 2.2 percent of scenario 7 to -5.9 percent. The company is clearly subject to considerable new business strain, and a close watch must be kept on the level of new sales.

Finally, there was concern about the performance of the Term-to-100 product. Consideration was given to dropping it altogether, cutting off new sales. Therefore, the guaranteed life division ran two scenarios, one to test the results of cutting off Term-to-100 and the other to test what would happen if Term-to-100 continued to sell but the

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nonparticipating whole life was cut off. As compared to the base case, and with all other divisions operating on the base scenario, the free surplus ratio rose to 25.9 percent when whole life sales were stopped, but to 39.7 percent when the Term-to-100 product was controlled. Most of the strain in the line is due to the Term-to-100 product. This was certainly a leading factor in the actuary's decision to recommend management pay close attention to Term-to-100 sales.

The preceding is only a small part of the results produced by the projection models. Things start to get really interesting when you take the company apart and look at the performance of the various divisions and the trade-offs between them under all scenarios. I hope I've managed to give you a bit of the flavor of what can be done and learned with these models and techniques. You've seen how we went about choosing some additional scenarios. If this was a real company and we were doing a real solvency study on it, we would have chosen many more scenarios to investigate. Remember, once you have the model built, it does not take much effort to run a few more scenarios. The information to be gained is bound to make the effort worthwhile.

I'd like to conclude with a remark or two about the notion of a solvency "test." Though I've made extensive use of the phrase *solvency test*, it is slightly misleading. We are not talking about a test that one passes or fails. We are talking about an exploration of sensitivity based on projections of possible futures. Remember that the object of this

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process is to give early warning of possible trouble and to give suggestions as to how the trouble may be avoided or, at least, lessened.

There is, however, a simpler solvency test, which one does pass or fail. That test is the minimum continuing capital and surplus requirement. In all of our work presented at this symposium, we have used the surplus formula as described in the CLHIA circular 4688 dated June 27, 1988. We have compared the resulting required surplus to surplus available according to the definition found in that same CLHIA circular. The Office of the Superintendent of Financial Institutions Canada (OSFI) is another player in this game, which may have a slightly different set of rules. According to a talk which Bob Hammond, Deputy Superintendent, gave at the CIA meeting in Calgary in June 1988, OSFI will probably not accept any of the surplus appropriation for cash-value deficiencies and negative reserves as part of available surplus to be used in satisfying the minimum continuing capital and surplus requirement (m.c.c.s.r.). There are, of course, other differences, particularly with respect to the treatment of subsidiaries. For the Solvent Stock Life Insurance Company, this difference between OSFI and the CLHIA is material. Required surplus appropriations for deficiencies in cash surrender value (CSV) and negative reserves are significant, and there are scenarios that passed the "test" under CLHIA standards, which would have failed under OSFI standards. In all scenarios, the company fared worse under proposed OSFI rules than under the CLHIA formulation. The Federal Insurance Act is being revised, and it may be possible to

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change the CSV floor and put it on an aggregate portfolio basis as is found in the United States. This could make the surplus test less onerous for some companies.

Our presentation has assumed that the statutory surplus formula would be the same as the CLHIA formula. I understand regulations specifying the formula are now being drawn up. It is not clear that our assumption is justified, particularly with respect to the changes in the latest draft of the CLHIA formula. Some of these changes can be quite significant for some companies.

We also built our model assuming the participating line has its own asset segment. This is not in accordance with the current Act, but it is anticipated that the new forthcoming Act will either permit or require this type of segmentation.

So, you see that the results we have placed before you are based on a set of assumptions, which are a combination of the known present situation and the situation as it seems likely to be. Our assumptions may not mirror exactly the present or the future. Therefore, our numbers, as well as our company, are hypothetical.

But that should not matter at this time. The purpose of this presentation is to demonstrate how to check solvency through scenario testing. We have been most concerned with the construction of a model, the choice of additional scenarios, and the

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conclusions one can draw after having carried out the study. We are concentrating not on the numbers but on the type of investigation to be done and the type of report to be prepared.

## REPORT ON SOLVENCY TESTING RESULTS

MR. TREVOR C. HOWES: The Solvency Standards Committee and, especially, the Modeling Subcommittee within it have devoted a great deal of time and attention to the development of our proposed solvency investigation, which we believe should be a regular, mandatory procedure for valuation actuaries to perform as part of any solvency monitoring process. The emphasis in our work so far has been on the techniques and tools required to perform this analysis and on the guidelines, which will define the extent of the work we contemplate being done.

Nonetheless, the projection and analysis effort will have no point to it, unless the knowledge and insight to be gained can be clearly recorded and communicated in a report. Accordingly, this important concluding step in the process deserves specific attention.

I plan to first discuss certain general objectives and requirements of the valuation actuary's report and then indicate how the Solvent Stock's sample report was drafted with these points in mind.

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To decide what should be in the solvency testing report, or how it should be organized or worded, we first must consider what the report is intended to accomplish.

The primary and most obvious goal is to communicate the test results and their implications to the company management. Beyond this, however, there are two secondary objectives: (a) to confirm that applicable legal or professional obligations have been fulfilled, assuming that this surplus projection process is made mandatory, and (b) to document the work that was done in accordance with professional standards.

Secondary objective (b) refers to professional standards. We are not yet in the position of having final, or even draft standards, that specifically deal with this new and complex area of practice for the Canadian valuation actuary. Nonetheless, there are several existing sources we can turn to for some guidance. For example, we can easily find a number of existing Rules of Professional Conduct in the Blue Binder of the Canadian Institute of Actuaries (CIA) that would apply to this newly evolving area.

In particular, let me quickly review Rules of Professional Conduct numbered 8 to 11, all of which should be quite familiar to you. These rules refer to reports or opinions, and require the actuary:

1. to document the sources of data and the methods and assumptions used;

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2. to identify himself as the source of any opinion and be available to advise or explain as required;
3. to base his work on sufficient and reliable data, using adequate and appropriate assumptions and methods based on established principles or, if this is not possible, to qualify his findings accordingly.

In addition, we could also look to any relevant standards established in the United States and judge to what degree they may apply to this work as well. For example, the Interim Actuarial Standards Board of the American Academy of Actuaries, recently published an exposure draft of "Recommendations Concerning Cash Flow Testing for Life Insurance Companies." This document provides thirteen separate recommendations concerning the methods and assumptions used in cash-flow testing work and how they should be documented in a report. I commend this exposure draft to you as a reference.

It is important to note that the authors of these recommendations began their paper by quoting "Interpretive Opinion 3" of the Academy of Actuaries. This opinion basically defines the meaning and purpose of an actuarial report and requires such a report to "describe and identify the data, assumptions and methods used with sufficient clarity that another actuary practicing in the same field could make an objective appraisal of the reasonableness and validity of the report."

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It is clear then that both Canadian and American standards of sound actuarial practice will require clear and complete documentation in order to fully describe all methods and assumptions and all sources for the data used. It is easy to imagine how a company's efforts to prepare a report might conceivably run to a multivolume set, in order to fully disclose the basis of the work.

This then raises a question of structure or format: Need all this data be included in one formal document, or should the report be limited to the significant results and the actuary's conclusions and recommendations for future action? In the latter case, the detailed supporting documentation regarding methods and assumptions might be included in appendixes, or supplementary reports or files, and merely referred to within the main report. A summary of methods and overall assumptions might be all that is required within the body of the report.

This alternative would certainly seem preferable when the intended audience for the report is senior management or, perhaps, the board of directors of the company.

At this point, we have not specifically proposed the form or content of any report for other interested parties, and it certainly is likely that other parties will be interested. Knowing that such a document exists, I would imagine that external auditors would want to see it and discuss its implications. Similarly, the regulators will find it difficult to

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ignore this work, especially for any company whose annual statement shows marginal surplus at the past year-end. At least both these audiences have some ability to protect the confidentiality of the results.

A more sensitive situation exists when considering other audiences, such as the consumer protection plan being proposed by the CLHIA. Clearly, companies will be reticent in filing or releasing any portions of the work, which show declining surplus balances, when there is risk of inappropriate public disclosure.

In any event, the Solvent Stock Life Company's report, which was created for internal purposes, was basically organized along the following lines.

The introduction provided general background and an overview of the work. The introduction and the summary of results and conclusions, which in combination form the "Company Overview" in the sample report, would make a reasonable, but still lengthy, executive summary. The remaining sections go into much more detail regarding the results by line of business, the details of the individual models (by segment and in consolidation) and all the various assumptions employed.

Before exploring the introduction further, let's review secondary objective (a) of the report, regarding the fulfillment of obligations.

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As a committee we have a bit of a "chicken-and-egg" dilemma. We recommend that the valuation actuary should be required to perform a thorough investigation of his company's projected surplus position. This work is an essential step for the valuation actuary to be able to enhance his understanding of the complete financial position of the company and, thus, take on the broadened role as described in the Report of the Special Committee on the Role of the Valuation Actuary. Accordingly, it is entirely consistent with the principles already endorsed by the profession in Canada.

While we as a committee are convinced, it is clearly another matter to obtain regulatory support through legislation, or through regulatory filing requirements, which would force this work to be done. Representatives of the Superintendent of Insurance have indicated that the profession must give a clear statement that it is ready and able to do this work before the regulators will consider mandating these broader responsibilities. This means that we as a committee must proceed to develop the concept, the standards, and the techniques, and sell them to the profession prior to expecting any laws to force their use.

Without regulatory support, we can still mandate the procedure through professional standards alone, and that is what we are assuming will happen. In fact, with the pending implementation of generally accepted accounting procedures (GAAP), and its

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prerequisite of adequate standards of solvency protection, the first steps on this path are about to be taken.

Accordingly, the introduction of the sample report begins with a simple description of the modeling and analysis work done and then cites the hypothetical CIA Solvency Standards as the authority under which this work was required.

There may well be an option whereby the full prescribed projection effort is not required, each year, by every company. While conditions have not yet been defined, it seems reasonable for there to be circumstances under which the valuation actuary might either conclude (1) that previously done investigations are sufficient for the current year, or (2) that significantly scaled down or simplified work is all that is justified by the current situation. In either case, his report should clearly state the extent of work actually done, and the authority and justification for the reduced effort.

Having just held out the tantalizing possibility of escaping at least some if not all of the extensive work we have illustrated for you, let me emphasize that the committee feels strongly about the value and the necessity of our proposals. We believe the only way for most actuaries to be assured their surplus situation will continue to be safe is by proving it - at least once - and that escape hatches therefore will be reserved for only those special situations that clearly warrant it.

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There is also a brief description in the introduction of the report of the nature and extent of the work, stating that projections of surplus were done, using a model, and then a paragraph covering the three types of scenarios used in the projections: the base scenario, prescribed scenarios, and additional scenarios.

So far this is all pretty tame. The next paragraph, however, commences, "In my opinion," and right there, the more nervous among you might be breaking out the antacids. However, the opinion is merely that:

- a. the model is sufficiently representative of the company's current financial position, and projected changes therein, to permit valid conclusions to be drawn from the test results, and
- b. the scenarios selected adequately cover those possible adverse environmental and experience trends which are reasonable, plausible, and pertinent to the circumstances of the company and the current environment.

This is clearly just a confirmation that the actuary feels he's done his job. The model is good enough to use the results, and he's run enough scenarios to feel safe.

There was plenty of discussion within our committee as to whether we should require the actuary to sign something stronger. The preceding opinion, which is tucked away in

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the introduction of the report without fuss or fanfare, was referred to by our committee as "the wimpy opinion." I'll get to the alternative in a moment, but first let me go on with the sample report.

The second main section of the report provides all the important and interesting material - the summary of results and conclusions. I won't go into details since these are well- covered by the Solvent Stock's report. However, I would like to describe what I foresee as being the four main types of messages conveyed within the recommendations for action section, the choice depending on the results of the study and the actuary's conclusions about them:

1. Type 1 might be "Battle Stations!" representing the most urgent of warnings to company management that quick action is required to avert negative surplus trends, which would probably emerge under even the base scenario. It is hoped, however, that the company has not had to wait for a formal report to have received this kind of a warning!
2. Type 2, which is probably much more common, provides a less panic-stricken warning, "There be monsters here." Unlike the ancient maps of uncharted seas, the actuary should have some real evidence of specific risks to surplus, which he feels require careful monitoring and preparation for possible defensive actions.

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Perhaps the current plans and internal policies or the lack of adequate monitoring systems are such that the actuary is concerned that improvements are necessary.

3. Type 3 or "Proceed with caution" is basically a confirmation that the direction of navigation is reasonable but that continued awareness of risks is still required. Likely the policies and plans of the company already take these risks into account, and monitoring systems are adequate.
4. Type 4, unfortunately, may be an acknowledgement of failure. "Picture not available" signifies that the actuary has been unable, through lack of resources, or for whatever reason, to adequately assess potential threats. This message should be conveyed to management, along with the plan of attack and the requirements for cooperation and resources, which may be necessary to allow him to properly carry out his responsibilities.

Earlier, I emphasized that professional standards require the actuary to adequately document his methods, his sources of data, and the basis for his assumptions. Formal statements might well be used to identify the explicit source of the initial data entering the model and whether actual movements influenced the subsequent projections.

Confirmation of the actual definition of required surplus used to calculate ratios is also

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necessary. Other sources of basic data, or of significant assumptions as to company policy, should be clearly disclosed including (1) the business plan, (2) the investment philosophy and policy, (3) pricing and policyholder dividend policies, and (4) the policy regarding shareholder dividends or surplus transfers.

It is easy to envisage situations where the actuary's projections of declining surplus are seriously impacted either positively or negatively by his implementation of these policies within the model, especially to the extent they are not assumed to react appropriately to adverse trends. The actuary may have to make key assumptions as to these policies on scant knowledge or evidence, especially where no formal documentation of them exists, in which case explicit disclosure of this fact and possibly qualification of his conclusions, will be required within the report.

Documentation of methods and assumptions about experience are pretty familiar items to actuaries. Clearly the model structure and the validation tests performed should be discussed, and the sample report gives some good suggestions to consider in these areas.

You must include three complete sets of assumptions according to usage, each handling the normal items of mortality, interest, etc., but this shouldn't present any problems other than the volumes of paper consumed.

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In conclusion, I'd like to return to the issue regarding the strength of the opinion provided by the actuary in this process. As described, the committee safely tucked away within the introduction of our model report a rather weak opinion, limited to confirming the quality and extent of the actuary's work.

After some vigorous debate within our committee, it was agreed a much stronger, visible, signed opinion should be drafted for consideration and comment. The feeling was that since the valuation actuary has a duty to the various publics, as well as to his employer, and since so much time and effort was invested in determining the company's financial position and its future trends, he should be prepared to make some sort of meaningful public statement about his results.

An example of this "macho" approach is found in the report on a separate page titled "Valuation Actuary's Report on Solvency Testing." After several paragraphs describing the investigations performed, it concludes "In my opinion there is no immediate significant threat to the continuing solvency of the Company. Those scenarios, which result in significant reduction of Company surplus over the long term, have been discussed with management, along with implications as to possible future action. Signed: Guy Macho, FCIA."