# *The Concentration Charge: Reflecting Catastrophe Exposure Accumulation in Rates*

by Donald F. Mango, FCAS

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# Reflecting Catastrophe Exposure Accumulation in Rates

Donald Mango, F.C.A.S.
Crum & Forster Insurance

## Abstract

Diversification of exposure concentration means geographical balancing amongst capacity providers -- insurers, reinsurers, or capital market participants. But how to diversify those exposures is still unsettled. Efforts to this point have focused on balancing the exposures which have already been written by insurers -- via catastrophe reinsurance (regular or securitized), several proposed catastrophe indices, even direct exposure exchanges. This paper proposes an alternative approach: exposure balancing at the point of sale using an *insurance pricing structure* which reflects the insurer's exposure level or "*portfolio state*" -- what can be called *portfolio state dependent pricing.* Instead of one set of filed loss costs and loss cost multipliers, insurers would quote a manual rate which included a surcharge which reflects their exposure level in the area where the potential insured is located. If all carriers were required to quote on a similar basis, had similar loss costs and multipliers, a potential insured's desire to be charged the lowest premium would lead them to choose the carrier who was *least exposed in their area.*

## Biography

Mr. Mango is with Zurich Centre ReSource in New York City. Prior to that he was with Crum & Forster Insurance in Morristown, New Jersey, where he was responsible for Catastrophe Management, Ceded Reinsurance, and Umbrella pricing and reserving. He holds a B.S. degree in Mechanical Engineering from Rice University.

# The Concentration Charge: Reflecting Catastrophe Exposure Accumulation in Rates[1]

Donald Mango, F.C.A.S.
Crum & Forster Insurance

## Section 1: Introduction

This paper will present a method for reflecting exposure concentration in property catastrophe rates via a "*concentration charge*" -- an additional charge on top of the manual rate which varies based on the insurer's exposure level in the area where the potential insured is located.

On first glance one might well ask why have a concentration charge? In a perfectly functioning economy, with plentiful reinsurance and capital market capacity, insurers would be able to diversify away exposure concentration problems. Since the market does not reward diversifiable risks, it would appear a "charge" or return for exposure concentration risks could be an arbitrage opportunity. Insurers would collect the additional money for their concentration problems, then diversify those problems away, presumably for less cost than they collected in concentration charges. Competitive markets would not allow such an arbitrage engine to exist for long. So why continue this paper?

Because the situation is not as simple as that. Diversification of exposure concentration means geographical balancing amongst capacity providers -- insurers, reinsurers, or capital market participants. But how to diversify those exposures is still unsettled. Efforts to this point have focused on balancing the exposures which have already been written by insurers -- via catastrophe reinsurance (regular or securitized), several proposed catastrophe indices, even direct exposure exchanges.

This paper proposes an alternative approach: exposure balancing at the point of sale using an *insurance pricing structure* which reflects the insurer's exposure level or "*portfolio state*" -- what can be called *portfolio state dependent pricing*. Instead of one set of filed loss costs and loss cost multipliers, insurers would quote a manual rate which includes a surcharge reflecting their exposure level in the area where the potential insured is located. If all carriers were required to quote on a similar basis, had similar loss costs and multipliers, a potential insured's desire to be charged the lowest premium[2] would lead them to choose the carrier who was *least exposed in their area*.

[1] *I would like to thank Gary Blumsohn, Matt Mosher, Clive Keatinge and Paul Kneuer for their (in)voluntary efforts providing needed peer review and feedback. I would also like to thank the anonymous reviewers on the CAS Ratemaking Committee for their helpful comments.*

[2] Ignoring for discussion purposes issues such as insurer security levels, services and/or other coverages provided, personal relationships,....

This is an important distinction: the concentration charge proposed here is not a reward for bearing a risk which can be diversified away, it is a means to let the market forces at the point of sale do the diversifying.

This approach is a departure from the current ratemaking paradigm, and significant issues stand in the way of implementation. There is no place in the current filed loss cost/LCM paradigm for PSD pricing. Adoption would require fundamental changes to the concepts underlying insurance pricing. PSD pricing is also computationally intensive and complex. Personal lines carriers with hundreds of thousands or millions of policyholders may feel the additional costs outweigh any marginal benefits. However, as will be discussed below, these are not insurmountable problems.

Perhaps the biggest concern though is unfair discrimination. Under PSD pricing potential insureds could be quoted different rates based on the month, week, or day they come in. Such apparently arbitrary pricing does not seem appropriate for an economic necessity such as insurance.

However, PSD pricing need not appear arbitrary. The public could be made aware of the concentration charge's intended purpose. It could be broken out and quoted separately from the "regular" premium. Policyholders would have a strong incentive to shop around and get several quotes. They may even feel empowered rather than powerless in tight insurance markets such as Florida. They become an active participant in improving the insurance market rather than a passive recipient of what may seem arbitrary capacity decisions by carriers.

The remainder of this paper is organized as follows. Section 2 develops the needed surplus distribution, derived from the modeled loss distribution and available funds for payment of catastrophe losses. Section 3 introduces the concept of surplus tiers, which are ranges of percent of total policyholders surplus. In Section 4 we look at the costs of exposure accumulation and the concentration charge, an annual "payback" charge which takes the form of an expense load to be applied to the new account's loss cost. In Section 5 we combine all these concepts into an approach for pricing new business. We conclude in Section 6 with a discussion of PSD pricing in relation to the provisions in the CAS "Statement of Principles Regarding Property and Casualty Insurance Ratemaking" [1].

## Section 2: Needed Surplus Distribution

What is the relationship between surplus and the payment of catastrophe losses? The company has some collected funds on hand with which to pay catastrophe losses. It may be a planned or budgeted annual cat loss load, or the sum of collected loss cost provisions for catastrophe coverage (e.g. the wind load portion of the Basic Group 2 loss cost for Commercial Multi Peril). These funds will be referred to as the *catastrophe fund* (CF).

For events whose losses are less than or equal to the CF, no surplus is needed. However, surplus will be needed to cover losses in excess of the CF. This *needed surplus* is equivalent to the catastrophe loss net of a deductible equal to the CF amount. Each modeled event loss will require a different surplus amount. This means given a CF amount and a modeled loss distribution, one can develop a *needed surplus distribution*.

Using a modeled occurrence size of loss distribution[3] with event identifiers **i**, the event probabilities $p_i$ and modeled loss amounts $L_i$[4], the needed surplus distribution by event $NS_i$ is:

$$NS_i = \text{Max}[\, L_i - CF,\ 0\,] \qquad [2.1]$$

*where $L_i$ = modeled loss for event i*

It will prove more convenient going forward to express $NS_i$ as a percentage of PHS:

$$NS_i = \frac{\text{Max}[\, L_i - CF,\ 0\,]}{PHS} \qquad [2.2]$$

The needed surplus distribution tells us what percentage of the available surplus will be depleted by each modeled event. But different amounts of depletion can have qualitatively different impacts upon a company's ability to continue functioning post-event. To better discuss the different amounts of depletion we introduce the concept of *surplus tiers*.

## Section 3: Surplus Tiers

An insurer of reasonable size should be able to withstand an event-based depletion of say **-10%**[5] of available surplus without significant disturbance to ongoing operations. This amount might be considered the limit of "acceptable variation": there will be no regulatory intervention, ratings downgrades, or loss of market position or viability.

Between **-10%** and **-20%**, the company may begin to attract the attention of regulators and rating agencies. Between **-20%** and **-30%**, regulatory bodies may step in to oversee operations and protect the interests of other policyholders; guaranty funds may be put on alert; ratings downgrades are almost certain, and with them comes possibly irreparable damage to market position and viability. Between **-30%** and **-50%**, the company would almost certainly fall under direct regulatory control. Beyond **-50%**, the company is in all likelihood headed for major reorganization, runoff, or even insolvency.

[3] Annual aggregate loss distributions could also be used.

[4] See Appendix A for a discussion of possible modifications to modeled losses which a company may want to consider before calculating the needed surplus distribution.

[5] I have selected these breakpoints arbitrarily for discussion purposes.

These highlighted "ranges" demarcate what I call *surplus tiers*:

> Surplus tiers are ranges of surplus bounded by selected percentiles within which the ongoing operating status of the company is considered "constant."
>
> Movement from one tier to the next reflects a qualitative change in the ongoing operating status of the company.

We will be using this sample set of surplus tiers throughout the remainder of the paper:

Table 1 - Sample Surplus Tiers

| Surplus Tier | Percentile Range | Impact |
|---|---|---|
| 1 | 0-10% | None - Acceptable Variation |
| 2 | 10-20% | Regulatory and Rating Watch |
| 3 | 20-30% | Regulatory Oversight, Ratings Downgrade |
| 4 | 30-50% | Regulatory Intervention |
| 5 | 50-100% | Reorganization, Runoff or Insolvency |

(*Note the convention that "higher" numbered tiers of surplus represent deeper shocks and more severe impairment to the company.*)

This means that each modeled event has both a needed surplus amount $\mathbf{NS}_i$ and a *corresponding surplus tier* . Events can even be referred to by their tiers -- a very severe event might be "Tier 4." These tier references are both company specific and portfolio state dependent. They will change as the exposure levels, collected premiums, and surplus of the company change.

Now that we have a framework for relating exposure levels and surplus via tiers, we turn our attention to the development of an appropriate concentration charge.

## Section 4: The Concentration Charge

Should the concentration charge just be another form of risk load? If the answer is yes, then an application of one of the well known risk load methods -- from Kreps [2] or Meyers [3], for example -- would suffice. Both methods would give larger charges for adding a risk to a more exposed area, which makes intuitive sense.

However, these methods would generate a concentration charge for the addition of a risk to *any* geographic area, even those with Tier 1 exposure. This expands the concentration charge's definition beyond its intended focus: reflection of exposure

accumulation beyond critical amounts. Also, these methods while being theoretically sound may not be acceptable to a regulator as support for additional surcharges. The issue of additional (marginal) surplus and an appropriate return thereon have yet to be satisfactorily resolved in the public forum.

This may be a purely semantic distinction, but I intended for the concentration charge to serve as more of an *economic indicator* than as a reward for bearing risk. I had hoped this approach could be filed and used to develop portfolio state dependent rates for catastrophe coverage. I believe this requires a concentration charge which is economically sound yet understandable and acceptable to both regulators and the public.

In that light, I propose a formula for the concentration charge which focuses on the reparation of impairment by requiring depleted surplus to be *replenished* in order for the company to continue operating as a viable going concern. The time frame for replenishment would depend on the tier: higher tiers would need to be replenished more quickly than lower. Tier 2 surplus need not be replaced within one year, but maybe over five years. Depletion to the Tier 4 level may mean regulatory supervision, so a two year turnaround may be mandated just to restore viability.

Each tier will be assigned a replenishment period. Since each event has a tier associated with it, it too will have a replenishment period. That means an incremental dollar of loss to that event exposes a dollar of surplus which must be replenished within the appropriate time period. To accomplish this replenishment, that loss dollar would need to carry an accompanying annual surplus replenishment load (as a percent of that dollar of loss) equal to the inverse of the replenishment period (in years). This expense load shall be referred to as the *concentration charge* (CC):

Table 2 - Sample Surplus Tiers and Concentration Charges

| Surplus Tier | Percentile Range | Replenishment Period | Concentration Charge (CC) |
|---|---|---|---|
| 1 | 0-10% | - | - |
| 2 | 10-20% | 5 Years | 1/5 = 20% |
| 3 | 20-30% | 3 Years | 1/3 = 33% |
| 4 | 30-50% | 2 Years | 1/2 = 50% |
| 5 | 50-100% | 1 Year | 1/1 = 100% |

*Summary*

Before proceeding it may be helpful to review the new components to the approach:

- The needed surplus distribution by modeled event, expressed as a percentage of total surplus, associates a surplus tier with each event.
- Surplus tiers are percentile ranges of surplus within which the company's operational status is considered constant, but between which material changes in operational status are assumed to occur.
- Each tier has a different replenishment period associated with it, based on the severity of the predicament.
- The inverse of the replenishment period yields a surplus replenishment load called the concentration charge which is applied to any additional loss dollars added to that event by a new account.

These new components will now be combined into a pricing approach for a new account.

## Section 5: Pricing A New Account

The first step in pricing a new account is creation of its own occurrence size-of-loss distribution, consisting of loss amounts $n_i$ by event. The concentration charge dollars by event ($CC\$_i$) for the new account then equals

$$CC\$_i = [\ CC_i * n_i\ ] \qquad [5.1]$$

*where* $CC_i$ = *concentration charge for event i*

These dollars represent the replenishment costs of the additional loss to each event. For Tier 1 events, this charge is 0. For Tier 5 events, it is according to our example equal to an additional 100% of modeled loss for the new account -- a 100% surcharge to pay for exposure concentration.

The expected concentration charge dollars over all events (**CC$**) equals

$$CC\$ = \sum_i [\ CC\$_i * p_i\ ] \qquad [5.2]$$

*where* $\sum_i$ = *sum over all events*

The **concentration charge** (**CC**) -- the expense provision to be applied to the catastrophe loss cost -- is calculated as follows:

$$CC = CC\$ \ /\ \sum_i [\ n_i * p_i\ ] \qquad [5.3]$$

*where* $\sum_i [\ n_i * p_i\ ]$ = *modeled expected loss for new account*

This assumes that the ratio of

$$\frac{\text{expected concentration charge dollars}}{\text{modeled expected loss}}$$

is a suitable proxy for the required concentration charge to be applied to the filed *catastrophe*[6] loss cost.

*Example: Homeowners*

One might deem this detailed approach to be "continuous" PSD pricing. Computational and regulatory restrictions for a line like homeowners might call for more of a "discrete" or approximate method. An example would be *territorial loss cost multipliers*.

Begin by calculating the concentration charge for a sample policy added to each of the company's territories (could be bureau defined, county, zipcode,...). This concentration charge would be a loss-based expense to be included with the company's other expenses in developing loss cost multipliers. For example, say a company had two territories, Y and Z. Territory Z is more heavily exposed than Territory Y. Their expense loads and loss cost multipliers would be:

Table 3 - Example of Homeowners Territorial LCM's

| | Expense Item | Terr. Y | Terr. Z |
|---|---|---|---|
| (1) | Premium-Based Expense Load | 31% | 31% |
| (2) | Concentration Charge | 15% | 30% |
| (3) | Loss Cost Multiplier<br>= [ 1.00 + (2) ] /<br>[ 1.00 - (1) ] | 1.667 | 1.884 |

*(Note: the formula in (3) assumes the concentration charge is included as part of premium for determination of taxes, commission and other variable expense provisions. It could easily be modified to accommodate different treatments -- e.g. surcharge.)*

Territorial LCM's do represent a compromise position between PSI and PSD pricing. They would still be on file with the insurance department. An insured would be quoted the same manual rate independent of portfolio state for the period the LCM's are in effect. However, they do represent a step forward in their explicit recognition in the loss cost multiplier of the cost of exposure accumulation.

[6] Clearly the introduction of separate catastrophe loss costs and multipliers represents yet another regulatory hurdle to be overcome before this approach can be implemented. However, many cat-prone states are pushing companies to provide a cat/non-cat breakout of their "indivisible" package premiums (HO or CMP). See Walters and Morin [4] for more on separate cat rates.

*Example: Large Commercial Account*

Companies may wish to use the "continuous" approach when pricing a larger commercial account. The addition of a large account will likely have a substantial impact on the portfolio state, so it may be worth the extra effort to get the more exact answer from the continuous method over the approximate territorial method. Also, the locations may be so geographically dispersed that the territorial LCM method cannot be effectively applied.

Table 3 shows highlights of an example[7] showing the difference in concentration charge for adding a new account to two portfolios, LOW and HIGH. To reflect the differences in exposures, I set LOW's modeled losses equal to 50% of HIGH's by event.

Table 4 - Example of Adding a New Large Account

| | Item | Identifier | LOW | HIGH |
|---|---|---|---|---|
| (1) | Expected Loss | $\sum_i [ n_i * p_i ]$ | $151.78 | $151.78 |
| (2) | Expected Concentration Charge Dollars | CC$ | $9.73 | $33.38 |
| (3) | Concentration Charge = (2) / (1) | CC | 6.41% | 21.99% |

Holding all else constant, the difference between the LOW and HIGH concentration charges is due to the lower tiers exposure (see Columns (7) and (15) on Table 5).

## Section 6: Portfolio State Dependent Pricing and the CAS Ratemaking Principles

Before giving PSD cat pricing further consideration, we might ask how it compares to the recommendations of the CAS "Statement of Principles Regarding Property and Casualty Insurance Ratemaking" [3].

*It is important that proper actuarial procedures be employed to derive rates that protect the insurance system's financial soundness and promote equity and availability for insurance consumers.*

PSD pricing produces rates which directly reflect threats to a company's *financial soundness* due to exposure accumulation. PSD pricing is *equitable* among

[7] A full version of the example is included at the end of the paper in Table 5.

policyholders covered under different lines of business and/or different states, the collectibility of whose insurance is threatened by exposure accumulation. In counterpoint to the discriminatory charge against PSD pricing, one could argue that portfolio state *independent* pricing represents an implicit subsidy among property cat policyholders in high exposure areas and policyholders in other states and/or lines of business and/or companies. Excessive exposure accumulation also threatens the *availability* of insurance. If the exposure balancing promise of PSD pricing were fulfilled, it may actually lead to more availability.

*Principle 1: A rate is an estimate of the expected value of future costs.*
*Principle 2: A rate provides for all costs associated with the transfer of risk.*
*Principle 3: A rate provides for the costs associated with an individual risk transfer.*

PSD pricing is based on the view that the cost of adding a new cat policy depends not only on the characteristics of the policyholder (*transfer of risk*) but also on the state of the portfolio at the time it is written (*individual risk transfer*).

*Principle 4: A rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is [based on Principles 1-3].*

A PSD pricing process can be as objective and fair as a PSI process if it is systematic, based on sound economic principles, objectively applied, auditable, and not subject to distortion or fraud. It is not by definition unfairly discriminatory, instead reflecting the consumption and availability of a limited resource -- underwriting capacity as represented by surplus.

*[It] is desirable to encourage experimentation and innovation in ratemaking.*

That is the intent of this paper.

## Section 7: Conclusion

The outlined approach provides a connection between

- current portfolio exposure levels,
- modeled losses,
- the resulting exposure of surplus,
- the costs of that surplus exposure, and
- required pricing for a new account based on the current portfolio state.

It reflects exposure accumulation in the rates, but requires a ratemaking paradigm shift to portfolio state dependent pricing. There are unresolved regulatory and social issues of fairness and order dependency which clearly must be addressed for this approach to

ever be implemented. Still, it is meant to be a forward-looking paper, providing a conceptual framework for discussion and advancement of the science.

## References

[1] Casualty Actuarial Society, "Statement of Principles Regarding Property and Casualty Insurance Ratemaking," as adopted May, 1988.

[2] Kreps, Rodney, "Reinsurer Risk Loads from Marginal Surplus Requirements," *PCAS* LXXVII, 1990, pp. 196-203.

[3] Meyers, Glenn, "Managing the Catastrophe Risk," *Incorporating Risk Factors in Dynamic Financial Analysis*, Casualty Actuarial Society Discussion Paper Program, 1995, pp. 111-150.

[4 Walters, Michael, and Morin, Francois, "Catastrophe Ratemaking Revisited (Use of Computer Models to Estimate Loss Costs)," *CAS Forum*, Winter 1996, pp.347-382.

## Appendix A
## Possible Adjustments to Modeled Losses and Surplus

The needed surplus distribution should reflect all payments related to a large catastrophe net of all budgeted funds. There are several cost components which a company may want to consider in addition to the modeled loss amounts produced by their catastrophe models:

1. Reinsurance recoveries (including non-recoverables and Catastrophe reinsurance reinstatement premium);
2. Model adjustments -- demand surge, fire following earthquake;
3. Non-voluntary and guaranty fund assessments;
4. Bond losses due to forced liquidation.

(1) Reinsurance Recoveries
Needed surplus will be reduced by the recoveries from reinsurance programs, particularly catastrophe treaties. These recoveries and those from per risk treaties as well as facultative can be built directly into many catastrophe models to give accurate net loss numbers.

However, care should be taken to reflect reasonable non-recoverable provisions. It may not be realistic to expect full recovery in a $50B industry event for example. Also, cat treaty recoveries should be net of any reinstatement premium.

(2) Model Adjustments
Demand surge (the localized inflation of materials and labor after an event) and fire following earthquake are just two examples of adjustments to modeled results which may warrant reflection, depending on a company's conservatism and faith in the modeled results.

(3) Non-voluntary and Guaranty Fund Assessments
Both of these represent costs which will vary with industry event size and company participation. The assessments could be substantial and should not be ignored. Non-voluntary pools in cat-prone states have gone from insurers of last resort to first choice providers for the difficult to insure. Insurers and the public need to know the non-voluntary facilities' exposure levels.

(4) Bond Losses Due To Forced Liquidation
This item differs from the others in that instead of increasing losses it would act to decrease asset value and thus surplus. The P-C insurance industry could flood the capital markets in the aftermath of a large catastrophe in their demand for cash. This create a self-feeding downward pricing spiral, causing material losses to asset value.

## TABLE 5: Concentration Charge Example - Large Account

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|
| Event i | P(Event) p(i) | HIGH Portfolio Loss H(i) ($000's) | Collected Cat Loss Cost Amt CLC | Needed Surplus By Event NS(i) | Needed Surplus as % of PHS PHS = $500MM | Surplus Tier Exposed | Conc Charge CC(i) | New Account Loss n(i) ($000's) | Conc Charge Dollars CC$(i) |
| 1 | 0.76% | 200,000 | 10,000 | 190,000 | 38.0% | 4 | 50.0% | 1,811 | 905 |
| 2 | 0.75% | 175,000 | 10,000 | 165,000 | 33.0% | 4 | 50.0% | 3,270 | 1,635 |
| 3 | 0.40% | 150,000 | 10,000 | 140,000 | 28.0% | 3 | 33.3% | 2,236 | 745 |
| 4 | 0.52% | 125,000 | 10,000 | 115,000 | 23.0% | 3 | 33.3% | 277 | 92 |
| 5 | 0.32% | 100,000 | 10,000 | 90,000 | 18.0% | 2 | 20.0% | 2,128 | 426 |
| 6 | 0.73% | 85,000 | 10,000 | 75,000 | 15.0% | 2 | 20.0% | 3,268 | 654 |
| 7 | 0.80% | 70,000 | 10,000 | 60,000 | 12.0% | 2 | 20.0% | 2,900 | 580 |
| 8 | 0.65% | 55,000 | 10,000 | 45,000 | 9.0% | 1 | 0.0% | 2,170 | 0 |
| 9 | 0.31% | 40,000 | 10,000 | 30,000 | 6.0% | 1 | 0.0% | 2,447 | 0 |
| 10 | 0.73% | 25,000 | 10,000 | 15,000 | 3.0% | 1 | 0.0% | 819 | 0 |
| 11 | 0.40% | 15,000 | 10,000 | 5,000 | 1.0% | 1 | 0.0% | 1,186 | 0 |
| 12 | 0.34% | 12,500 | 10,000 | 2,500 | 0.5% | 1 | 0.0% | 4,948 | 0 |
| Else | 93.29% | 0 | 10,000 | 0 | 0.0% | 1 | 0.0% | 0 | 0 |
| | | | | | | | Expected Value : | 151.78 | 33.38 |
| | | | | | | | Concentration Charge : | 21.99% | |

| (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
|---|---|---|---|---|---|---|---|
| LOW Portfolio Loss L(i) ($000's) | Collected Cat Loss Cost Amt CLC | Needed Surplus By Event NS(i) | Needed Surplus as % of PHS PHS = $500MM | Surplus Tier Exposed | Conc Charge CC(i) | New Account Loss n(i) ($000's) | Conc Charge Dollars CC$(i) |
| 100,000 | 10,000 | 90,000 | 18.0% | 2 | 20.0% | 1,811 | 362 |
| 87,500 | 10,000 | 77,500 | 15.5% | 2 | 20.0% | 3,270 | 654 |
| 75,000 | 10,000 | 65,000 | 13.0% | 2 | 20.0% | 2,236 | 447 |
| 62,500 | 10,000 | 52,500 | 10.5% | 2 | 20.0% | 277 | 55 |
| 50,000 | 10,000 | 40,000 | 8.0% | 1 | 0.0% | 2,128 | 0 |
| 42,500 | 10,000 | 32,500 | 6.5% | 1 | 0.0% | 3,268 | 0 |
| 35,000 | 10,000 | 25,000 | 5.0% | 1 | 0.0% | 2,900 | 0 |
| 27,500 | 10,000 | 17,500 | 3.5% | 1 | 0.0% | 2,170 | 0 |
| 20,000 | 10,000 | 10,000 | 2.0% | 1 | 0.0% | 2,447 | 0 |
| 12,500 | 10,000 | 2,500 | 0.5% | 1 | 0.0% | 819 | 0 |
| 7,500 | 10,000 | 0 | 0.0% | 1 | 0.0% | 1,186 | 0 |
| 6,250 | 10,000 | 0 | 0.0% | 1 | 0.0% | 4,948 | 0 |
| 0 | 10,000 | 0 | 0.0% | 1 | 0.0% | 0 | 0 |
| | | | | | Expected Value : | 151.78 | 9.73 |
| | | | | | Concentration Charge : | 6.41% | |

## Notes for Table 5
## Concentration Charge Example - Large Account

Column (1) = the event identifier **i**
Column (2) = the event probability $\mathbf{p}_i$
Column (3) = the current losses for the HIGH portfolio $\mathbf{H}_i$
Column (4) = the collected catastrophe loss cost amount **CF** of $10MM
Column (5) = the needed surplus by event $\mathbf{NS}_i$ for the HIGH portfolio
= the maximum of [(3) - (4)] and 0
Column (6) = the needed surplus by event as a % of PHS (= $500MM).
Column (7) = HIGH surplus tier from Table 2
Column (8) = HIGH concentration charge $\mathbf{CC}_i$ from Table 2
Column (9) = the New account loss $n_i$.
Column (10) = the HIGH concentration charge dollars $\mathbf{CC\$}_i$ by event
= [(8) * (9)]
Column (11) = the current losses for the LOW portfolio $\mathbf{L}_i$
Column (12) = Column (4)
Column (13) = the needed surplus by event $\mathbf{NS}_i$ for the LOW portfolio
= the maximum of [(11) - (12)] and 0
Column (14) = the needed surplus by event as a % of PHS (= $500MM).
Column (15) = LOW surplus tier from Table 2
Column (16) = LOW concentration charge $\mathbf{CC}_i$ from Table 2
Column (17) = Column (9)
Column (18) = the LOW concentration charge dollars $\mathbf{CC\$}_i$ by event
= [(16) * (17)]

Expected losses for the New account = $\sum_i$ [ (2) * (9) ]

Expected **CC$** for the HIGH portfolio = $\sum_i$ [ (2) * (10) ]

HIGH Concentration Charge **CC** = 33.38 / 151.78 = **21.99%**

Expected **CC$** for the LOW portfolio = $\sum_i$ [ (2) * (18) ]

LOW Concentration Charge **CC** = 9.73 / 151.78 = **6.41%**