TOWERS PERRIN

Workers' Compensation Terrorism Reinsurance Pool Feasibility Study

Summary of Study Findings and Conclusions

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PREFACE

The terrorist attack of September 11, 2001 was first and foremost a human tragedy. With over 3,000 fatalities and countless more people displaced from their homes and businesses, the attack directly affected the lives of tens, if not hundreds, of thousands of people — and left an indelible imprint on the nation's psyche.

In addition to the devastating human toll, the September 11 attack shook the U.S. economy. While many sectors were adversely affected, nowhere was the effect felt more strongly than in the property/casualty insurance and reinsurance industries. Insurers and reinsurers absorbed the brunt of the direct economic losses, mitigating the economic impact on untold individuals and businesses. The latest consensus estimates suggest that, once the claims are finally settled, insured losses from the September 11 terrorist attack will total between $40 billion and $50 billion. This is by far the most devastating and costly catastrophic event in the history of the insurance industry.

Immediately after the September 11 attack, the insurance industry did exactly what the public expected it to do: insurers began paying the claims resulting from the insured losses of their policyholders — notwithstanding the staggering value of those losses and the fact that no specific charges for terrorism exposure were included in commercial premiums.[1]

At the same time, insurers and reinsurers began the process of reassessing their risk in light of this new and difficult peril. Data on geographic concentrations of exposure were compiled and scenario models of alternative terrorist attacks were developed. The inescapable conclusion for many insurers was that the prospect of future terrorist attacks on the scale of September 11 — and, conceivably, significantly greater in the case of a nuclear, biological, chemical or radiological attack — represented a level of risk that they could not prudently accept. Terrorism experts have developed plausible scenarios in which the estimated total insured losses from a single event could exceed $250 billion.

In the months after September 11, there was a large-scale withdrawal of commercial insurance capacity for terrorism as insurers sought to reduce their terrorism risk to manageable levels. This primarily took the form of (a) coverage exclusions that protected insurers against losses from future terrorism events, introduced as insurance contracts were renewed; and (b) non-renewal of policies deemed to have too much terrorism exposure. The withdrawal of primary insurer capacity was exacerbated when commercial reinsurers (which act as "insurers to the insurers") were unwilling and/or unable to provide the needed terrorism reinsurance protection to their primary insurer customers.

[1] Some have suggested that the insurance industry performed exceptionally, even paying claims that under "normal" circumstances it might have legitimately challenged.

As the turmoil in the insurance market began to threaten the broader economy (particularly in the financing and construction of commercial property), Congress responded by enacting The Terrorism Risk Insurance Act (TRIA). The intent of TRIA was to provide a temporary window of relief to enable insurers to develop private market solutions to manage the ongoing risk of terrorism. While many of the TRIA provisions relate to the operation of commercial insurance markets, TRIA also created a temporary federal backstop that will reimburse insurers for terrorism losses above certain thresholds. In effect TRIA provides commercial insurers with the vital protection against the risk of catastrophic terrorism losses, without which they might not be able to provide terrorism coverage to all who want it. Most critically, the window of relief and the federal backstop protection closes when TRIA sunsets on December 31, 2005.

Today (in early 2004) most observers would agree that TRIA has contributed to the stabilization of the commercial insurance market. Coverage for terrorism is available (although expensive in some cases) and, more generally, the markets for Commercial Property and workers' compensation insurance are operating in an orderly manner. However, the existence of orderly markets should not be taken to imply that the issues associated with insuring against terrorism are solved. Terrorism presents numerous issues that defy the traditional assumptions upon which private insurance is based: that claim experience in the past is predictive of experience in the future; that the risk of loss is sufficiently stationary that it can be reasonably priced a year or more in advance; that the risk of loss on each policy is independent of other policies, such that risk can be diversified away through the pooling together of many policies; and, perhaps most important, that insured losses from a foreseeable single event will not expose the insurer to ruinous financial loss.

These issues are particularly acute for workers' compensation insurers because of the uniqueness of the coverage provided on this insurance product. In managing terrorism risk, workers' compensation insurers face a unique set of challenges for two important reasons:

(1) With the exception of one state,[2] workers' compensation statutes do not permit the exclusion of terrorism or war losses. Unlike other lines, where coverage for terrorism may be excluded or limited contractually, an insurer's decision to write a workers' compensation policy brings with it the potential for losses from all perils — including terrorism.

(2) The benefits payable under a workers' compensation insurance policy are defined by state statute rather than by negotiation between the insurer and insured. Unlike Accident & Health policies that use co-payments and caps on the maximum amount payable to manage overall costs and risk, statutory benefit provisions expose workers' compensation insurers to unlimited benefit payments. Payments to individual

[2] The Pennsylvania workers' compensation law excludes loss due to acts of war; all other states and jurisdictions are silent on this issue.
[3] Individual medical claims, particularly those involving burns and extensive skin grafting, can result in workers' compensation medical payments in excess of $15 million.

claimants are limited only by statutory benefits, which include unlimited potential medical payments on individual claims.[3] Payments are also not limited by caps on the aggregate payments to multiple claimants.

In combination, these factors create a situation in which a workers' compensation insurer that provides coverage to hundreds or even thousands of employees working in close proximity is exposed to potentially ruinous catastrophe losses from acts of terrorism. Experts have developed attack scenarios in which the total insured losses for workers' compensation alone would be $50 billion or even higher. And the only two options available to the insurer to manage this catastrophe risk are either to: (1) not write the workers' compensation policy in the first place, or (2) obtain catastrophe protection from a third party.

Since the overall demand for workers' compensation insurance coverage must be met, the critical issue for private workers' compensation insurers is where the capacity to provide cost-effective catastrophe protection will come from; and whether new, capacity-creating private market mechanisms are feasible. Historically, this catastrophe protection has come primarily from commercial reinsurers; however, it is unlikely that reinsurers will be able or willing to fully meet the needs of primary insurers for terrorism protection in the new environment. The catastrophe protection provided by reinsurers today — and in the foreseeable future — continues to be very limited in size and scope, particularly in relationship to the magnitude of potential losses.

One possible alternative source of terrorism protection is an industry pool in which catastrophe losses arising from terrorism would be shared among the participating insurers. An industry effort was launched to explore the feasibility of this alternative — a voluntary workers' compensation terrorism reinsurance pool that would be an effective, equitable, voluntary risk-sharing mechanism; and that could attract significant industry participation, spread the risk as broadly as possible across the industry and complement any federal backstop relief.

The feasibility study was funded by fourteen insurers that account for roughly 40% of the workers' compensation market. The sponsor group engaged the Tillinghast and Reinsurance businesses of Towers Perrin to conduct the feasibility study. This paper summarizes the work and conclusions from the study, which took place between April and September of 2003.

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March 2004

I. EXECUTIVE SUMMARY

CONTEXT

In the aftermath of the September 11 terrorist attack, it has become clear that the insurance industry faces a new and difficult source of risk — one that will almost certainly generate additional insured losses from future events. Experts have stated that another terrorist attack is almost certain to occur, and that even with an ongoing commitment to the war on terrorism, the risk of attacks will persist for many years.

The prospect of future terrorist attacks on the scale of September 11 — and, conceivably, significantly greater in the case of nuclear, biological, chemical or radiological attack — poses an enormous ongoing challenge for the insurance industry. Experts have developed plausible scenarios in which the estimated total insured losses could exceed $250 billion. Quite simply, the private insurance industry does not have enough capital to withstand the potential losses from a massive terrorist event or an onslaught of multiple terrorist attacks — nor the private market mechanisms to spread this level of risk broadly enough to make it manageable.

The issue is particularly acute for workers' compensation insurers because of the statutory nature of the coverage. Since insurers cannot exclude or limit coverage for terrorism losses on workers' compensation policies, the only two options available to manage the risk of catastrophic losses from this peril are either to: (1) discontinue writing the workers' compensation policy in the first place or (2) obtain catastrophe protection from a third party.

Congress responded to the turmoil created by the emergent risk of terrorist losses by enacting The Terrorism Risk Insurance Act (TRIA). The intent of TRIA is to provide a temporary window of relief so insurers could develop private market solutions to manage the ongoing risk of terrorism. Among its many provisions, TRIA creates a temporary federal backstop that will reimburse commercial insurers for terrorism losses above certain thresholds, providing them with a vital source of protection against the risk of catastrophic terrorism losses. Without that protection, insurers might not be able to provide terrorism coverage to all who want it. However, even under TRIA, individual insurers retain significant terrorism exposure due to high and escalating TRIA deductibles, and — for workers' compensation writers — the mandatory provision of terrorism coverage required under state workers' compensation laws.

From the insurance industry's perspective, TRIA represents a valuable first step in recognizing that the complexities and magnitude of terrorism risk are extraordinary and cannot be resolved by the insurance industry alone. However, the window of relief afforded by the federal backstop protection closes when TRIA sunsets on December 31, 2005.

Following TRIA's passage, a group of 14 workers' compensation insurers came together to assess the feasibility of a workers' compensation terrorism reinsurance pool. Their purpose was to explore whether such a pool could serve as an effective, equitable, industry risk-sharing mechanism that could help address the unique challenges that terrorism risk poses for workers' compensation insurers.

Three key issues were identified at the outset of the study as the likely major obstacles to the success of a voluntary pool: (a) creating a meaningful addition to industry risk-taking capacity, (b) measuring the terrorism exposure of each participating insurer in a meaningful manner, and (c) achieving equity among the diverse set of insurers that write workers' compensation. These issues were a focus of analysis in the study and are treated at some length in the body of this report. Before summarizing the conclusions related to these and other important issues, it is useful to first briefly describe the essential features of the prototype pool design.

PROTOTYPE POOL DESIGN

The final prototype design was intended to describe a specific, tangible pool structure consistent with the discussion and decisions made with sponsors throughout the feasibility assessment process. It was expected that the prototype would be subject to further refinement and specification if the effort were to advance to a detailed pool design phase.

Strategic and tactical objectives for the pool, together with a set of guiding principles, informed the design and served as touchstones to help evaluate alternative designs. These were captured in a concise mission statement:

The goal of the Workers' Compensation Reinsurance Pool is to maximize the effective use of industry-wide capacity and minimize the potential for insurer insolvency/ruin resulting from large and unpredictable terrorism events,

- *By mutualizing primary workers' compensation insurers' extreme event terrorism risk across geography and over time,*
- *In order to help ensure stable, affordable coverage for employers and provide uninterrupted benefits to injured workers,*
- *To the capacity limit of the voluntary, private-market mechanism,*
- *In a manner that integrates with other industry reinsurance, including a federal backstop.*

The pool would provide aggregate coverage for domestic and foreign terrorism losses. It would reimburse members for 90% of losses in any year that are in excess of the member's retention for that year, subject to an overall limit. Losses would be defined broadly to include claims arising out of foreign and domestic terrorism acts occurring in the U.S., including nuclear, biological, chemical and radiological attacks.

The pool would be an aggregate excess reinsurer funded primarily through accumulated premiums paid by members. There would also be a small post-loss funding element to enhance capacity in the first two years — or thereafter, if the pool's capacity were depleted by losses. Companies would share an aggregate limit, rather than an individual company limit on pool recoveries — that is, total pool resources would be available to all members. The limit would build over time, as funds in the pool accumulated.

An estimate of pool participants' relative exposure to terrorism losses would serve as the basis for determining each participant's "burden" (i.e., pre-funded premium, paid-in capital contribution, post-loss assessment).

The attachment points offered by the pool — the point at which the losses of an individual member are sufficiently large to trigger reimbursement of losses above it — would vary by size of company; each member would be offered several attachment point options. Commercial reinsurance could be purchased "underneath" the pool's attachment point, to the extent that companies had lower risk tolerances and coverage were available.

While TRIA remains in effect, an insurer's losses for pool attachment point purposes would be its losses after any applicable TRIA recoveries.

More details on the prototype pool design can be found in Section IV, Prototype Pool Design.

ISSUES AND CONCLUSIONS

The pool feasibility study represented a major investment of time and effort on the part of the industry participants over a period of nearly six months. What, then, are the key insights that emerge?

Capacity

The most critical issue for the pool is the capacity that it creates. Simply stated, there is no compelling reason to create the pool unless it contributes materially to the insurance industry's capacity to insure terrorism exposure. (The term "capacity" refers to an insurer's ability to write business — that is, to maintain sufficient capital resources to absorb losses from fluctuations in its financial performance, mostly due to adverse fluctuations in insurance claims.)

A voluntary reinsurance pool does not in and of itself create net additional ("new") industry capital. Rather, by participating in a pool, participants agree to share their risk and capacity with one another in a way that reduces the likelihood that any individual participant will suffer severe financial loss (or become insolvent) from a terrorist event. However, in so doing, the pool increases the diversification of risk and thereby creates some additional capacity for its members by increasing the efficiency with which existing capital is deployed.

In this context, the central capacity question is: Can the pool accumulate enough capacity to afford meaningful protection to its members against catastrophic terrorism losses? The answer: While the pool could create some capacity, it would not be enough to matter in the case of a major terrorism event. In fact, the entire industry's capacity is not enough to respond to a mega event. Herein lies the fundamental, intractable problem with respect to insuring terrorism risk.

Using very round numbers, private workers' compensation insurance is roughly a $30 billion industry — that is, annual premiums collected for workers' compensation are about $30 billion. Again using round numbers, insurers write workers' compensation business with roughly a one-to-one relationship between premium and capital, meaning that every dollar of premium is backed by an equivalent dollar of capital that is available to cover adverse fluctuations in workers' compensation claims/losses. Without a federal backstop that caps industry losses, a mega event — including a nuclear, biological, chemical or radiological attack that terrorism experts consider plausible — could exceed the entire workers' compensation industry's capital.[4] Terrorism and insurance experts conceive of plausible catastrophic terrorism events that generate workers' compensation losses of $90 billion or more; in rough numbers, this is over three times the capital backing the private insurance industry's workers' compensation line of business! It is impossible to ignore the consequences of inadequate overall industry capacity for the pool.

If the industry as a whole does not have enough capital to manage the risk of terrorism, then neither can an industry pool that simply mutualizes the existing industry capital. Longer term, even if the pool were to be funded at an aggressive rate, it would take many years before it could build enough capital of its own to protect against even "moderate" terrorism events. In the face of catastrophic events (the type that threaten the viability of the industry), the pool could not provide the industry any meaningful protection for the foreseeable future. This is true even under the most optimistic assumptions including, notably, that the pool could achieve favorable tax treatment that enables it to accumulate capacity more quickly.

Federal Backstop Protection

The issue of capacity leads to another important conclusion about the need for a more permanent federal backstop.

For catastrophic losses — ones in which the size of the loss approaches or exceeds the industry's capital — a logical solution is a public/private partnership involving some form of federal backstop. Other solutions that would limit workers' compensation insurer losses, such as allowing terrorism exclusions in workers' compensation policies, are clearly less desirable.

[4] Although an insurer's entire capital base (i.e., capital supporting all lines of business) is theoretically available to pay for workers' compensation losses, it is reasonable to assume that terrorism events that cause catastrophic workers' compensation losses would also result in devastating losses in other lines of business. It is therefore double-counting to compare workers' compensation terrorism losses to total industry capital.

In addition to these mega events, terrorism experts contemplate small and "medium"-sized events. Insurers would likely be able to absorb the associated losses from small events themselves. For medium-sized events, depending on the size and concentration of losses, some insurers could absorb these losses themselves, but smaller, less well-capitalized and mono-line workers' compensation writers could be significantly impaired by them.[5] Some of these insurers could find a reinsurance pool valuable to help manage intermediate size losses that are within the capacity of the industry but beyond their individual capacity to absorb, both for medium-size losses and for the portion of losses from a mega event that falls below a federal backstop.

So, an ongoing federal backstop is critical to the management of terrorism risk in workers' compensation. Without it, the industry could be decimated by catastrophic terrorism losses and insurers and regulators will face a significant dilemma — how to provide statutorily required coverage without being certain that insurers could fulfill their promise if there were a major terrorism event. This prospect looms as TRIA's expiration date approaches.

Measuring Terrorism Exposure

For a voluntary pool to work, participants must perceive that their burden is fair in relation to the benefit they receive. Unless participants believe that they would be treated equitably in terms of measuring their contribution to pool exposure and their draw on pool resources in case of a loss, they would likely not be willing to join the pool.

For purposes of the pool feasibility study, the challenge was to define a consensus measure for terrorism exposure and determine if the necessary data are, or could become, available as the basis for measuring each company's contribution to the pool's overall terrorism exposure.

The sponsor group unanimously agreed that employee headcount data by geographic location represents the best measure of workers' compensation terrorism exposure from among the three possible contenders (workers' compensation premium, payroll, headcount). Moreover, the analysis suggested that "reasonably credible" location-specific headcount data is available because of insurers' extensive efforts to gather these data for internal risk management purposes since 9/11. Although the data are far from perfect, they appear adequate to support the exposure measurement process required for the pool; the data are also improving over time as insurers enhance their collection and validation processes.

Agreeing on a terrorism exposure measure is itself a significant accomplishment; a uniform industry measure of terrorism exposure could yield benefits in both efficiency (e.g., standardize data protocols for reinsurance proposals/purchase, facilitate responses to state insurance department questions) and effectiveness (e.g., provide a more reliable basis for developing terrorism loads within the primary rate structure).

Achieving Equity

Having established that reasonably reliable exposure data appear available, the next question is whether it is possible to translate the differences in pool participants' terrorism exposure into a fair and appropriate pool "burden" — i.e., a pool reinsurance pricing formula.

The feasibility study suggests that developing an equitable pricing formula is theoretically possible. (It is also fair to say that the feasibility study sponsors did not reach consensus on the proposed pricing basis for the pool.) The existence of several credible commercial terrorism loss models that could be selected from and/or combined into a consensus model creates a range of possible pricing formulae.

But ultimately, implementing a voluntary pool is not a theoretical exercise. Negotiating a mutually agreeable pricing approach among charter pool members would undoubtedly be very difficult. Considerably more work would be needed to determine whether an agreeable pricing formula could be developed. This is clearly an obstacle that must be overcome to be able to implement a pool.

[5] While these impairments/insolvencies may not jeopardize the industry's overall stability, insurer failures often result in market disruptions that affect the continuity of medical care and payments to injured workers, delay reimbursements to medical providers, increase costs to employers, etc.

Basis Differences Between Pool Reinsurance Cost and Terrorism Loads in Primary Workers' Compensation Rates

The recommended exposure base for the pool is employee headcount; moreover, the pool's rates per headcount will vary by geographic location within a state and factor in each insurer's exposure concentration. This rating structure, which the participants agreed was necessary to achieve equity, is quite different from the current terrorism loads typically built into the primary workers' compensation rates. (Generally the latter do not vary geographically within a state, and use non-terrorism premiums or payroll as their exposure base.) Unless the primary rating structure is modified, the basis for terrorism pricing between the primary workers' compensation rates and the reinsurance pool will be inconsistent, such that the terrorism premium collected on an individual insurance policy could be greater or less than the incremental cost of buying pool reinsurance. This will inevitably create pressures to adjust the primary rates, so that they are consistent with pool reinsurance costs.

CURRENT STATUS

So where do things now stand?

The sponsor group decided not to pursue the detailed design and implementation of a voluntary workers' compensation terrorism reinsurance pool at this time. Ultimately, the pool would not offer enough capacity to meaningfully help the industry absorb losses from catastrophic terrorism events — the primary reason for its formation. This is particularly true given the considerable uncertainty about the future of federal backstop relief. Quite simply, without some form of a more permanent federal backstop, the pool would not materially help. In addition, the specific design of the pool could not be finalized without knowing how any ongoing federal backstop will work. Logic suggests that further work on the pool design should occur after the form of any federal backstop is known; the pool can then be designed to integrate with that program.

The sponsors agreed that the effort had created important insights into the key philosophical, conceptual and practical issues associated with creating a workers' compensation reinsurance pool and has laid the foundation for future work on an industry pool, if and when further work is appropriate.

LOOKING AHEAD

Although we can know little about the future, it seems certain that the threat of terrorism will continue for the foreseeable future. Al Qaeda, and those sympathetic to its cause and committed to its methods, views its enterprise as an epic struggle — one with no room for compromise and no end date.

For the insurance industry, a critical milestone is fast approaching: With TRIA set to expire on December 31, 2005, insurance policies written and renewed beginning in January 2005 will extend beyond the current TRIA federal backstop protection. The expiration of TRIA could dramatically alter the current market equilibrium and could cause significant market disruption. Inevitably, insurers will need to reconsider how they compete in a workers' compensation market that mandates terrorism coverage for insureds but leaves them fully exposed to potentially ruinous losses.

While it seems clear that current conditions are not right for a voluntary industry workers' compensation reinsurance pool, if and when the outlines of a federal solution are developed, it may be useful to revisit the pool concept — to consider whether a pool, effectively integrated with the federal backstop, could help some portion of the insurance industry manage its terrorism exposure.

Undoubtedly, between now and the TRIA expiration date there will be much discussion about the roles and capacity of individual insurers, the insurance industry and the federal government in managing terrorism exposure. We believe that the results of this feasibility study will contribute to the dialogue aimed at finding a sensible, long-term solution that serves — and balances — the interests of insureds, insurers and taxpayers.

II. INTRODUCTION

As noted earlier, the critical issue for workers' compensation insurers in the post-September 11 environment is the need for capacity to provide cost-effective catastrophe protection against potential future terrorism losses. While reinsurers are now providing some limited protection and TRIA provides some temporary relief, the catastrophe protection available today is insufficient and will become substantially more so when TRIA sunsets.

To begin addressing this issue, an industry effort was launched to explore the feasibility of a voluntary workers' compensation terrorism reinsurance pool. The feasibility study was facilitated by the American Insurance Association (AIA) and funded by 14 insurers that account for roughly 40% of the workers' compensation market. The sponsors reflect the broad diversity of workers' compensation insurers — small and large companies, mutual and stock companies, state funds and private writers. The Property Casualty Insurance Association of America (PCI, then the Alliance of American Insurers and the National Alliance of Independent Insurers) and the National Council on Compensation Insurance (NCCI) were also represented. The sponsor group — led by Richard Palczynski, then Chief Actuary at The Hartford and the selected project leader for this initiative, with the assistance of Bruce Wood, Assistant General Counsel at the AIA — engaged the Tillinghast and Reinsurance businesses of Towers Perrin to conduct the feasibility study.

The objective of the study was to assess the feasibility of a workers' compensation terrorism reinsurance pool: an effective, equitable, voluntary workers' compensation terrorism risk-sharing mechanism, that could attract significant industry participation, spread the risk as broadly as possible across the industry and complement any federal backstop relief. More specifically, the project objectives were to:

- Solicit industry perspectives to establish a set of common objectives for the pool
- Develop, test and validate an approach for measuring relative terrorism exposure
- Analyze options against objectives and develop a specific prototype pool design
- Model potential pool liabilities, capital requirements and risk-sharing efficacy
- Assess preliminary interest in participating in such a pool.

This study represents an effort by the insurance industry — in combination with the essential support of a federal insurance terrorism backstop — to address the unique challenges faced by workers' compensation insurers in light of the emergent threat of terrorism. (See the box insert *"What is Workers' Compensation Insurance and How Is It Unique?"* for an overview of workers' compensation and its unique attributes.) The feasibility study focused on a voluntary pool that would operate according to market-based principles; however, the key conclusions would be applicable to a mandatory pool as well.

This paper summarizes the work and conclusions from the study, which took place between April and August, 2003. The paper describes the prototype pool design developed with the project sponsors, examines the key obstacles to creating a voluntary pool and articulates the key conclusions from the study. The paper is designed for a non-technical audience so that the work might be useful to further efforts by readers both within and outside the industry.

STRUCTURE OF THE PAPER

The paper is structured as follows:

- The Preface describes the overall market context within which this study was conducted, including the challenge workers' compensation insurers face in trying to manage terrorism risk.
- Section I, The Executive Summary, distills the study's key findings; by necessity much of the detail is excluded.
- In Section II, Introduction, we describe the study's objectives and the structure of this report; we also include a brief overview of workers' compensation and why it differs from other lines of insurance regarding terrorism.
- Section III, Pool Objectives, Guiding Principles and Perceived Obstacles, lays out the objectives and principles that guided the design of the pool and served as touchstones for evaluating alternative designs; we also introduce the three key obstacles — capacity, measuring terrorism exposure and achieving equity — identified as the critical challenges for a voluntary pool, which therefore became the focus of analysis and discussion during the study.
- Section IV, Prototype Pool Design, describes the pool's conceptual design, beginning with a discussion of two basic structural design elements — first dollar vs. excess and pre-funding vs. post-funding. A basic understanding of the pool's design will provide useful context for the discussion of key issues in the next section.
- Section V, Underwriting Issues and Analysis, addresses the three main obstacles introduced in Section III — capacity, measuring terrorism exposure and achieving equity.
- In Section VI, Illustrative Pool Offer, we describe the hypothetical offers given to sponsors (as if they were being solicited to participate in a real pool) to help further test the conceptual pool design.
- Section VII, Conclusions, highlights essential learnings and implications that emerged from the study and elaborates on some of the findings introduced in the Executive Summary.
- The appendices provide additional detail, illustrations and technical discussion of issues raised in the body of the report.

WHAT IS WORKERS' COMPENSATION AND HOW IS IT UNIQUE?

Workers' (originally "Workmen's") Compensation is a form of social insurance developed in the early 1900s to respond to the occupational hazards inherent in a modern, industrialized economy.

Before the advent of workers' compensation, injured workers could sue their employers in court to collect compensation for medical expenses, lost wages and, possibly, pain and suffering from workplace injuries. Although the burden of proof on the worker to prove employer negligence was considerable, the monetary award could also be large if the suit were successful. Workers who couldn't prove negligence (and the state of the law at the time made this very difficult), were often left destitute, with no social safety net to provide relief. The introduction of workers' compensation, was an effort to provide a social safety net and at the same time introduce economic incentives for employers to improve workplace safety (since employers would now pay the cost of injuries that resulted from a dangerous work environment). In addition, absent a workers' compensation system, the potential for numerous worker lawsuits combined with possibly sizeable awards against employers would introduce friction/inefficiency into the developing industrial economy.

Developed as a form of no-fault insurance (i.e., injured workers are compensated without assignment of blame), workers' compensation is intended to provide a floor of financial security for workers and to protect employers from litigation to secure compensation for workplace injuries. Workers' compensation provides for payments to workers to cover medical costs and lost wages resulting from work-related injuries; in the case of work-related fatalities, benefits are paid to workers' spouses/dependents. Like all insurance, workers' compensation is regulated at the state level; however, unlike other lines, workers' compensation benefits are specified by statute and vary considerably by state.

Like other lines of insurance, workers' compensation insurance was not designed, nor ever intended, to cover terrorism risk.[6] However, terrorism risk is particularly problematic for workers' compensation insurance because it differs in important ways from other types of insurance:

- No exclusions or coverage modifications — Workers' compensation insurance policies cover occupational injuries without regard to the peril that caused the injury. Terrorism risk cannot be excluded from coverage without state legislative action.
- Mandatory coverage — Providing statutorily prescribed benefits for injured workers is mandatory for virtually all employers[7]; availability of insurance coverage is statutorily guaranteed through state workers' compensation funds or assigned risk mechanisms.
- Unlimited obligations/no policy or claims limits — There are no caps on medical payments or for lifetime income replacement, nor are there any overall policy limits on payments from one event or in the aggregate. This means an individual employee who is seriously injured can generate medical payments in excess of as much as $15 million. It also means that if many individuals were injured in a single event (or series of related events), losses could accumulate without limit.
- Statewide rating — Rating is on a statewide basis, with no provision for territorial rates (by contrast, terrorism risk is considered to be highly territorial).

By far the most significant of these differences is the first: workers' compensation insurers cannot make coverage exclusions without specific state legislation allowing them to do so. That is, workers' compensation covers workers from virtually every conceivable source of injury incurred while on the job.

[6] It is perhaps more accurate to state that like most other lines of insurance in the U.S., terrorism was never perceived as an exposure for workers' compensation. This was not a question of product "design" per se, but rather (in hindsight) lack of awareness. Nevertheless, the intent of workers' compensation was always to provide protection against occupational hazards, which arguably do not include terrorism — at least in spirit, if not in statute.

[7] Most employers satisfy this requirement by purchasing commercial workers' compensation insurance. Some employers — particularly very large ones — self-insure (i.e., set aside their own funds to pay for losses). Even employers that self-insure often purchase commercial "excess" insurance to cover losses that exceed a certain threshold in order to protect themselves from unusually large workers' compensation losses.

III. POOL OBJECTIVES, GUIDING PRINCIPLES AND PERCEIVED OBSTACLES

OBJECTIVES AND GUIDING PRINCIPLES

At the outset of the feasibility study, the sponsors agreed on the key strategic objectives for the voluntary pool as well as a number of more specific tactical design objectives and considerations. (See Exhibit 1)

These objectives were translated into a concise mission statement that describes the essential purpose and goals of the pool:

The goal of the Workers' Compensation Reinsurance Pool is to maximize the effective use of industry-wide capacity and minimize the potential for insurer insolvency/ruin resulting from terrorism events,

- *By mutualizing primary workers' compensation insurers' extreme event terrorism risk across geography and over time,*
- *In order to help ensure stable, affordable coverage for employers and provide uninterrupted benefits to injured workers,*
- *To the capacity limit of the voluntary, private-market mechanism,*
- *And provide a window to other industry reinsurance, including a federal backstop.*

This mission, which had broad agreement among the sponsor group, together with the following guiding principles developed with project sponsors, guided the pool design and served as touchstones to help evaluate alternative designs:

EXHIBIT 1
Overarching Pool Strategic and Design Objectives

Strategic Objectives		Design Objectives/Considerations
Mutualize the extreme event risk across the insurance industry (or more broadly), to maximize the effective use of industry-wide capacity and minimize risk of insolvency/ruin	Industry Based Solution	Provide a cost-effective, equitable and competitively neutral mechanism for managing this risk
		Create a mechanism that can serve as a "window" to any proposed ongoing federal backstop program for the most extreme events
Provide a tangible measure of terrorism cost, facilitating inclusion of a terrorism load in approved primary workers' compensation loss costs		Provide a tax-efficient mechanism to build up a fund to pay for these losses when they eventually occur
		Retain incentives for individual companies to manage risk appropriately
Establish a solution quickly		Keep the data requirements and administrative aspects of the program simple

- Primary insurers — The pool is intended to provide a risk-sharing mechanism for primary workers' compensation insurers, whose assumption of terrorism risk is mandatory. This includes primary companies that write either first dollar or excess and high-deductible workers' compensation business; it excludes reinsurers, self-insured employers and single-parent captives.
- Solvency protection — The pool is intended to protect against major terrorism events that could otherwise cause significant financial hardship (or ruin) to individual participants.
- Equity — The pool is intended to provide an equitable and competitively neutral mechanism in which each participant's burden is proportional to the exposure it contributes; it should also preserve and reinforce incentives for good underwriting practices.
- Long-term orientation — The pool is intended to serve as a long-term and stable mechanism to allow for the spreading of risk over time through some degree of pre-funding.
- National — The pool will be national in scope, spreading risks among insurers across states.
- Broad participation — As a voluntary mechanism, the pool will seek to attract the broadest industry participation possible, subject to the standards established to ensure the pool's integrity.
- Reinsurance — The pool is intended to supplement, not replace, protection available in the commercial reinsurance market.
- Not for Profit — The pool is intended to achieve neither a profit nor a loss.
- Partial solution — The pool is intended to provide as much protection as practical for voluntary pool participants, up to an agreed upon limit that reflects the pool's capacity; however, it is neither intended to be, nor capable of being, a complete solution to the industry's significant exposure to large-scale and/or multiple terrorism events.
- Independence from precise form of federal backstop — While the pool must integrate sensibly with TRIA, its design should not be dependent on TRIA in its current form; a future reformulation of the federal program may necessitate revisiting the pool design.

PERCEIVED OBSTACLES

A number of issues were identified *prima facie* as the key obstacles to creating a successful voluntary pool. These obstacles, described briefly below, were a key focus of analysis and investigation during the feasibility study. The sponsor group believed that if these obstacles could be overcome, then the many additional details required to implement such a pool — while by no means trivial — could be addressed subsequently in a detailed pool design effort.

At the outset of the study, three issues were of particular importance to establishing the viability of an effective voluntary pool.

Issue 1 — Capacity. A voluntary reinsurance pool does not in and of itself create new industry capacity, by which we mean it does not bring net additional capital to support writing more business. Rather, by participating in a pool, participants agree to share their risk with one another in a way that reduces the likelihood that any individual participant will suffer massive financial loss (or become insolvent) from a terrorist event. However, in so doing, the pool increases the diversification of risk and thereby creates some additional capacity for its members by increasing the efficiency with which existing capital is deployed.

In this context, the central pool capacity question becomes: What size terrorism loss could such a pool absorb and over what period of time. That is, how much capacity can the pool accumulate to provide relief/protection to its members for the specific and limited purpose of responding to losses resulting from terrorist acts?

Issue 2 — Measuring terrorism exposure. Determining pool participants' relative terrorism exposure has two key facets:

- First, establishing the specific exposure data and related measure(s) that most accurately reflect the underlying terrorism risk; and
- Second, to the extent that the needed exposure data differ from currently available data (either in form or specificity), establishing that participants have or can reasonably collect those exposure data and that the data are reliable enough to form the basis for measuring each company's contribution to the pool's overall terrorism exposure.

What makes this issue particularly difficult in the context of a pool is that companies must not only have confidence in the choice of the measures themselves and in the quality of their own data; they must also have confidence in the quality of the data of every other participant in the pool (without being able to verify the quality of these highly confidential competitive data).

For purposes of the pool feasibility study, the challenge was to define a consensus measure for terrorism exposure and determine if the necessary data are, or could become, available in order to discern meaningful differences in prospective pool participants' mix of business. This challenge included reaching agreement in principle that, if there were appropriate data standards and audit procedures in place, other companies would not be able to "game the pool" by under-reporting their exposure data.

Issue 3 — Achieving equity. Closely related to Issue 2, the key question in achieving equity is whether it is possible to translate the differences in pool participants' terrorism exposure into a fair and appropriate pool burden.

For a voluntary pool to work, participants must perceive that their burden is fair in relation to the benefit they receive. Unless they believe that they would be treated equitably in terms of measuring their contribution to pool exposure and their draw on pool resources in case of a loss, they would likely not be willing to join the pool.

Another important dimension of equity that had to be addressed in the context of a voluntary pool is "intergenerational equity." Developing fair treatment for late entrants to the pool, and for those who subsequently withdraw from the pool, is necessary to establish a stable, long-term, voluntary mechanism.

OTHER ISSUES

In addition to these three issues, there were many more detailed issues (e.g., tax treatment of the pool itself and participants' transactions with it; accounting treatment of pool transactions at both the pool and the member company level; form of legal entity; governance structure; definition of covered terrorism events) that would need to be resolved in order to create the pool. While some of these other issues — notably tax — received some attention during the feasibility study, most of them were to be addressed only after the sponsor group had been satisfied that the major issues/obstacles were surmountable.

The feasibility study was designed to explore the issues and concerns that were considered the most significant obstacles to creating a viable, voluntary, industry risk-sharing mechanism and to create a pool prototype that could serve as the basis for the pool's ultimate design.

IV. PROTOTYPE POOL DESIGN

In order to examine the key issues and obstacles to creating a viable voluntary pool, it is important first to understand the basic design and features of the pool. In the feasibility study, developing and refining the pool design was a highly iterative process, undertaken in parallel with an equally iterative analysis/examination of the key issues described in the previous section. What we learned from the analysis of the issues informed the emerging design of the pool; similarly, our evolving thinking about the pool design helped shape the analysis of the issues and the potential solutions we considered. Throughout this process our views, and those of the sponsor group representatives, evolved as new information and insights emerged.

BASIC POOL DESIGN ELEMENTS

The first step in the development of the prototype pool design was to reach agreement on two fundamental design characteristics: First dollar vs. excess and pre-funded vs. post-funded.

First Dollar vs. Excess

A basic design question was whether the pool would function from the "ground up," collecting premium and paying for losses from the first dollar of loss incurred (i.e., members share all eligible terrorist losses); or whether the pool would only pay for losses above a layer of losses that participants would retain. In the case of an excess pool, companies would be free to buy commercial reinsurance (subject to its availability) to cover the losses they retain up to the point at which coverage in the pool begins.

Exhibit 2 highlights some of the advantages and disadvantages of each alternative.

EXHIBIT 2
Advantages and Disadvantages of First Dollar and Excess Pool Design Alternatives

First Dollar	Excess
■ **Pros** – All terrorism premium can be funneled into tax-efficient industry "war chest" to pay eventual claims ■ **Cons** – Reduces incentives for individual companies to manage exposure concentrations through underwriting and pricing	■ **Pros** – Differences in individual company underwriting practices are mitigated by retained layer – Better to use industry capacity above individual company capacity ■ **Cons** – Excess fund will build up more slowly than first dollar – Funding of terrorism risk may be less tax-efficient because of retained layer

On this basic design question, sponsors overwhelmingly favored an excess pool over first-dollar. Sponsors' primary interest in the pool is for protection against catastrophic terrorism losses/events that might otherwise threaten their financial viability. Companies were expressly not looking to shed all terrorism risk (nor, in so doing, to forfeit the associated premium). In other words, insurers are willing to retain some terrorism risk based on informed, albeit imperfect, judgments about the probability and severity of potential losses. What they will not (and should not) do is to retain a level of risk that, with less-than-a-remote probability, could threaten their very existence.

In conjunction with an overarching federal backstop, an excess pool structure is much better suited to address the need for catastrophe protection than a first-dollar pool.

EXHIBIT 3
Advantages and Disadvantages of Pre-funding

Advantages of Pre-funding	Disadvantages of Pre-funding
■ The credit risk of individual members is minimized ■ The accumulated surplus can be used to fund higher limits of coverage in the future ■ The risk of subsequent assessments for unfunded pool losses is minimized ■ The premiums paid to the pool can be used to justify the inclusion of terrorism elements in members' primary rates	■ It necessitates the creation of a legal entity to hold the premiums ■ The profits of that entity will be taxable, unless a way can be found to make them tax exempt ■ It necessitates estimating the expected losses as a basis for the premiums ■ It magnifies the need for critical mass ■ To the extent that the pool premiums are greater than the underlying primary element in member rates, member profit margins will be depressed

Pre-funded vs. Post-funded

The choice of an excess pool design determines what losses are ceded to the pool. The next design question, whether to pre-fund or post-fund pool losses, determines how losses that are paid by the pool in the event of loss are funded/financed.

In a pre-funded approach, the pool would collect premiums from participants before an event occurs and thereby accumulate funds to pay for future losses if and when they occur. In a pure post-funded approach, there are no premiums paid into the pool, only an exchange of commitments — members would pay an administrative fee to participate and agree to share any pool losses according to a pre-determined formula.

Although each alternative has its advantages and disadvantages (Exhibit 3 shows them for pre-funding), most sponsors strongly favored a pre-funded approach, particularly because it:

- Eliminates (or substantially reduces) the credit risk to which they would be exposed in a post-funded pool (i.e., if one or more members were unable to meet their post-funded pool obligations)
- Enables risk to be pooled over time through the accumulation of premiums year after year (if losses do not occur)
- Avoids unfunded contingent liabilities associated with post-event assessments.

In fact, pre-funding and post-funding are not mutually exclusive, and the pool design could easily and usefully incorporate both pre- and post-funding components into a sensible overall funding approach.

The issue of pre-funding versus post-funding was one area in which sponsors' perspectives evolved during the study. Initially, several sponsors were adamantly opposed to a pool with any post-funded component. However, as we explored the issue of pool capacity, sponsors recognized that, at least initially, some form of post-funding might be necessary to increase the pool's capacity in its early years. However, after reviewing an illustrative company-specific pool "offer" at the end of the study, some sponsors again concluded that any post-funding component, however small, would be highly undesirable.

Another important consideration for, and implication of, the funding approach is its effect on pool eligibility (i.e., which insurers would be eligible to join the pool). In a pre-funded approach, the pool can more or less "take all comers." That is, provided a company can provide the necessary exposure data and pay its (pre-funded) pool premium, it can participate. (As a practical matter, the pool may impose any number of eligibility criteria that prospective members must meet.) By contrast, in a post-funded pool (or one that has a post-funded component), poorly capitalized companies would not be allowed to join because they introduce a level of credit risk that other pool members do not wish to assume. While this type of credit risk can be addressed by requiring poorly rated companies to post security (e.g., a letter of credit), a post-funding approach necessitates the imposition of an important constraint on pool membership.

In conclusion, sponsor group preferences for an excess, predominately pre-funded pool determined the basic skeletal structure of the pool. Iterative analysis and ongoing discussions among the sponsor group helped to detail and refine the basic design.

SUMMARY OF POOL DESIGN PROTOTYPE

This section summarizes the final prototype pool design. The final prototype design was intended to describe a specific, tangible pool structure consistent with the discussion and decisions made with sponsors throughout the feasibility assessment process. It was expected that the prototype would be subject to further refinement and specification if the effort were to advance to a detailed pool design phase.

The overall objective of the pool is to mutualize extreme event terrorism risk and minimize the potential for insurer insolvency/ruin resulting from terrorism events to the extent possible for a voluntary, private market mechanism.

The pool would provide aggregate excess coverage for domestic and foreign terrorism losses. The pool will reimburse members for 90% of losses in any calendar accident year that are in excess of the member's aggregate retention for that year, subject to an overall limit. Losses would be defined broadly to include claims arising out of foreign and domestic terrorism acts occurring in the U.S., including nuclear, biological, chemical and radiological attacks (*de minimis* events would be excluded from consideration).

Prospective pool members would be required to meet two key eligibility criteria:

- Meet standards for capturing, auditing and reporting exposure data
- Maintain an A- rating or post letter of credit/security in the years where there is a retrospective rating element to the premium (i.e., the potential for a small post-loss funding obligation).

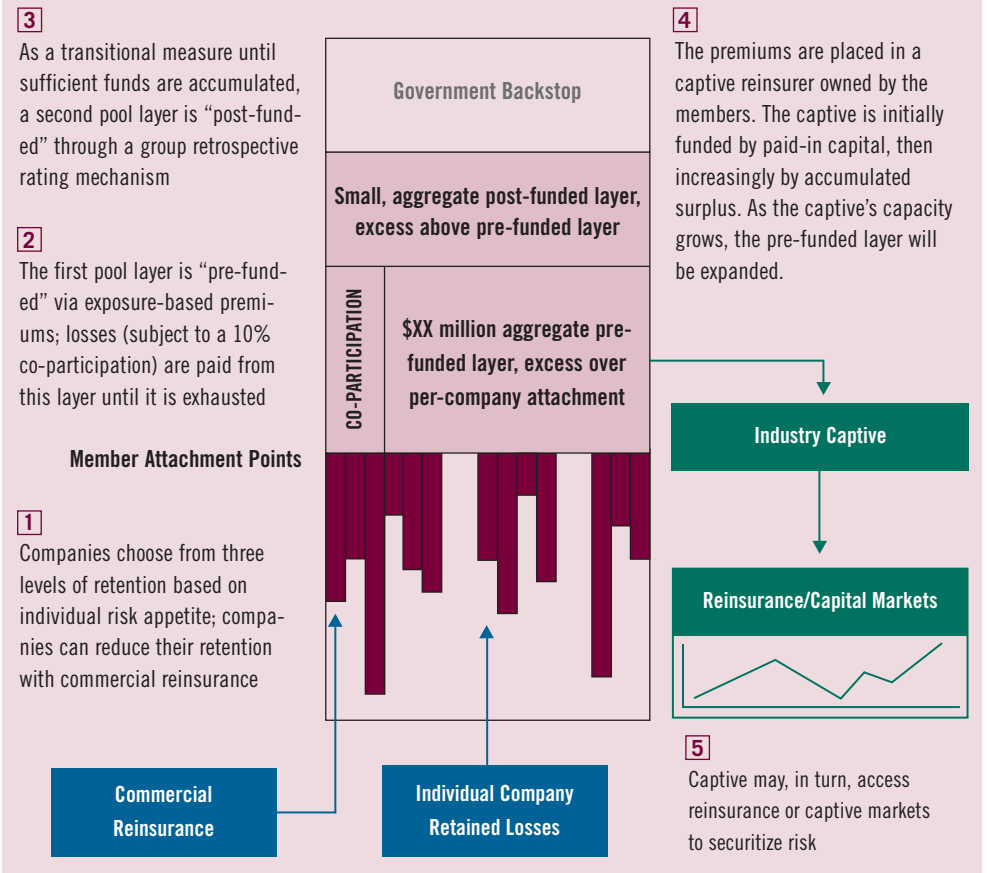
Further, once the pool is formed, its board of directors could also establish eligibility rules for new members to manage the pool's overall exposure concentration.

The pool would be an aggregate excess reinsurer funded primarily through accumulated premiums paid by members. The basic structure of the pool is shown above in Exhibit 4.

The pool could provide an equitable risk-sharing mechanism because it is able to determine participants' relative exposure to terrorism losses. An estimate of the relative risk among pool participants would serve as the basis for determining each participant's burden (i.e., pre-funded premium, paid-in capital contribution, post-loss assessment).

To attract members to a voluntary pool without anti-selection, the pool's exposure measurement must be:

EXHIBIT 4
Overview of Prototype Pool Design



- Based on quality data that support meaningful measurement of relative exposure
  - The vast majority of sponsors have already constructed databases that capture employee headcounts by location:
    - Procedures implemented to collect and validate data on an ongoing basis
    - Plans to improve the quality/completeness of the data over time.
- Consistent with the consensus judgment in the market as to the relative likelihood and potential magnitude of terrorist losses
  - Risk Management Solutions, Inc. (RMS) presented its approach to terrorism to the sponsor group.
  - Tillinghast presented a "proxy" exposure model that relies on fewer and less precise assumptions.
  - Subsequent interviews with individual sponsors suggest that a consensus approach can be reached.

The results of RMS's loss modeling and Tillinghast's development of a "proxy measure" algorithm — both of which rely on employee headcounts by location — demonstrate that key differences in each company's exposure can be meaningfully determined:

- Location — reflecting the relative likelihood of terrorist events
- State mix — reflecting the relative cost per claim by state, indicating different state benefit requirements
- Coverage — reflecting differences in exposure associated with first dollar vs. excess and high-deductible business
- Concentration — reflecting the potential severity of losses from exposures that are in close proximity to one another.

Based on the results of the analyses, the study sponsors agreed that the exposure data appear sufficiently reliable and that exposure measurement can capture critical differences in companies' workers' compensation portfolios. A key requirement for pool members would be that their headcount data meet the standards of the pool and be subjected to the pool's ongoing audit procedures.

Attachment points, limits and co-participation were developed and tested.

The attachment points offered by the pool would vary by size of company; each member would be offered several options. The minimum retention for small companies would be $5 million, grading up to $90 million for largest companies. For 90% of the market, the lowest pool attachment would be less than 6% of surplus. Commercial reinsurer capacity could be used underneath the pool, to the extent that companies have lower risk tolerances.

A 90% co-participation would assure that each member has "skin in the game." Companies would share an aggregate limit, rather than an individual company limit, on pool recoveries — that is, total pool resources would be available to all members. The limit would build over time, as funds in the pool accumulate.

Critical mass requirements assure that the pool would not go forward unless the limit would provide meaningful coverage and risk diversification benefit to its members.

To enhance capacity in the first two years there would be a post-loss funding element:

- In the first year, up to an additional 50% of member premiums
- In the second year, up to an additional 25% of member premiums
- 100% pre-funding after that, unless funds are depleted by losses.

As noted previously, sponsors' feedback on the final prototype suggested considerable discomfort with the level or existence of the post-funding component among some members. Although sponsors acknowledged its value in increasing pool capacity (especially in the early years), it is not clear whether a post-funding element would be acceptable if a pool were to be implemented.

Other key elements of the pool are designed to achieve intergenerational equity, given that members can join and leave over time. Companies that wait for several years to join, until a large pool of funds has accumulated, would have to contribute extra capital — so that they don't receive an unfair benefit. A formula specifies whether they would have to pay one, two or three times their premium. (Appendix 2 illustrates the proposed approach to ensuring intergenerational equity.)

Once the target funding level is reached, premiums from the early years would be returned to members with interest. An experience account would be established for each coverage year, under a group retrospective rating plan. Accumulated premium funds not used to pay losses would be returned *pro rata* to members for each year, in succession from oldest forward. Premium funds stay "at risk" for ten years or longer. If the pool were dissolved, the premium returns would be accelerated according to the same basic principle.

The rate at which funds accumulate would depend on the tax treatment of the pool. The experience of other industry pooling mechanisms that serve important national interests (e.g., American Nuclear Insurers California Earthquake Authority, Florida Hurricane Catastrophe Fund) suggests it may be possible for the pool to obtain favorable tax treatment. This would accelerate/facilitate the buildup of pool capacity and expand the range of terrorist events to which the pool could respond.

To minimize administration of lifetime claim benefits, the pool would commute any remaining liabilities to its members after five years, using fair reserve valuation process, with arbitration, if necessary. Commutation would be deferred if there were unusual uncertainty — e.g., disease claims from biological, chemical or radiological events. The commutation of claims would mitigate against ongoing credit risk and adverse development risk and reduce the pool's administration burden.

The pool would not go forward unless there were sufficient "critical mass" to achieve meaningful risk diversification. For example, the largest member's premium could be limited to no more than 10% of total; aggregate pool limit must be five times largest member's attachment.

HOW DO P/C INSURERS USE PML CURVES TO MANAGE CATASTROPHE RISK?

All insurers hold capital to protect against adverse fluctuations in their claim experience. The amount of capital needed depends on the nature and amount of risk that it has accumulated by issuing insurance policies to its customers. For example a home insurer writing business in Florida would have more risk than one writing in Kentucky — because Florida has greater exposure to losses from hurricanes.

In property/casualty insurance, demand for capital — that is, the range of potential future losses for which capital is required — is traditionally represented by a "loss exceedence curve" also commonly referred to as a "probable maximum loss" (PML) curve.[8] A loss exceedence curve is simply a depiction that describes the probability that insured losses from a particular peril or combination of perils will exceed a certain amount over a given time period (usually one year, the typical duration of insurance policies). The curves show the values and probabilities of all possible losses, from very small to very large. These curves are often constructed for the industry overall (reflecting all insured exposures) and for individual companies (reflecting only the exposures each company insures). For example, such a curve might show that there is a 5% chance that industry property losses from hurricanes would exceed $20 billion in a given year, but only a 1% chance that they would exceed $50 billion.

Insurers use PML curves to help assess and manage their risk and determine the amount of capital required to support the business that they underwrite. Insurers are most concerned with the so-called "tail" of the distribution, that is, the portion that represents the large/extreme events with relatively lower probabilities. It is these large events that are most likely to impair an insurer and, therefore, attract the most attention for purposes of risk management. Rather than holding all of the capital themselves, insurers often buy catastrophe reinsurance — essentially "renting" part of the needed capital from the reinsurer. The insurer would then hold capital of its own based on its net retained risk.

More specifically, insurers typically focus on particular points along the tail of the PML curve, such as the 1-in-100, 1-in-250 and 1-in-500 loss, or the points that represent the amount of loss expected to occur with a probability of 1%, .4% and .2%, respectively. As a point of reference, insurers typically buy property catastrophe reinsurance to protect their capital against events in the 1-in-250 to 1-in-500 range — that is, they protect themselves against very large/extreme events that have relatively low likelihoods of occurring. The actual reinsurance buying habits of individual insurers vary, dictated by a variety of factors, including the amount of capital (surplus) maintained by the insurer ("capital at risk"), individual risk tolerances/preferences, commercial reinsurance pricing, etc.

[8] Although the terms are commonly used interchangeably, a loss exceedence curve and a probable maximum loss curve are not literally the same. While they both relate size of loss to probability, they are technically the mathematical inverse of one another.

V. UNDERWRITING ISSUES AND ANALYSIS

In order to examine the key pool issues (i.e., capacity, exposure measurement, equity) and to test different pool designs/structures, we created a hypothetical pool, representative of the industry and accounting for 50% of the workers' compensation market (based on 2001 workers' compensation direct written premium). Exhibit 5 compares the composition of the hypothetical pool with the overall workers' compensation industry.

Tillinghast developed a stochastic simulation model to analyze the performance of alternative pool designs and the effects of various loss scenarios (e.g., size, concentration, distribution across lines of business) on the pool as a whole as well as on its individual members. The hypothetical pool included the sponsor companies for which RMS had created company-specific workers' compensation PML curves. For other companies we constructed synthetic

EXHIBIT 5

Composition of the Hypothetical Workers' Compensation Terrorism Reinsurance Pool

Workers' Compensation Industry*					vs.	Hypothetical Workers' Compensation Terrorism Reinsurance Pool				
	Industry						Pool			
	Local	Regional	National	Total			Local	Regional	National	Total
Number of companies						**Number of companies**				
Multi-line	16%	27%	21%	**65%**		Multi-line	12%	22%	23%	**58%**
WC Dominated	7%	4%	4%	**15%**		WC Dominated	10%	8%	3%	**21%**
Mono-line WC	14%	4%	2%	**20%**		Mono-line WC	14%	4%	1%	**21%**
Total number of companies	**37%**	**36%**	**27%**			**Total number of companies**	**38%**	**34%**	**28%**	
Market share						**Market share**				
Multi-line	1%	10%	54%	**64%**		Multi-line	0%	8%	52%	**60%**
WC Dominated	3%	5%	14%	**22%**		WC Dominated	3%	6%	18%	**27%**
Mono-line WC	9%	4%	1%	**14%**		Mono-line WC	9%	3%	1%	**13%**
Total market share	**12%**	**19%**	**69%**			**Total market share**	**13%**	**17%**	**71%**	
Average WC DWP ($000)**				**$152,616**		**Average WC DWP ($000)**				**$187,713**

Note: May not add exactly to totals due to rounding. Reflects A.M. Best data for 2001. A.M. Best data does not include data for select carriers, such as Employers Insurers Company of Nevada, SCF of Arizona, CompSource Oklahoma, Pinnacol Assurance, South Carolina State Accident Fund, West Virginia Workers' Compensation Division, Ohio Bureau of Workers' Compensation, Pennsylvania State Workers' Insurance Fund, New York State Insurance Fund, Minnesota State Fund Mutual Companies, North Dakota Workers' Compensation Bureau, Washington Department of Labor and Industries, Puerto Rico State Insurance Fund Corporation.
*Excludes California State Workers' Compensation Insurance Fund and certain companies considered ineligible for pool (e.g., inadequate capital).
**Total industry average workers' compensation DWP equals $107,185.
Source: A.M. Best

terrorism loss distributions, drawing from the RMS industry PML curve, the industry PML curve used by NCCI to file workers' compensation terrorism loads in the primary rates (based on the EQECAT terrorism loss model), and the individual sponsor company curves developed by RMS for measuring their relative terrorism exposure.

CAPACITY

Arguably, the most critical issue for the pool is the capacity that it creates. Simply stated, there is no compelling reason to create the pool unless it contributes materially to the insurance industry's capacity to insure terrorism exposure. While the term "capacity" can be interpreted in different ways, at its core capacity refers to an insurer's ability to write business — that is, to maintain enough capital to absorb losses from fluctuations in its financial performance, mostly due to adverse fluctuations in insurance claims.

There are two basic ways for an insurer (and, for that matter, the insurance industry) to increase capacity: The first is to add more capital — additional capital allows an insurer to write more units of risk because it has more capital to pay for, and protect against, future losses. The second way to increase capacity is to deploy existing capital more efficiently — through better risk diversification, the same amount of capital can support a higher level of business because the risk of adverse fluctuations has been reduced.[9]

These two ways to increase capacity get to the heart of what a pool can and cannot do.

To take the issue of new capital first: The terrorism pool (like other pools) does not create new capital for the industry, nor for any individual pool participant. This is what industry observers mean when they suggest that a fundamental limitation in the pooling concept is that it doesn't bring new capacity.[10] By contrast, increasing capacity (i.e., enabling pool participants to write more business) through more efficient deployment of existing capital is precisely what pools are designed to do. A pool creates capacity insofar as whenever risks are further diversified (up to the point at which no further diversification is possible), less capital is required to support the more diversified portfolio of risks. The new capacity is the result not of net additional capital but of more efficient deployment of existing capital from greater risk diversification.

Since risk diversification is the fundamental benefit of pooling and the only means by which it creates capacity for its members, it is worth looking at the risk diversification performance of the hypothetical workers' compensation pool.

The box insert *"What Is an 'Expected Loss'?"* on the following page provides background information that may clarify the subsequent discussion on capacity and risk diversification.

[9] The idea of risk diversification is the foundation of insurance: A portfolio of risks requires less capital than the sum of capital required if each risk were held separately, assuming the risks are not perfectly correlated.

[10] In theory, a pool could create capacity indirectly by enticing other ("new") sources of capital to assume some of the risk. For example, if the pool were to transfer some of its risk to reinsurers who were not otherwise participating in the market, this would add to the base of capital supporting the risk. These reinsurers could be existing reinsurers that are currently not involved in the workers' compensation excess market or primary insurers that are not writing workers' compensation, such as the major personal lines insurers. (This latter group might be willing to swap other risks for a share of the workers' compensation terrorism exposure.) Similarly, if the pool were to securitize some of its risk, it would be accessing a broader base of capital.

WHAT IS AN EXPECTED LOSS?

Insurers use *loss distributions* to help describe the losses they are likely to incur. A loss distribution is a graphical representation of all possible size losses and their probabilities. In Diagram A below, the horizontal axis shows the size of loss (expressed in dollars); the vertical axis shows the probability of loss (expressed in percent). Each point along the curve can be represented by a pair of coordinates (X,Y), in which X denotes the size of loss and Y its probability. For example, point (2.5, 20) would mean that there is a 20% probability of a $2.5 million loss.

An *expected loss* can be thought of as the consensus estimate of the most likely size of the future loss, which takes into account the probabilities assigned to losses of different sizes. Mathematically, it can be represented as ∑(probability of loss of a certain amount) X (loss of a certain amount). To use a simple example, if there were a 60% chance of a $10 loss and a 40% chance of a $2.5 loss, the expected loss would be $7 because [(.6*10) + (.4*2.5)] = [(6) + (1)] =7.

Diagram A shows a so-called normal distribution (sometimes called a bell curve). Normal distributions, which are used to describe many phenomena, have specific properties (e.g., symmetry, specified distance between the mean and key points along the curve) that define their shape.

However, normal distributions are generally not very good representations of projected insured losses. Diagram B illustrates the shape of a more typical insurance loss distribution. The shape of the curve shows that there is a relatively high probability of incurring small losses (i.e., losses toward the left side of the curve). However, there is also a small probability of incurring a very large loss — the far right side (or "tail") of the curve extends very far, representing very large losses with very low probabilities. Consider property losses from hurricanes, for example. In a given year, there is a very good likelihood that there will be property losses within some range that, experience suggests, is more or less "expected." This is represented by the "fat" part of the distribution. However, there is always a small possibility that a hurricane will cause an unexpectedly large amount of property damage (like Hurricane Andrew in 1992), because of its size/strength or trajectory. This possibility is represented by the tail of the distribution. For risk and capital management purposes, insurers focus primarily on the tail of loss distributions.

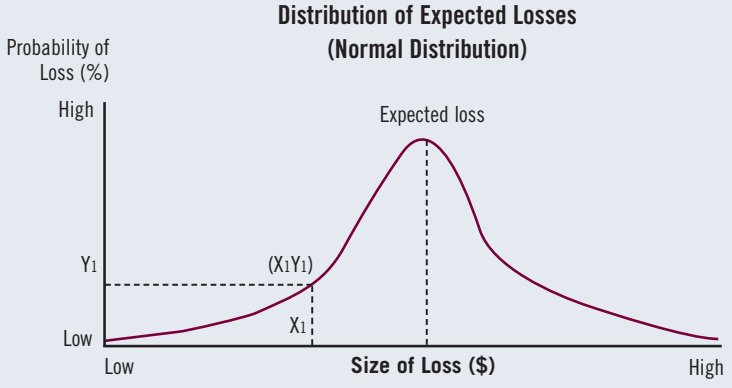


DIAGRAM A

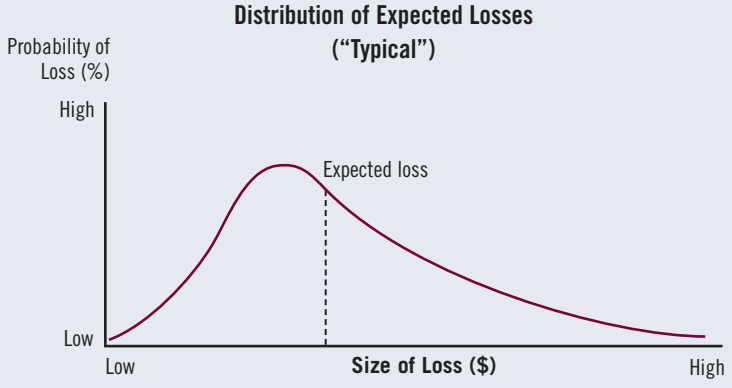


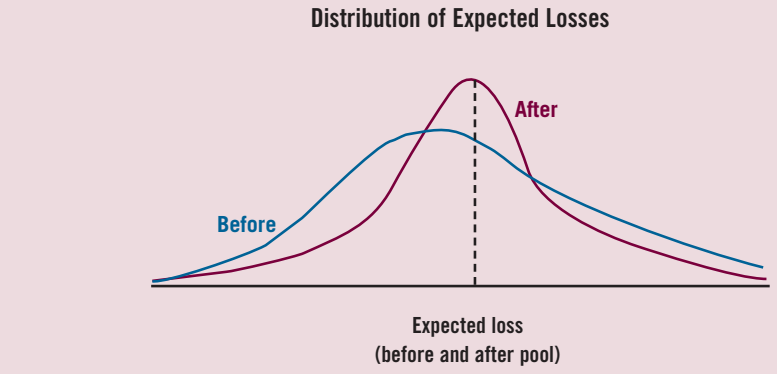
DIAGRAM B

Risk Diversification

As we have described, the fundamental benefit of this (or any) pool is risk diversification. A pool not only enables existing industry capital/capacity to be deployed more efficiently, it also reduces the risk that individual participants carry, allowing them to write more business.

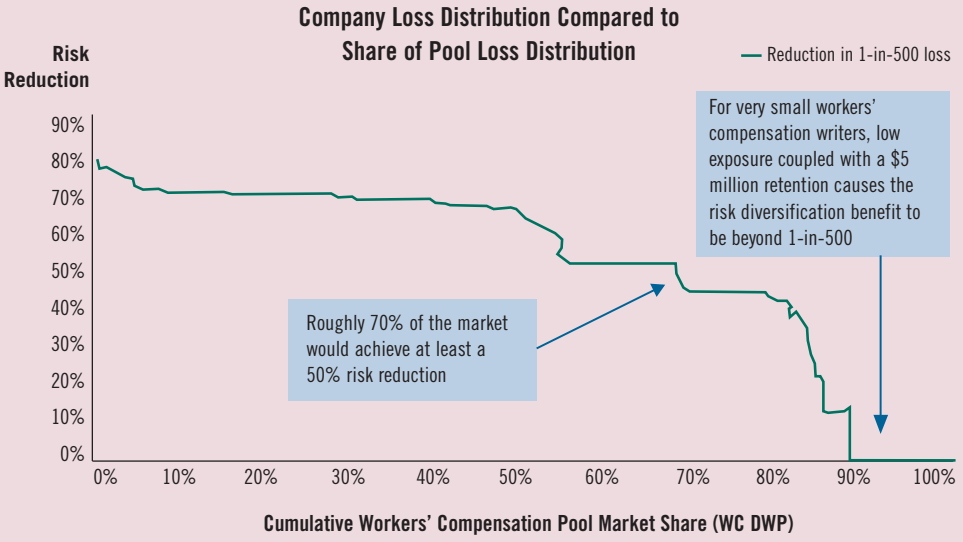
As illustrated in Exhibit 6, a pool works by changing the shape of members' loss distributions: it creates a tighter distribution of losses, thereby reducing the financial risk related to the uncertainty of losses. Most important for our purposes, given sponsors' interest in the pool as catastrophe protection, the pool reduces the size of the loss along the tail of the distribution (i.e., large losses with relatively low probabilities) that participants must absorb themselves. Through pooling, members give up (i.e., "cede") some of their premium to the pool in exchange for more certainty about their future financial results because some of the losses they would otherwise retain now sit within the pool. This is also the fundamental benefit of traditional (i.e., commercial) reinsurance, although the mechanics and specific effect on an insurer's loss distribution differ from that of a pool. However, as noted earlier, commercial terrorism reinsurance has not been widely available. (Indeed, like primary insurers, commercial reinsurers are concerned about the risk to their financial stability from a mega terrorism event and therefore are reluctant to provide reinsurance capacity for the terrorism peril, particularly for nuclear, biological, chemical and radiological threats.)

EXHIBIT 6
Effect of Pooling on a Member's Loss Distribution (Illustrative)



- Pooling creates a tighter distribution of expected losses (i.e., decreases both upside and downside risk)
- Expected losses remain the same (before and after), since participants' share in the pool is based on their expected losses

EXHIBIT 7
Pool Members' Risk Diversification Benefit



Since pooling creates capacity for members through risk diversification, the question is how much risk diversification the pool provides. Given the prototype design of the pool, analysis indicated that most members of the hypothetical pool would receive a significant risk diversification benefit at the 1-in-500 event level. (See Exhibit 7) In fact, about 70% of the market share (based on direct written premium) in the hypothetical pool realizes at least a 50% risk reduction.

A key challenge in forming any voluntary pool is the possibility that the largest prospective members will not receive a large enough risk diversification benefit to interest them in joining. As the largest prospective member bows out, the next largest company becomes the largest prospect, which may also bow out; as this dynamic repeats itself — since there is always a new largest prospect — it creates a "race to the bottom," and eventually there are no prospects left to join. Exhibit 7 does not capture this dynamic; it assumes that the selected group will participate, including companies for which the risk diversification benefit is relatively low. Obviously, as some prospective members withdraw, the risk diversification benefits to others will diminish.

The workers' compensation terrorism reinsurance pool is no different — one of the initial concerns was whether the pool could afford a risk diversification benefit to very large member companies. The logic underlying this concern is simple and compelling. The portfolios of very large workers' compensation writers are so big and diverse that they have already captured a significant diversification effect. So, is there any further diversification benefit available? Perhaps somewhat surprisingly the answer appears to be "yes." In fact, the average risk reduction benefit for the ten largest companies in the hypothetical pool (out of a total of 90 companies) is 57%.

While one can debate how much risk diversification is enough (and at what price companies should be willing to buy more), there is no question that the pool creates additional capacity for its members — even its largest members — through the more efficient use of members' capital.

The preceding discussion of capacity addresses the essential purpose of a pool — namely, to increase capacity through greater risk diversification and capital efficiency. It also notes that the pool does not bring any new dollars of capital to the market.

For the terrorism pool, there is another equally fundamental, and arguably more practical, question related to capacity: What size terrorism loss could such a pool effectively respond to above and beyond what the industry could absorb without it? (In the Conclusion section we will address the critical corollary question: Is the pool's capacity material enough for it to be a meaningful industry mechanism to help address terrorism risk?)

There are two key parts to this dimension of the capacity issue: demand and supply. For "demand," the question is how much capacity is needed. For "supply," the question is how much capacity can be accumulated. Each of these questions is explored below.

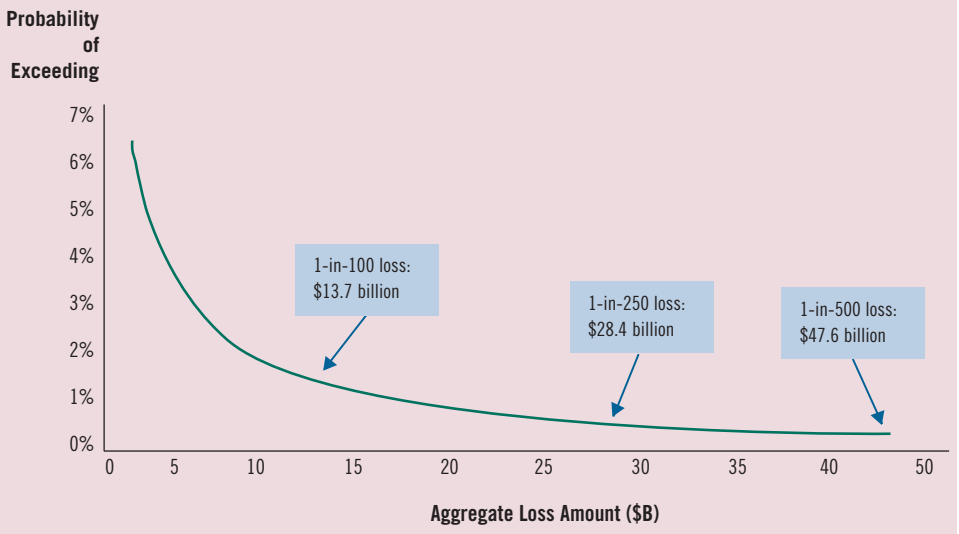
Demand

What does the workers' compensation industry PML curve look like for terrorism losses? It is this loss distribution that represents the size and likelihood of losses that the industry (with or without a pool) would have to be able to withstand.

Exhibit 8 shows a portion of the workers' compensation industry terrorism loss exceedence curve that NCCI used to develop its indicated terrorism load within workers' compensation rates in 2002.[11] This curve is based on the

EXHIBIT 8

NCCI/EQE Workers' Compensation Industry Terrorism Loss Exceedence Curve (Tail Only)



Source: National Council on Compensation Insurance, Inc. (NCCI)

EQECAT terrorism loss model, one of the three leading commercial terrorism loss models available.

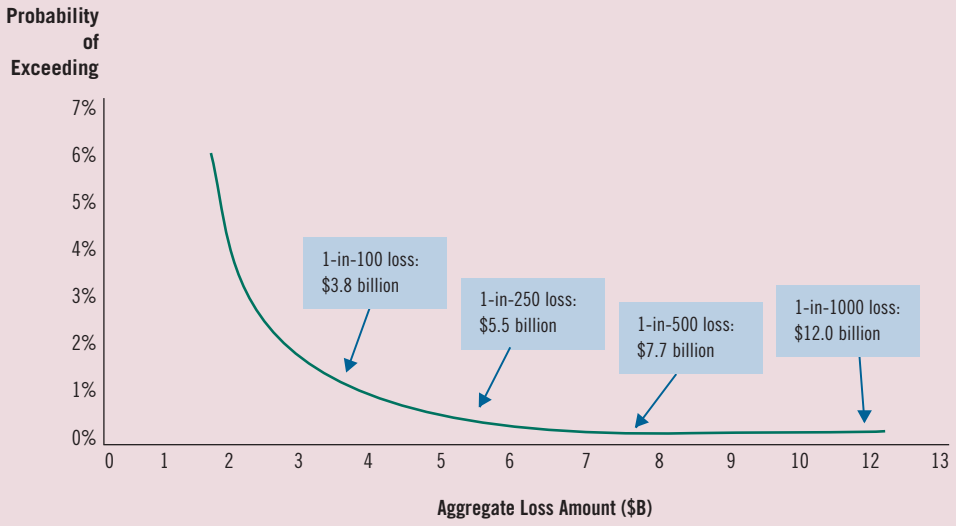
The loss exceedence curve shows that the industry might expect to suffer terrorism losses at or above $13.7 billion with a probability of 1%, losses at or above $28.4 billion with a probability of .4% (1-in-250) and losses at or above $47.6 billion with a probability of .2% (1-in-500). The curve continues in both directions beyond what is shown: extending to the right, larger losses have increasingly low probabilities of being exceeded; extending to the left, smaller losses have increasingly high probabilities.

Exhibit 9 shows a portion of the workers' compensation industry terrorism loss exceedence curve based on the RMS model.

As you can see from the exhibit, the RMS model estimates relatively lower levels of loss exceedence than those used by NCCI — $.8 billion, $1.6 billion and $3.9 billion at the 1-in-100, 1-in-250 and 1-in-500 probabilities, respectively. Note that in the RMS model the potential for much larger losses appears further along the tail of the PML curve (i.e., the larger losses have lower probabilities of being exceeded).

EXHIBIT 9

RMS Workers' Compensation Industry Terrorism Loss Exceedence Curve (Tail Only)



Source: Risk Management Solutions, Inc. (RMS)

Exhibits 10 and 11 suggest an obvious problem when it comes to estimating demand — namely, that the PML curves produced by two different credible sources are very different from one another. The main reason the results differ so dramatically is that the models assign different probabilities to particular terrorism events.[12] Moreover, there is no reliable basis for determining which one of them is "right." These differences are not entirely unexpected given the nature and recency of the terrorism threat. Indeed, they depict in very tangible terms the vast uncertainty associated with potential future terrorist attacks (e.g., the size, number, nature, targets and timing of attacks).

[11] It is important to remember that the terrorism losses shown in Exhibit 8 are for workers' compensation only. These represent only a portion of the total losses associated with a terrorist event, which would also include losses for personal and commercial property, business interruption, life, liability, etc. As a point of reference, workers' compensation losses from the 9/11 terrorist attack are estimated at $2–$4 billion, or roughly 5%–10% of total insured losses.

[12] These probabilities are based on judgment from global experts on terrorism, intelligence, security, weapons, etc. Although these probabilities represent the best judgments of very knowledgeable and informed resources, they are only educated guesses. The probabilities assigned to particular terrorism events are generally considered the most speculative part of terrorism loss models. Similarly, while loss exceedence curves are necessary and useful, the modelers themselves would acknowledge that they imply an unwarranted degree of precision — what one colleague has called "delusional exactitude."

Ultimately, it is more important to understand that there is a reasonable possibility of major losses from terrorism attacks than to focus on the specific mathematical probabilities. On this point, each of the major commercial loss modelers contemplates a range of plausible catastrophic terrorism events that generate huge workers' compensation (and other insured) losses. Exhibit 10 describes several such catastrophic events that are included in the RMS model.

In summary, the terrorism loss models provide an order-of-magnitude indication of the size of potential terrorism losses that the pool should need to fund — i.e., they help establish the size of the demand. The precise number is unknown, and probabilities assigned to specific events are somewhat speculative. However, the experts all contemplate a range of plausible catastrophic terrorism events that result in huge workers' compensation losses.

In the next section on supply, it will become clear that the constraint on pool capacity derives from how much participants can reasonably fund, rather than from any limit on how much is likely to be needed, based on expert views about the magnitude of potential future terrorism events.

EXHIBIT 10

Illustrative Catastrophic Terrorism Events from RMS Event Library

Event	Estimated WC Loss	Description
Sears Tower airplane attack	$0.9 billion	A 747 is hijacked and flown into the Sears Tower in Chicago during a peak working hour (2 pm weekday). The building would collapse, but not immediately, allowing some people to escape. An estimated 1,300 people would be killed, with thousands of others sustaining injuries ranging from smoke and dust inhalation to permanent disabilities.
El Paso Energy truck bomb	$1.1 billion	A two-ton bomb is detonated at 1001 Louisiana St. (headquarters of El Paso Energy) in Houston during peak working hours. A bomb of this magnitude could be delivered by a mid-size box van, similar to the Ryder Truck used in the Oklahoma City bombing. An estimated 1,000 would be killed, with hundreds of additional severe injuries and thousands of minor injuries requiring only basic medical treatment.
Rockefeller Center truck bomb	$7.4 billion	A ten-ton bomb at the GE Building (Rockefeller Center) in New York City. In this scenario, a massive explosion occurs at the target building. A bomb of this magnitude would likely be delivered via a large semi-truck. Damage to the target would be extensive, causing at least partial collapse to it and other surrounding buildings. Casualties, assuming the event occurs at a peak working hour (2 pm weekday) would also be significant, with an estimated 12,300 fatalities and as many as 52,300 other non-fatal (ranging from medical only to permanent total disability) injuries.
Nuclear power plant sabotage	$15.4 billion	The Indian Point Nuclear Power plant, 25 miles north of Manhattan, is sabotaged by terrorists, resulting in the release of a large amount of radioactive material. Facilitated by a southern blowing wind, radioactive material is dispersed throughout the area and into New York City. Of the roughly 350,000 people directly affected, most would require only minor medical treatment. Few would die, but thousands could suffer severe and permanent effects. Long-term effects such as radiation cancer are not considered.
New York City anthrax release	$91.0 billion	A large anthrax attack occurs in downtown New York City. In this scenario, anthrax is weaponized and dispersed in aerosol form, resulting in inhalation of anthrax by a large number of people, aided by wind dispersion. Casualties, assuming the event occurs at a peak working hour (2 pm weekday) would be enormous. Of the more than one million people affected, most would require only minor medical attention, but an estimated 173,000 people would die.

Source: Risk Management Solutions, Inc. (RMS)

Supply

The loss exceedence curves shown in the previous section indicate the likely magnitudes of possible future workers' compensation terrorism losses. These curves, reflecting in part expert input on the type and likelihood of particular events, help to establish the "demand" function. "Supply" represents the amount of capacity that the pool could reasonably accumulate to meet this need.

Central to the issue of "supply" (or pool capacity) is the element of time. Recall that one of the guiding principles for the pool is that it enable the spreading of risk over time — that is, through pre-funding (the dedication of capital contribution prior to a loss), *over time* the pool can accumulate a "war chest" to pay for losses if and when they occur.

The question, then, is what rate of funding is appropriate (i.e., how much premium should members contribute) and how much capacity will it generate over time. The answers to these questions require that one balance the desire to accumulate a meaningful sum of funds over time while maintaining some reasonable proportionality to the underlying economics of the business.

Over the last five calendar years, private carriers' workers' compensation combined ratio (the sum of loss and administrative costs divided by premiums) has averaged close to 115% — that is, costs have exceeded premiums by 15% — and pre-tax operating gains (defined as the combined ratio less investment gain on insurance transaction and other income) have averaged just over 3%. It is within this context of industry performance that we must consider the level at which pool participants would be willing to fund the pool, for each dollar that insurers contribute to the pool would effectively reduce their already depressed operating profits proportionally.

The accounting treatment (including income statement and balance sheet items) for pool participants would depend on the specific legal entity form of the pool. For example, if the pool were incorporated as a "qualifying reinsurer," payments (i.e., premiums) to the pool would serve to reduce participants' direct written premium. In all likelihood, members' equity interest in the pool would be recorded in their financial statements using the "equity method" of accounting. (Under this method, pool participants would include their proportionate share of the pool's accumulated surplus as an asset on their balance sheet; they would include their proportionate share of the pool's earnings as income.)

Another important point of reference in determining the appropriate level of funding for the pool is its relationship to the indicated terrorism load embedded in primary workers' compensation rates, as filed by NCCI. (The terrorism load is the portion of the premium intended to cover terrorism losses.) Note that an important difference between the filed terrorism load and the pool premium is that the filed load is intended to cover losses from the ground up, whereas the pool premium will cover only losses in excess of those retained by participants. In other words, the filed loads should be higher than the pool premium because they are intended to cover all terrorism losses, whereas the pool is designed only to cover an excess layer of losses. The NCCI-indicated national average terrorism load is about 1.9% of workers' compensation direct written premium.

BASIC P/C INSURER ECONOMICS

In simplistic terms, premiums charged to employers must cover the cost of paying for workers' compensation losses as well as the administrative costs of running the operation, which include, notably, distribution/sales costs such as commissions and loss adjustment expenses (LAE) required to verify and adjudicate claims. The reserves that are set aside to pay for claims are invested and the investment returns provide another source of revenue to the insurer. The pre-tax operating ratio is the relationship of the loss, loss expense and related administrative costs to revenues (i.e., premiums and investment returns), expressed as a percentage of premiums.

As part of the feasibility study, we explored different funding approaches to examine the relationship between accumulated capacity ("supply") and 1-in-x losses ("demand"). It is important to recognize, that the probability of different types of terrorist events is highly uncertain and, therefore, the specific results described below provide only a directional indication of the "demand."

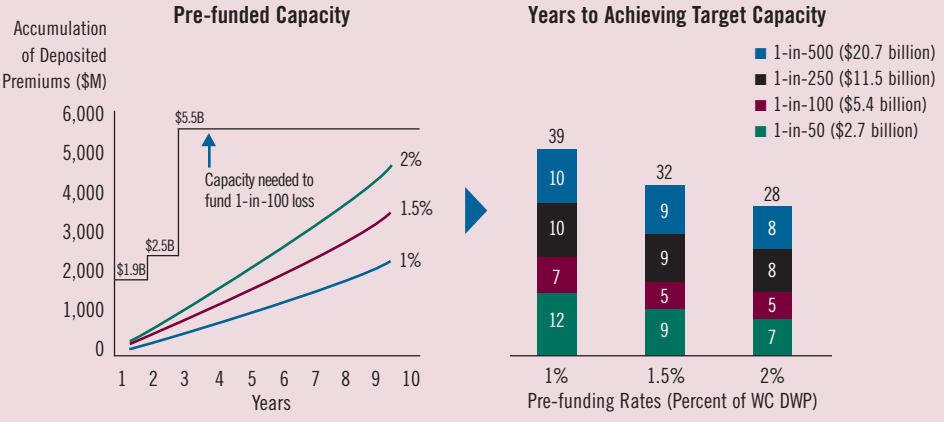
Exhibit 11 illustrates the number of years required to accumulate the amount of funds needed for the hypothetical pool based on the NCCI/EQE loss exceedence curve. The exhibit shows that even under an aggressive funding approach whereby fully 2% of workers' compensation direct written premium (i.e., more than the entire NCCI-indicated terrorism load in the primary rates) is used to fund the pool, it would take almost 30 years to accumulate enough capacity to fund a 1-in-500 loss.[13] Moreover, this assumes that the capacity of the pool is not depleted by any terrorism losses in the intervening years.

Exhibit 12 shows the comparable information based on the RMS loss exceedence curve. Because of the differences in the NCCI/EQE and RMS loss exceedence curves noted in the previous section, it takes less time to accumulate the needed capacity using RMS assumptions — eight years for a 1-in-500 event funding at 2% of workers' compensation direct written premium.

EXHIBIT 11

Pre-funded Pool Capacity Accumulation — Based on NCCI/EQE Loss Exceedence Curve

(Funding Expressed as a Percent of Workers' Compensation DWP)

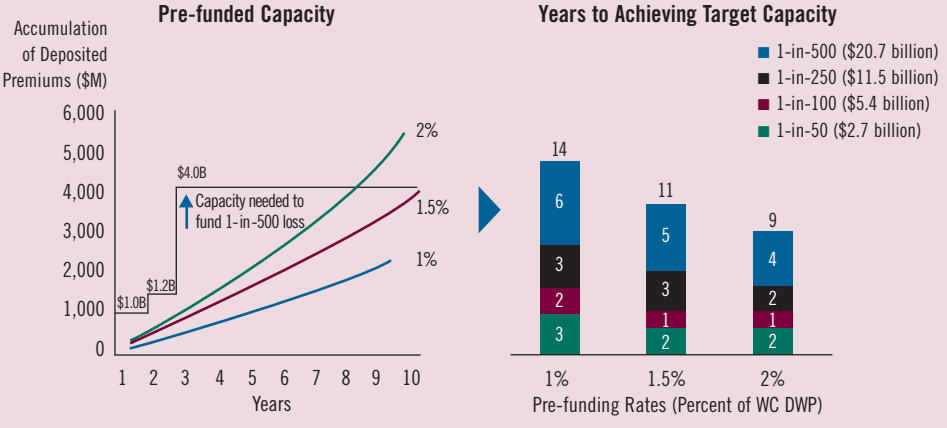


Note: Assumes 5% annual investment return. Pool represents 50% of market, 10% co-participation, 2% attachment point across all members. Years to achieve capacity assumes no successor to TRIA.

EXHIBIT 12

Pre-funded Pool Capacity Accumulation — Based on RMS Loss Exceedence Curve

(Funding Expressed as a Percent of Workers' Compensation DWP)



Note: Assumes 5% annual investment return. Pool represents 50% of market, 10% co-participation, 2% attachment point across all members. Years to achieve capacity assumes no successor to TRIA.

[13] In Exhibits 11-14, the target capacity is shown for 2006 because this is the first year after the expiration of TRIA and, therefore, the year for which there is currently no federal backstop in place to limit insurers' potential losses. It is also apparent that even in the first two years of the pool, while TRIA is in effect, the pool capacity would fall well short of the capacity needed even for a 1-in-100 loss. Note that the line showing the step increase in required capacity in the left side of the graphs reflects the role of TRIA in limiting potential pool member losses.

When pool funding is expressed as a percentage of the NCCI-indicated terrorism load in the primary workers' compensation rates, as in Exhibit 13, the numbers differ, but the relativities remain the same.[14]

Depending on the loss model, it will take 6 or 18 years for the pool capacity to equal what is needed for a 1-in-500 event, assuming the entire terrorism load in the primary rates is ceded to the pool and there are no losses in the intervening years. (See Exhibit 13) (Recall that the terrorism load in the primary rates is intended to cover all terrorism losses versus the smaller portion of excess losses that the pool will cover.)

Conclusion

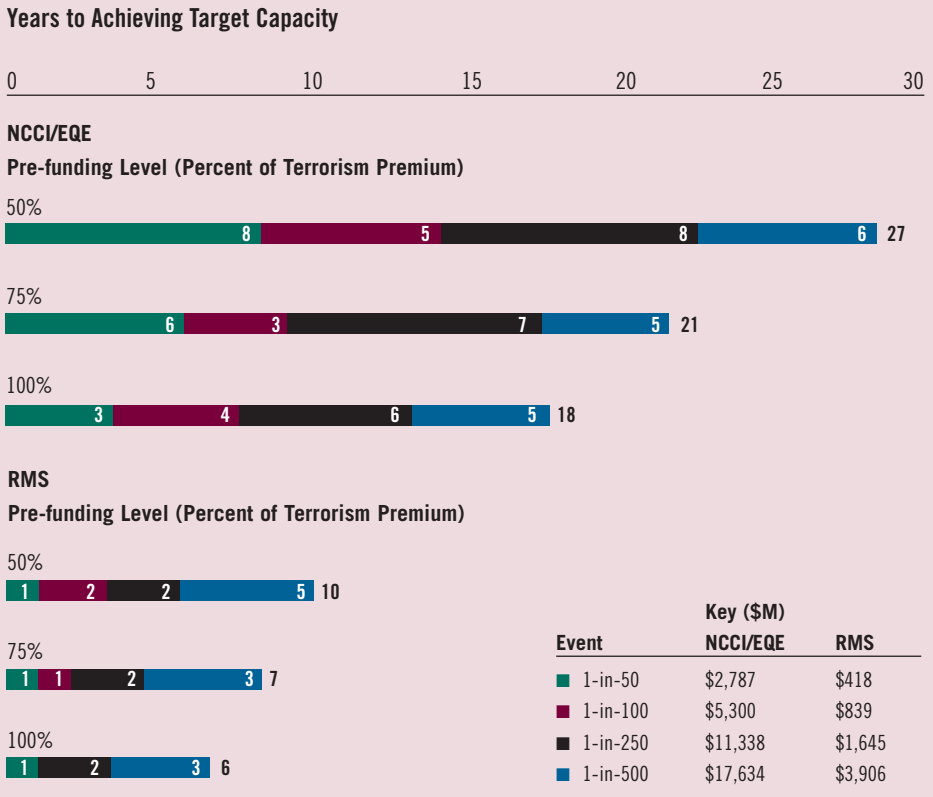
So, what are we to conclude about the level of pool capacity from this discussion of demand and supply?

Recall that the PML curves indicate the likely magnitudes of possible future workers' compensation terrorism losses. This establishes the "demand" function and sets out the capacity required. "Supply" represents the amount of capacity that the pool could reasonably accumulate to meet this need. Ideally, we would seek some convergence between demand and supply to assure that the pool capacity could roughly meet the inherent need.

EXHIBIT 13

Pre-funded Pool Capacity Accumulation — Based on NCCI/EQE and RMS Loss Exceedence Curves

(Funding Level Expressed as a Percent of NCCI-Indicated Terrorism Load in Primary WC Rates)



Key ($M)

Event	NCCI/EQE	RMS
1-in-50	$2,787	$418
1-in-100	$5,300	$839
1-in-250	$11,338	$1,645
1-in-500	$17,634	$3,906

Note: Assumes 5% investment return, 10% co-participation, 4% attachment across all members, and initial capital infusion of 100% of deposit premium. Years to achieve capacity assumes no successor to TRIA.

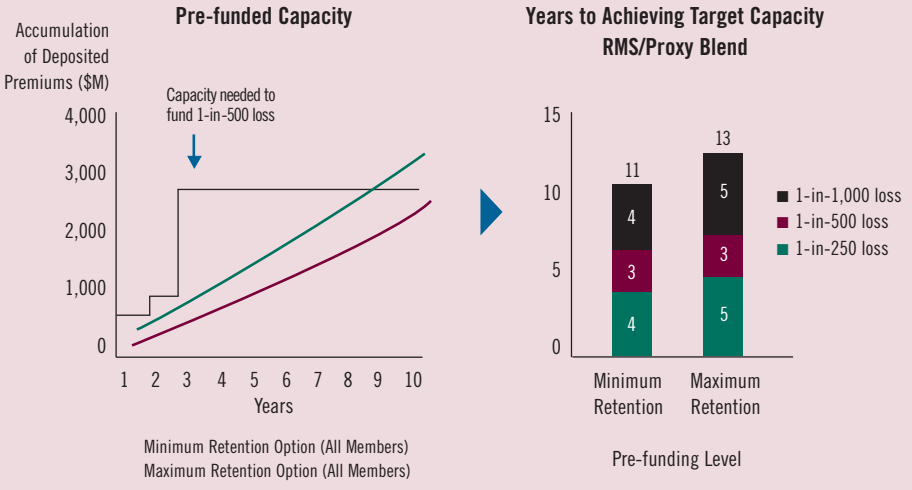
We observe from the various funding levels that we explored that it will take a considerable period of time — from six years at best to as much as several decades (assuming no intervening losses) — for the pool to build enough capacity to handle workers' compensation terrorism losses at the 1-in-500 level, which is about the point that the industry historically has sought to protect itself against large natural catastrophes. Building enough capacity to handle the truly mega events would obviously take much longer. During the intervening years, because the pool's resources are limited, it would be able to respond only to terrorism events of rather modest size.

[14] There are several reasons that the estimated losses associated with "1-in-x" events differ between exhibits. The primary reason is that the analyses use projected industry losses based on simulations — generally, runs of 10,000 to 12,500 simulated events — that sample from the industry loss exceedence curve; this introduces some variability in results (i.e., "sampling error"). Also, during the course of the study we refined the composition of the hypothetical pool to more closely reflect the profile of the industry. We believe that the resulting variations do not materially affect any findings or conclusions.

For the pool prototype design, we established the following funding objective: To accumulate $4 billion over ten years assuming no intervening losses. This was intended to be an *enduring* objective — i.e., in the event of loss, the funding replenishment rate would continue to target a $4 billion accumulation at (the new) 10-year mark. This funding objective translates into pool premiums averaging 1.35% of workers' compensation direct written premium for members, though individual members' premiums vary depending on their exposure. Exhibit 14 illustrates the pre-funded capacity accumulation at this target funding level.[15]

EXHIBIT 14

Pre-funded Pool Capacity Accumulation — Based on Blended Loss Exceedence Curve Used in Pool Prototype Design



Note: Assumes 5% investment return, 10% co-participation and initial capital infusion of 100% of deposit premium using the minimum retention option. Years to achieve capacity assumes no successor to TRIA.

The intent was to select a funding level that is straightforward (i.e., simple and understandable) and that appropriately balances the supply and demand considerations described earlier. Although the funding target was developed by triangulating various estimates of potential future losses, the underlying workers' compensation economics and the indicated terrorism load in the primary rates, there is nothing magical about $4 billion. In theory, the funding target could just as well have been set at $3 billion or $6 billion. However, higher funding targets imply higher pool reinsurance costs for members that ultimately would need to be passed through to policyholders as higher premiums. Feedback from sponsors about the prototype pool design suggested little appetite for raising the funding target above the proposed $4 billion. Conversely, a lower funding target would limit the pool's ability to respond to terrorism events.

We also concluded that a small amount of post-loss funding would be appropriate to supplement pre-funding capacity in the first couple of years. The maximum post-funding amount (.5 times a company's premium) would decrease to .25X and 0 in years two and three, respectively, as the pre-funded portion accumulated. The post-funding element would also come into play in later years if pool capacity were depleted by a loss.

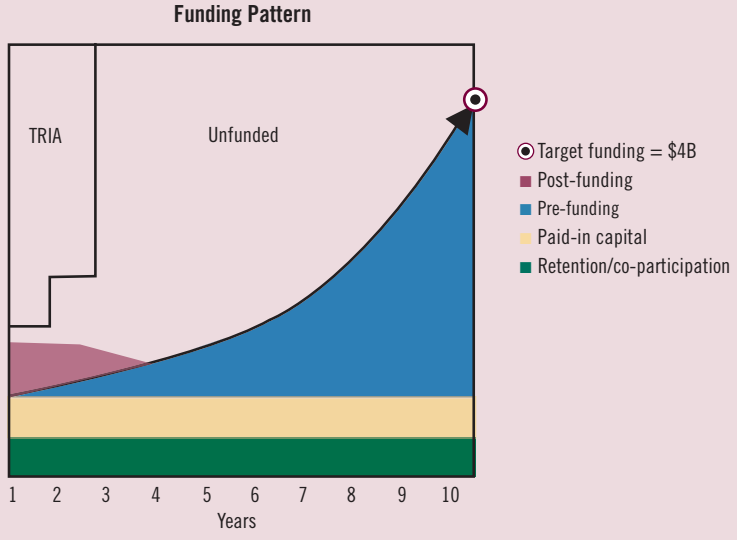
[15] The 1-in-500 loss line reflects a blend of the RMS loss exceedence curve and a loss exceedence curve derived from a "proxy measure of exposure" that we created. This is explained in the section on Achieving Equity.

(As noted previously, some sponsors objected to the post-loss funding element.) Lastly, we added a one-time paid-in capital infusion from each member in order to enhance the initial capacity of the pool. Exhibit 15 illustrates the overall pool funding scheme.

Needless to say, if the pool were to be implemented, the funding scheme and targets would need to be revisited and refined to reflect the prevailing sentiments of the pool's founding members (including their willingness to assume any post-funding obligations).

Before concluding the discussion of capacity, it is important to note that the illustrations of capital accumulation shown thus far (and hereafter) ignore the effects of taxes on the pool. A number of sponsors expressed concern that if the pool were taxed like a regular insurer, as much as one-third or more of the capacity created each year through premium contributions by members could be depleted by federal and state tax obligations. This could substantially reduce the capacity accumulated over time and proportionally increase the number of years it would take the pool to accumulate enough funds to cover a 1-in-x event.[16]

EXHIBIT 15
Illustration of Overall Pool Funding Pattern



Given the tax treatment that has been afforded other reinsurance pools serving important national interests (e.g., the American Nuclear Insurers, the California Earthquake Authority), it may be possible for a voluntary workers' compensation terrorism reinsurance pool to garner favorable tax treatment through an IRS private letter ruling or through legislative action. This would clearly be desirable.

[16] Preliminary research suggests that the impact of taxes on pool capacity may be less deleterious than this discussion implies. In fact, pool losses in a year can be carried back (up to 15 years) to recoup past taxes paid. That is, the pool could effectively reach back to recover taxes that have been paid in the preceding years to cover the portion of losses paid out of the pool that exceed the pool's capacity. If this were the case, the pool's balance sheet would understate its true capacity. The real economic loss to the pool's capacity from taxes, then, would be equal to the compound interest/returns foregone on the sums paid out as taxes that would otherwise be earning interest (and contributing to pool capacity) as part of the pool's invested reserves. The impact of taxes on the capacity of a voluntary pool is an important issue that requires further investigation.

MEASURING TERRORISM EXPOSURE

Measuring terrorism exposure is the second fundamental issue we examined in the feasibility study. At the outset of the study, sponsors expressed considerable skepticism about whether terrorism exposure could be fairly and reliably measured across pool members. Before we turn to exposure measurement, it is important to define what we mean by achieving equity, because this sets the context in which exposure measurement is applied.

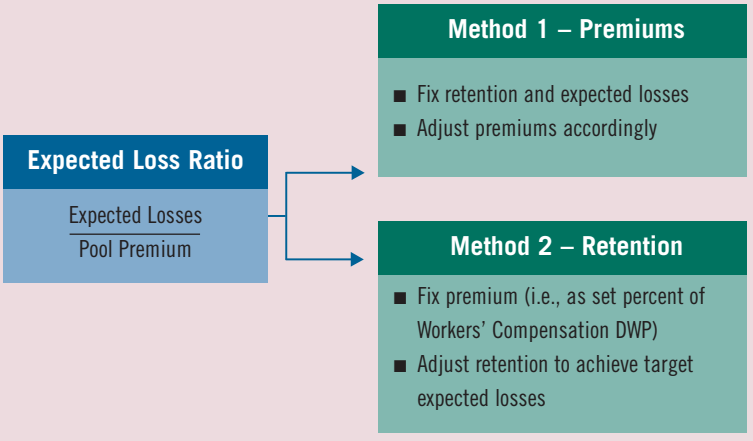
Defining Equity

A fundamental design objective was to establish each participant's share in the pool based on its risk profile relative to that of other participants. An estimate of the *relative* risk among pool participants would serve as the basis for determining each participant's burden (i.e., pre-funded premium, paid-in capital contribution, post-loss assessment).

The estimate of relative risk should consider material differences in the risk profile of participating companies, reflecting their underwriting practices, including:

- Magnitude of exposure
- Location of covered employees
- Distribution/concentration of covered employees
- Differences in state benefits
- First dollar vs. excess writer
- Precision/accuracy of exposure data.

EXHIBIT 16
Alternative Methods to Equalize Participants' Expected Loss Ratio



So the underlying premise of the pool is that each participant's burden should reflect the exposure it contributes to the pool and be proportional to its expected benefit.[17]

Expected loss is used as the basis for determining exposure. Therefore, each participant's expected ceded loss ratio (i.e., expected losses ceded to the pool divided by pool premium) should be equal.

Given this definition of equity, there are two basic ways to equalize participants' expected loss ratio, as shown in Exhibit 16.

While there are practical and technical differences between the two methods that may make one or the other more attractive, the two methods represent different mechanical approaches to achieve the same result.

As described previously, the final prototype pool design uses premiums (i.e., Method 1) as the main lever to achieve equity. It establishes three optional levels of retention (low, medium, high) for each participant based on its exposure, and calculates the pool premium required for each level of retention. Obviously, the higher the member's retention (i.e., the more losses the member retains), the lower its pool premium.

[17] Note that because a company's exposure profile can change relatively quickly as it writes new business, the pool would perform periodic updates of participants' relative exposure, including immediately following a pool loss.

Exposure Base

The first step in measuring participants' relative terrorism exposure was to agree on an exposure base (i.e., the basic unit(s) for measuring terrorism exposure).

In general, an effective exposure base should "...accurately reflect the overall exposure to loss, be simple to compile, and not be subject to manipulation... the exposure base should accurately reflect differences in exposure to loss [among insureds]."*

For workers' compensation, there are three logical candidates for the exposure base: payroll, workers' compensation premium and headcount. The sponsor group unanimously agreed that, taking into account both cost and benefit, headcount represented the best exposure base. While workers' compensation premiums data is readily available, it varies with occupational hazard: premiums for office workers are relatively low, while premiums for construction workers (for example roofers) are relatively high. However, occupational hazard is not correlated with terrorism exposure, making premium a poor choice. Payroll data would be usable, but they are actually harder to obtain (particularly split by employee location) than headcount.

The key question, then, is availability. Would insurers have, or be able to collect, credible headcount data that could be used by the pool to measure terrorism exposure? Interviews and analysis of company data conducted during the feasibility study suggest that headcount data is available.

Because reliable data are a prerequisite for a successful pool (and a major concern at the outset of the study), it is worth exploring briefly the context for, and current state of, headcount data in the workers' compensation industry.

The 9/11 attack made insurers realize that they had a much less complete understanding of the extent and nature of the risks they held than they previously believed. In particular, workers' compensation writers realized that, in light of the emergent threat of terrorism, any large concentration of workers (whether in a single account location, or different accounts located close to one another) represents a potentially catastrophic loss.

Indeed, terrorism challenged several basic assumptions about workers' compensation exposure. For example, before 9/11 a large concentration of professional employees, such as in a law firm, was perceived as a relatively low risk and a highly desirable account. By and large, lawyers and supporting clerical workers are not very prone to occupational injuries (compared with, say, construction workers), and natural catastrophes (such as fires and hurricanes) resulting in large numbers of workplace injuries or deaths are very rare. However, in the post-9/11 era, the same concentration of lawyers represents a potentially huge workers' compensation exposure, magnified manyfold if it happens to be located in or near a "trophy building" or high-probability terrorist target.

With this in mind, in the aftermath of 9/11 many property/casualty insurers took aggressive steps to better understand the full breadth of their exposure. For workers' compensation writers, this meant working with their insureds and distributors (i.e., agents and brokers) to define exposures much more precisely (e.g., the location of each office for accounts with multiple sites, the number of employees located in each of the sites, the peak number of employees located at each site at any given time, the proximity of these locations to likely terrorist targets, etc.).[18] Most sponsors/insurers had settled on headcount by location as the most useful exposure information to collect and track. Collecting, validating and storing these types of data represented a major undertaking that continues to this day.

In addition to their efforts to collect and analyze exposure data, insurers made changes to their underwriting policies and practices to ensure that they were writing (and renewing) accounts that were consistent with their more complete understanding of the underlying risks, their risk appetites and controls and their fiduciary obligations to existing policyholders, shareholders and employees.

[18] Interestingly, in many ways these initiatives were modeled on industry efforts to gather and analyze more comprehensive property exposure in the aftermath of the tremendous property losses caused by hurricanes Andrew and Iniki in 1992, which vastly exceeded all expectations and predictions.

*Bouska, Amy. "Exposure Bases Revisted." Proceedings of the Casualty Actuarial Society, Vol. LXXVI, part 1, No. 134. Nov. 12-15, 1989.

Exposure Data

The workers' compensation terrorism reinsurance pool would be in a position to benefit greatly from the substantial, ongoing data collection and analysis efforts and investments being made by insurers.

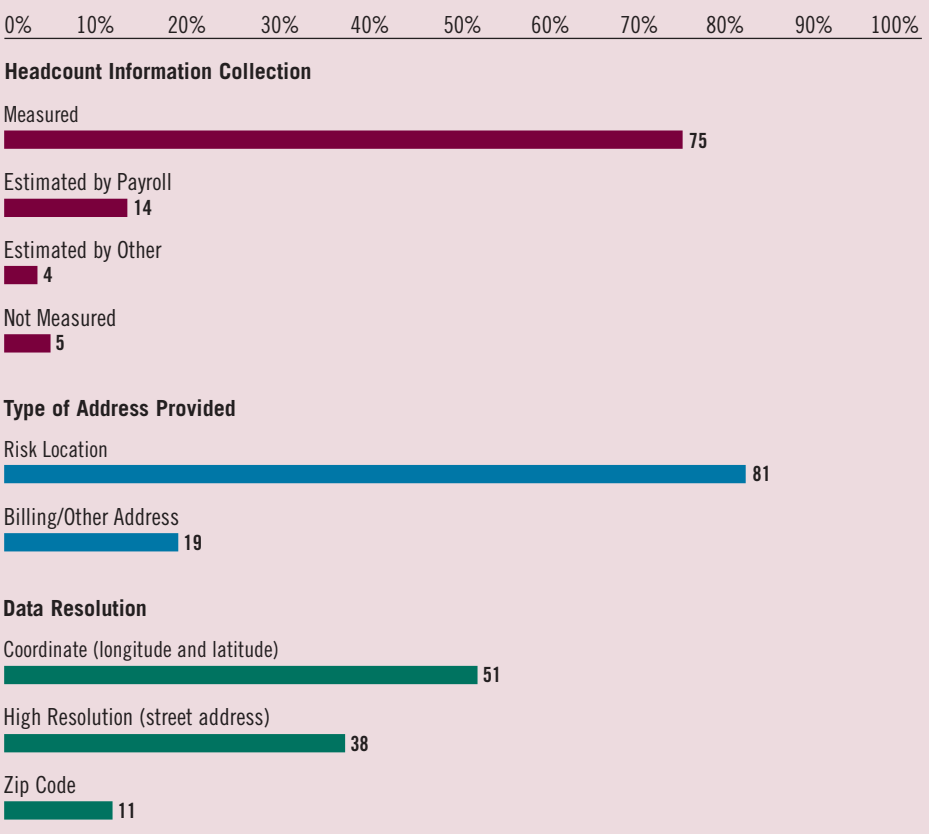
As part of the feasibility study, sponsors were asked to submit samples of their account data in order to conduct a cursory review of overall data quality and completeness. The data was also used to test different approaches to measuring relative exposure and pool share.

Exhibit 17 and Exhibit 18 summarize the results of the data review based on the data that were submitted. Obviously, a confirming audit would be an important early step in a detailed pool design or implementation effort, and would undoubtedly surface a number of data issues that would need to be addressed by the pool.

In terms of data *completeness*, most companies are actively collecting headcount exposure data for their workers' compensation portfolios. Many companies began by focusing on their largest accounts, but have steadily worked their way down. Intermediaries and employers reportedly are not overly resistant to providing headcount and location data.

EXHIBIT 17

Results of Exposure Data Review (Data Completeness)



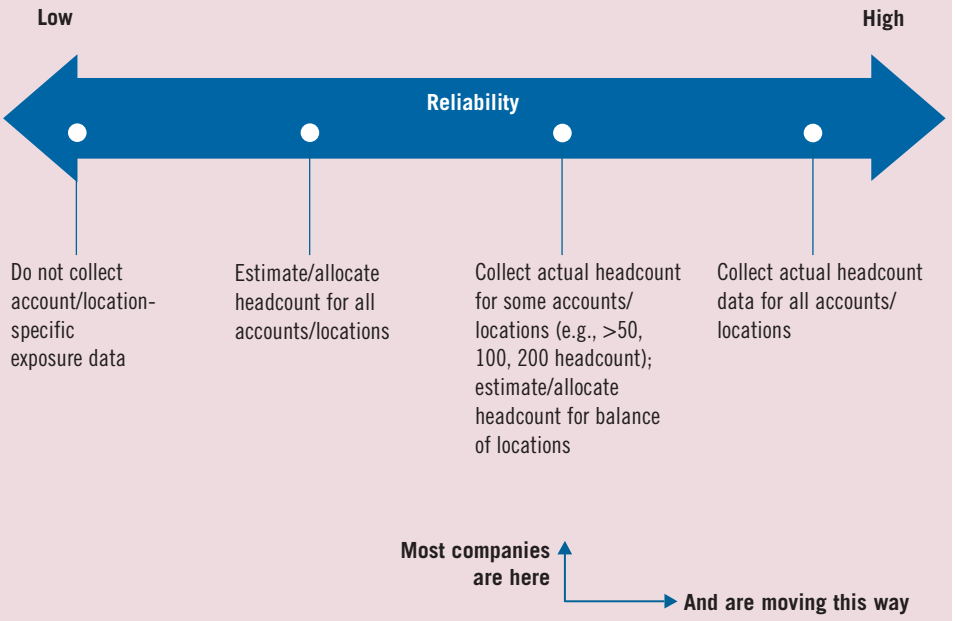
*Reflects totals across all 12 sponsor companies that submitted data sets; headcount and type of address statistics reflect totals for the 11 companies that provided data sheets with their exposure data.
Note: May not add to 100% due to rounding.

In terms of data *accuracy*, most headcount data are being collected, not estimated; when estimated, companies tend to estimate headcount based on payroll, which introduces relatively modest translation error. Similarly, most companies are gathering actual risk locations, except for small account business; the resolution of this data is generally quite high. When headcount by location is estimated (not measured), the specific approaches to assigning headcount to risk locations vary somewhat, but generally appear reasonable.

The results suggest that if the pool were made up of the 12 sponsor companies that submitted their workers' compensation account data for this exercise, the vast majority of its headcount would be 1) measured, not estimated 2) assigned a risk location and 3) available at a high level of geographic resolution (i.e., street address).

Notwithstanding this basic conclusion, it is important not to overstate the quality of industry headcount exposure data. Analysis of the sponsors' exposure data was not exhaustive, and their data represent but a sample — albeit a large and diverse sample — of the entire industry's data. In addition, we observed a number of important issues with the data — these issues are described briefly in Appendix 3, together with ways that a pool could address them. Also, a number of details related to exposure data (e.g., treatment of temporary and "mobile" employees, data auditing) were not addressed during the feasibility study. These would need to be specified in order to finalize the pool design and operating approach.

EXHIBIT 18
Approaches to Collecting Exposure Data



In summary, the exposure data appears promising. Headcount by location represents a good exposure base for terrorism losses, and insurers have made significant strides in gathering this kind of information. While the data are far from perfect, through each renewal the completeness and quality of companies' collected exposure data improve as companies enhance their data collection and audit processes, refine estimation methods and expand their collection (vs. estimation) of location-specific exposure data to smaller and smaller accounts. Moreover, because companies are already gathering these data for internal risk management purposes, there is relatively little or no incremental cost to using them for the pool's exposure measurement process. Although further analysis and more detailed specification are required, there appears to be enough credible exposure data to support the development and implementation of a voluntary pool using headcount by location as the basis for assessing participants' relative terrorism exposure.

ACHIEVING EQUITY

Achieving equity among pool members is a basic prerequisite for establishing a voluntary pool. Companies would not willingly join a pool unless they expected to be treated fairly in terms of the cost to participate and the benefits to which they would be entitled in the event of a loss.

Once headcount was established as the pool's exposure base, we needed to determine how the headcount data would be used to measure exposure. At the outset of the study we identified two basic approaches to measuring terrorism exposure, as summarized in Exhibit 19: Commercial terrorism loss model or a "proxy" measure of exposure.

EXHIBIT 19
Approaches to Measuring Terrorism Exposure

	Commercial Terrorism Loss Model	Proxy Measure of Exposure
Description	■ Causal model of the physical characteristics of a terrorist event: – Likelihood of various types of attack – Attractiveness of particular targets – Severity of attack (casualty footprint) – Concentration of exposure – Indemnity and medical costs ■ Output is the expected loss for each pool participant	■ Statistical model based on exposure: – Risk factors, i.e., location, exposure concentration, indemnity and medical costs – Formula that combines factors to develop a proxy measure of expected loss ■ Output is a proxy measure of exposure for each pool participant
Pros/Cons	■ Provides greatest flexibility in measuring exposure – First dollar or excess plan – Per occurrence or aggregate – Levers for establishing equity ■ Significant model risk due to heavy dependence on "expert" input	■ Requires fewer and broader assumptions — e.g., does not require explicit assumption of frequency and severity of events ■ Simpler to administer ■ More difficult to accurately assess exposure as coverage moves from first dollar to excess, or if deductible is used to establish equity

Commercial Terrorism Loss Model

The first approach is to use one of the commercial terrorism loss models developed for the insurance industry. After 9/11, as insurers focused on their exposure data, analysis and underwriting, companies that had historically provided modeling support to the industry for natural catastrophes (e.g., hurricanes, earthquakes) turned their attention to the problem of terrorism.

Using sophisticated analytic and scientific tools, and in collaboration with global experts on topics such as terrorism, security and intelligence, these firms developed models to estimate the frequency and severity of terrorism losses for use by the insurance industry.

There are three leading commercial terrorism loss modelers: Applied Insurance Research Worldwide (AIR), EQECAT and Risk Management Solutions, Inc. (RMS).

Although the three models differ in important ways, they share a number of basic characteristics, including:

- Development and maintenance of a library of potential terrorist targets, each of which is assigned a probability for each possible attack mode
- Reliance on expert input from panels of global experts on terrorism, security, intelligence, weapons systems, etc. to identify likely targets, assign probabilities to different attack modes, etc.
- Use of engineering science expertise to estimate likely damage functions associated with attacks of various types (e.g., conventional explosion, nuclear, biological) and sizes
- Use of stochastic modeling techniques to reflect the fundamental uncertainty of modeling assumptions
- Development of overall insurance industry and company-specific PML curves to estimate the likelihood of losses of various sizes.

The use of commercial loss models raises several important issues and questions.

First and foremost is whether terrorism can in fact be modeled. While this question could be debated extensively, for our purposes it is largely academic.[19] It is certainly true that these "first-generation" models are untested (in contrast, say, to hurricane loss models that have been refined over the course of the last 20 or so years). It is also true that the information and insights contained in these models represent the best available distillation of knowledge, experience and judgment about the motivations, capabilities and effects of terrorism for use by the insurance industry. In fact, by the time the feasibility study began in March 2003, many insurers had already begun using one or more of the models to analyze their terrorism exposure and test hypothetical loss scenarios.

As noted previously in the discussion on capacity, a second problem is that the results of the models differ, reflecting in part differences in their underlying theories of terrorism. If the modelers, collecting and synthesizing information from the most qualified global experts, reach different conclusions and generate divergent results, how are we to determine which one, if any, is "right" (or at least closer to being right) and thereby choose which model the pool should adopt?

As a practical matter, the issues with loss models are less problematic for the pool than for some other uses of the models — such as pricing terrorism coverage — because the pool need only establish a measure of the *relative* exposure of participants to determine each company's share. (By contrast, in pricing, insurers develop estimates of the absolute values of potential losses.) Selecting a measure of relative exposure requires only that companies agree to a common approach to measurement; they need not believe that the level of estimated terrorism losses is correct in an absolute sense. Put another way, prospective pool members may think the models are "wrong" and still be comfortable using them as long as they believe that any error or bias in the model is more or less uniform (i.e., it does not unfairly advantage or disadvantage any particular participants).

For the feasibility study, RMS was used to model the expected terrorism losses based on the exposure data submitted by each of the sponsors. The RMS modeling generated PML curves for each of the sponsors based on the key factors that influence expected losses:

- *Concentration:* How prevalent are company exposure concentrations within a 400-meter radius?
- *Cities:* How much of a company's business is located within cities of perceived high risk?
- *Targets:* Within high-risk cities, how much of a company's exposure is near targets of perceived high risk?
- *State Benefits:* How much of a company's exposure is in states with high benefits?

Appendix 4 contains a more extensive description of the RMS terrorism loss model.

Proxy Measure of Exposure

The second approach to exposure measurement is to develop a "proxy measure of exposure."

The purpose of such a proxy is to create a measure that relies on fewer (and simpler) assumptions[20] and that could be used more easily than a commercial loss model for certain purposes. Ultimately, the proxy measure could be used as part of a consolidated exposure measurement (e.g., in conjunction with results of a loss model) or on its own for certain uses (e.g., for interim updates of pool exposure, to provide preliminary price indications to prospective pool members).

[19] All of the models have two main parts. The first uses expert input to estimate frequency — targets, type of attack, size of attack, frequency of attack, etc. The second relies on engineering science to estimate severity — the size and nature of the damage (property, business interruption, and for workers' compensation, fatalities, injuries, etc.) which is then translated into insured losses. Skepticism about the loss models relates primarily to frequency, which inevitably relies heavily on expert input. Although many believe these probabilities are speculative at best, this is the best information available.

[20] The basic assumption embedded in the proxy measure is simply that locations (in this case, Zip Codes) with higher population and employee densities represent, on balance, more likely targets for terrorism. The proxy does not define specific terrorist targets (e.g., trophy buildings, infrastructure sites) nor does it assign specific probabilities to any targets or geographies aside from the inherent relativities of the population/employee density.

The proxy measure would use the same input exposure data — employee headcount by location — and would adjust the headcounts for the following risk factors:

- Location adjustment factor — to reflect differences in the likelihood of terrorist events at different locations
- State claim adjustment factor — to reflect differences in claim severity by state
- Coverage adjustment factor — to reflect the degree to which deductible or excess contracts are present.

The proxy formula would combine the exposure data and the risk factors to produce a substitute measure of relative expected terrorist losses. The proxy formula must also allow the pool to distinguish between retained and excess elements of total terrorism exposure at the account level, necessitating two additional risk factors:

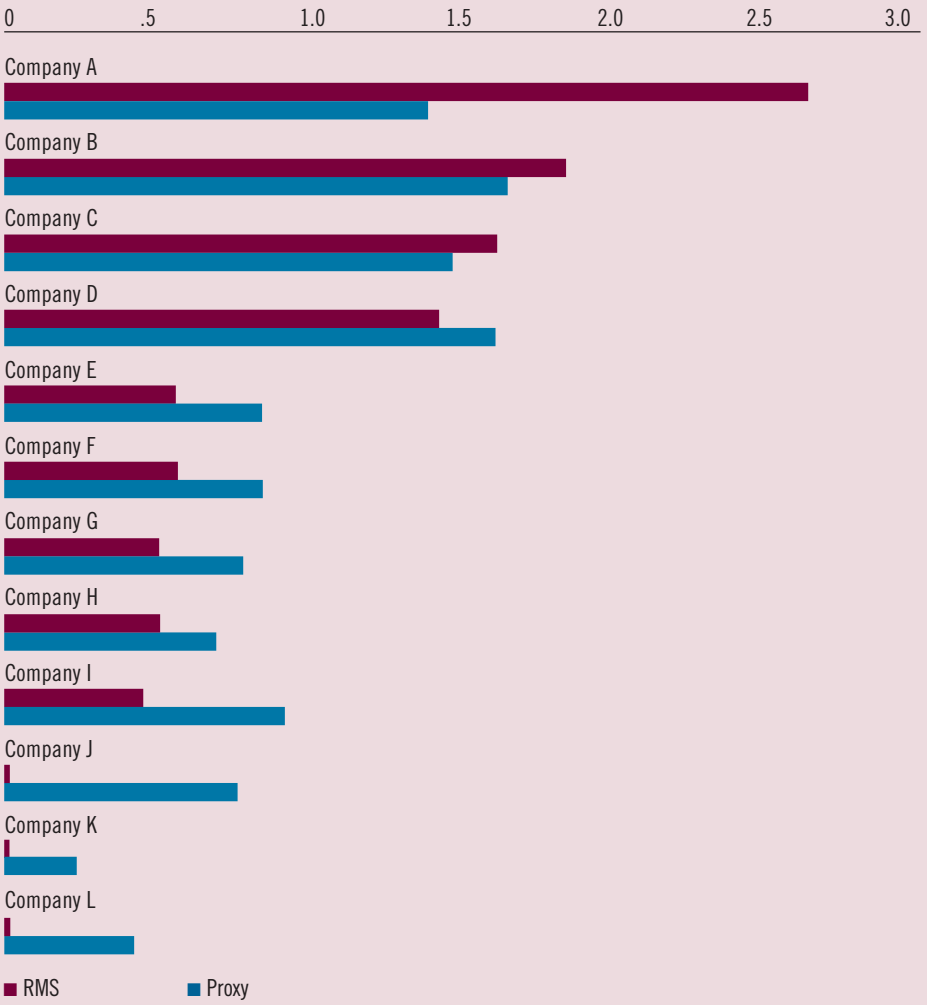
- Concentration adjustment factor — to reflect the degree to which exposures are concentrated, exacerbating the potential for catastrophic losses
- Size adjustment factor — to reflect differences in the loss distribution that are driven by insurers' size.

Work during the feasibility study suggests that a proxy measure can be constructed that captures the key drivers of risk, including relative likelihood of attacks, relative severity of claims and relative distribution of losses. (Appendix 5 contains a description of the initial proxy measure.)

EXHIBIT 20

Terrorism Exposure Share Results: Comparison of RMS Model Results and Proxy Measure of Exposure

Terrorism Share Divided by Headcount Share



Note: Reflects first-dollar (i.e., ground up) losses.

As can be seen in Exhibit 20, when comparing the results of the proxy measure to those of the RMS model, the proxy measure generally tracks the RMS measure, but the variance between companies is dampened.

Although the proxy measure is, by design, less "precise" than a loss model, it has several advantages over the loss modeling approach. First and foremost, it relies on fewer assumptions requiring less subjectivity. Second, it is more transparent in understanding the impact of location and concentration. Third, it is simpler to administer, with possibly lower cost.

In the feasibility study we used a blended approach to measuring exposure that combines RMS's loss model results (80%) and the proxy exposure measure (20%) to provide sponsors with illustrative pool "offers" based on the prototype pool design.

The rationale for using this blended approach is as follows: The RMS model reflects a theory of highly concentrated terrorist targets — i.e., the majority of the risk (and expected losses) are concentrated among a relatively small number of top-tier cities, and within those among very specific terrorist targets. While sponsors found the underlying theory compelling, there is no way to know whether it is in fact "right." For example, an alternative theory of terrorism (reflected in the EQECAT terrorism model) suggests that terrorists could also attack low-profile targets, such as suburban shopping malls, to instill the fear that "no place is safe." A blended approach based on relative weighting of the RMS terrorism model and proxy approach accommodates these alternate theories of terrorism. The effect of providing nominal weight to the proxy approach is to attenuate the sharp contrast in the assessment of risk between geographic regions in the RMS model. Since companies vary in their relative exposure under these differing theories of terrorism, the blended approach dampens the variability in pool share among participating companies (as shown in Exhibit 19) and may make the pool more attractive to a broader number of prospective members.

While we used an 80/20 blended approach for the feasibility study, the actual approach would undoubtedly differ if the pool were implemented. For example, the pool might use a different loss model, a combination of loss models, or a combination of one or more loss models blended with a proxy measure. The pool's founding members would determine the specific approach to exposure measurement.

Recall that at the outset of the feasibility study there was considerable skepticism and concern about whether it would be possible to develop an equitable and practical approach to measuring companies' relative terrorism exposure. While agreeing on a final approach to measuring exposure during the formation of a pool would likely be a challenging "negotiation," the feasibility study suggests that meaningful differences in company's terrorism exposure — based on collected headcount data — can be captured, measured and used as a basis for determining each member's pool burden.

Intergenerational Equity

The pool was intended to be a stable, long-term mechanism — i.e., not one in which companies frequently come in and out depending on, for example, short-term changes in the perceived threat of terrorist attack or commercial reinsurance pricing/availability. Accordingly, the goal is to encourage companies to join at its inception and remain members to ensure the pool affords enough scale and risk diversification to its members.

Because, in general, the pool would benefit from having more members, it would also be in the interest of the pool to encourage additional companies to join even after its formation.[21] By the same token, while the pool would like to encourage participants to remain so that the pool's capacity and risk diversification benefits would not be diminished, potential members might be discouraged from joining if they were unable to withdraw without suffering severe financial penalties.

[21] In some instances, adding new members is not beneficial to the pool. That is, the benefit of greater capacity and risk diversification associated with additional pool members may be offset by the additional exposure a participant would contribute to the pool. The prototype design envisioned that the Pool's Board of Directors would have the authority to reject new members beginning some time after the pool's formation if the new members would bring too much exposure to the pool.

So, there are two basic intergenerational equity issues that must be addressed in the final pool design: late entrants and departures.

To the extent that the pool has accumulated a fund to pay for future losses, late entrants — companies that enter the pool in the years after it is formed — could obtain a windfall in the form of the capacity that was created by previous members. The late entrants issue can be addressed rather easily by requiring companies that join after an initial "open window" (e.g., three years) to contribute extra capital in addition to their premium. The difficult part is to properly calibrate a formula for the capital contribution that balances the desire to 1) encourage companies to join at the outset 2) allow late entrants to join subsequently and 3) prevent late entrants from realizing an unfair benefit.

The second issue is departures — companies that chose to leave the pool after several years. Departing companies — those leaving the pool after several years — could forfeit substantial funds that they contributed to the pool, particularly if there were no losses for a few years. (There is also the question of fairness if a departing company had losses ceded to the pool that exceed the premiums it has contributed.)

One way to address intergenerational equity for departing members is to use a "retrospective premium approach." Once the overall target level of funding is reached (for example at year ten), then excess funds would be returned to participants based on their participation in years without losses.

Each coverage year would have a group experience account associated with it: premiums, less expense allowances, would be deposited; any losses for that year would be deducted; interest would be credited. If the experience account for a particular year is depleted by losses, any further losses would be deducted from the experience account of the previous year.

Distributions for a particular year would be made *pro rata* to the members for that year. Premiums would be "at risk" for a period of 10 years, and could be delayed if the overall funding is below the target level. The retrospective approach may have the added benefit of mitigating taxes, because every dollar collected will either be a loss or a premium liability. (See Appendix 2 for an illustration of the approach to ensuring intergenerational equity.)

Obviously, intergenerational equity is an important issue. The key is to develop rules that enable companies to join (even after the formation of the pool) and to encourage members to remain, but to provide the flexibility that allows them to withdraw.

While the "rules" would require further specification (e.g., agreement on how to address merger and acquisition situations or newly formed companies for purposes of late entry), there is no reason to believe that achieving intergenerational equity would become a major obstacle to the formation of a pool. Indeed, all of the existing reinsurance pools, whether related to terrorism or not, have had to address this issue in one way or another.

VI. ILLUSTRATIVE POOL OFFER

At the end of the feasibility study, having concluded that the conceptual prototype pool design seemed viable, we sought to test the design further by developing hypothetical quotes and engaging in one-on-one discussions with sponsors to solicit their thoughts and perspectives on the pool.

Each sponsor that had submitted exposure data (12 of 14) was given an illustrative offer, as if it were being solicited to participate in the pool. The intent of this offer was to help translate the conceptual pool design that had been developed with the sponsors into a more tangible "product."

The prototype offer included several components:

- "Share" in the hypothetical pool — indicated each company's share of total peak shift employees or PSEs (a refined measure of employee headcount), total pool premium (assuming all participants chose the lowest retention option available to them) and expected ground-up terrorism losses
- Financial obligation — the amount of paid-in capital (100% of first-year premium based on the lowest retention/highest premium option available), premium for each of the three possible attachment points available to them, maximum retro premium obligation
- Risk reduction benefit — for each retention option, the percentage decrease in the company's loss at three different terrorism event probabilities (1-in-100, 1-in-250, 1-in-500), based on a comparison of simulated direct workers' compensation terrorism losses gross and net of pool recoveries.

Appendix 6 summarizes the range of results from the illustrative offers for the study sponsors and for all 90 members of the hypothetical pool. These results highlight and reinforce several key findings:

First, a company's direct written premium represents a poor proxy for its terrorism exposure (i.e., DWP fails to capture the impact of the key determinants of terrorism risk). Second, meaningful differences in companies' relative exposure can be discerned. Third, while headcount forms the basis for measuring terrorism exposure, simple headcount (i.e., the number of insured lives) is itself a poor indicator of a company's terrorism exposure. The reason is that the location and concentration of that headcount primarily determine the extent of exposure. Fourth, the pool provides a material risk diversification benefit for many pool participants — for example, excluding the effects of TRIA, 9 of 12 sponsors receive a risk reduction of between 30% and 75%. One company's risk reduction is about 13%, and two companies receive no risk diversification benefit. For these two companies, the risk diversification is realized at points further along their loss distribution (i.e., at more extreme and, presumably, less likely events such as 1-in-1,000 events) because of the combined effect of their low terrorism exposure and their retention (the amount of loss they must absorb before they can draw on pool capacity).

VII. CONCLUSIONS

The pool feasibility study represented a major investment of time and effort on the part of the industry participants over the course of nearly six months. What, then, are the key insights/conclusions?

It is appropriate that we begin with capacity, the central issue for the pool. In fact, this topic is so important that the conclusions are grouped into two sections: *capacity* and *other conclusions.*

CAPACITY

The most critical issue for the pool is the capacity that it creates. Simply stated, there is no compelling reason to create the pool unless it contributes materially to the insurance industry's capacity to insure terrorism exposure. (The term "capacity" basically refers to an insurer's ability to write business — that is, to maintain enough capital to absorb losses from fluctuations in its financial performance, mostly due to adverse fluctuations in insurance claims.)

A voluntary reinsurance pool does not in and of itself create net additional ("new") industry capital. Rather, by participating in a pool, participants agree to share their risk and capacity with one another in a way that reduces the likelihood that any individual participant will suffer severe financial loss (or become insolvent) from a terrorist event. However, in so doing, the pool increases the diversification of risk and thereby creates some additional capacity for its members by increasing the efficiency with which *existing* capital is deployed.

In this context, the central pool capacity question is: Can the pool accumulate enough capacity to afford meaningful protection to its members against catastrophic terrorism losses? The answer: The pool could create some capacity, but not enough to matter in the case of a mega terrorism event. In fact, the *entire industry's* capacity is not enough to respond to a mega event. Herein lies the fundamental, intractable problem with respect to insuring terrorism risk.

Using very round numbers, private workers' compensation insurance is roughly a $30 billion industry — that is, annual premiums collected for workers' compensation are about $30 billion. Again using round numbers, insurers write workers' compensation business with roughly a one-to-one premium-to-surplus ratio, meaning that every dollar of premium is backed by an equivalent dollar of capital that is available to cover adverse fluctuations in

workers' compensation claims/losses. Without a federal backstop that caps industry losses, a mega event — including a nuclear, biological, chemical or radiological attack that terrorism experts consider plausible — could wipe out the entire workers' compensation industry's capital.[22] Terrorism and insurance experts conceive of plausible catastrophic terrorism events that generate workers' compensation losses of $90 billion or more; in rough numbers, this is over three times the capital backing the private insurance industry's workers' compensation line of business! It is impossible to ignore the consequences of inadequate overall industry capacity for the pool.

If the industry as a whole does not have enough capital to manage the risk of terrorism, then neither can an industry pool that simply mutualizes the existing industry capital. Even if the pool were to be funded at an aggressive rate, it would take many years before the pool had enough capacity to protect against even "moderate" terrorism events. In the face of catastrophic events (the type that threaten the viability of the industry), the pool could not provide the industry any meaningful protection for the foreseeable future. This is true even under the most optimistic assumptions including, notably, that the pool could achieve favorable tax treatment that would enable it to accumulate capacity more quickly.

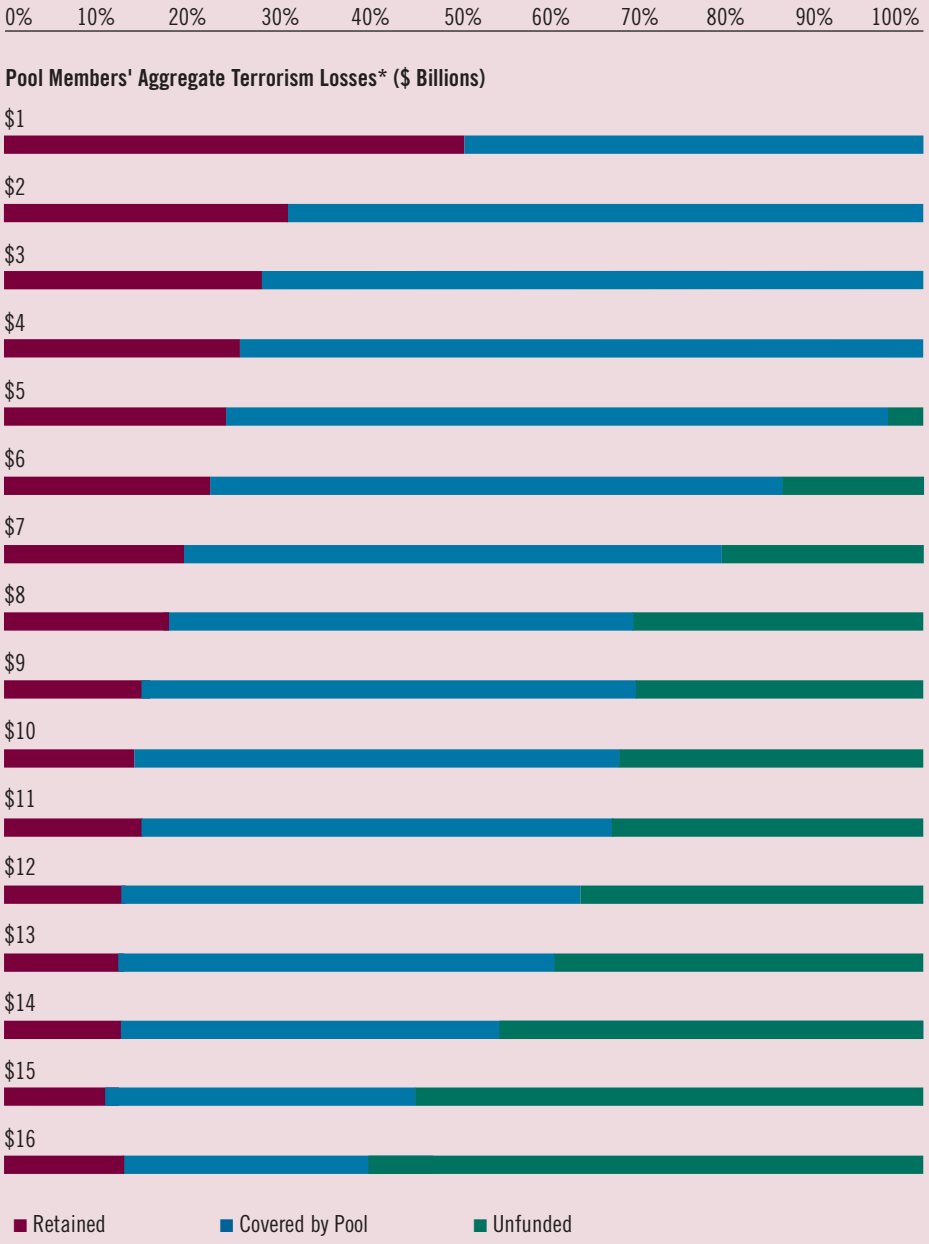
To illustrate this point, it is useful to consider how a pool would perform if there were a catastrophic terrorism event. If there were such an event, the pool would spread among participants the layer of excess losses ceded to the pool, up to the pool's capacity at the time. Once the pool's capacity was exhausted, losses would revert back to the individual companies. If the total losses were large relative to the pool's capacity, the pool has very little effect — that is, it absorbs a relatively small portion of the loss compared to what insurers retain. Much as they would if there were no pool, insurers would either be able to absorb the losses themselves (depending on their size/capital base, extent of individual losses, reinsurance coverage, etc.) or they would fail. If the size of the workers' compensation terrorism losses were more modest, the pool could serve a useful purpose in spreading those losses among pool participants because it could absorb a larger portion of the total loss.

In this context it is important to note that prior to 9/11, workers' compensation insurers were able to protect their solvency by purchasing large limits of affordable reinsurance against natural or man-made catastrophes. In this way, insurer losses were shared with their commercial reinsurance partners. (For example, a large portion of 9/11 losses were borne by reinsurers.) Today there is no sign that the global reinsurance market is prepared to cover the risk of a major terrorist attack. As a result, there is no efficient market for terrorism reinsurance, and reinsurers uniformly/routinely exclude all loss from weapons of mass destruction. Consequently, if a large attack were to occur today, in all likelihood the loss would be sustained entirely by primary insurers without the benefit of traditional commercial reinsurance protection.

[22] Although an insurer's entire capital base (i.e., capital supporting all lines of business) is theoretically available to pay for workers' compensation losses, it is reasonable to assume that terrorism events that cause catastrophic workers' compensation losses would also result in devastating losses in other lines of business.

EXHIBIT 21

Distribution of Pool Members' Aggregate Workers' Compensation Terrorism Losses (2013)

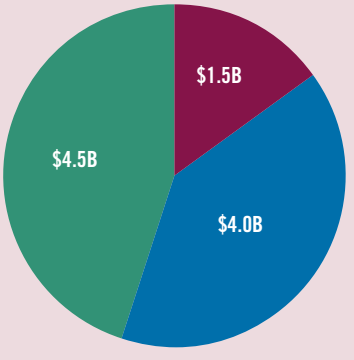


Note: Estimated based on 10,000 simulations assuming sponsors chose their low retention options.
*Assumes pool represents 50% of the market (therefore pool members' losses equal 50% of industry workers' compensation terrorism losses).

Exhibit 21 shows the simulated results of various size terrorism losses in 2013 (i.e., once the hypothetical pool has reached its $4 billion target funding capacity). Remember, the experts contemplate plausible terrorism events that result in workers' compensation losses more than five times greater than the largest loss shown here.

The exhibit reinforces the essential point about capacity: While the pool could help participants absorb small to moderate terrorism losses, it would be incapable of handling mega events.

Effect on Pool of Industry Event of $20B



OTHER CONCLUSIONS

Federal Backstop Protection

The issue of capacity leads to another important conclusion about the need for a more permanent federal backstop. The preceding discussion on capacity describes the industry's inability to handle very large terrorism events. For such catastrophic losses — ones in which the size of the loss approaches or exceeds the industry's capital — a federal backstop is required.

In addition to these mega events, terrorism experts contemplate small and "moderate" sized events. In the case of small events, insurers would likely be able to handle the associated losses themselves. For medium-sized events, depending on the size and concentration of losses, some insurers could absorb these losses themselves, but smaller, less well-capitalized and monoline workers' compensation writers could be significantly impaired by them.[23] Some of these insurers could find a reinsurance pool valuable to help manage intermediate size losses that are within the capacity of the industry but beyond their individual capacity to absorb. This is true for moderate size losses and also for the portion of losses from a mega event that falls below a federal backstop.

So, an ongoing permanent federal backstop is critical to the management of terrorism risk in workers' compensation. Without it the industry could be decimated by catastrophic terrorism losses. Further, without it insurers and regulators will face a significant dilemma — how to provide statutorily required coverage without being certain that insurers could fulfill their promise if there were a major terrorism event. This prospect looms as TRIA's expiration date approaches.

Measuring Terrorism Exposure

For a voluntary pool to work, participants must perceive that their burden is fair in relation to the benefit they receive. Unless they believe that they would be treated equitably in terms of measuring their contribution to pool exposure and their draw on pool resources in case of a loss, they would likely not be willing to join the pool.

For purposes of the pool feasibility study, the challenge was to define a consensus measure for terrorism exposure and determine if the necessary data are or could become available as the basis for measuring each company's contribution to the pool's overall terrorism exposure.

The sponsor group unanimously agreed that headcount by location represents the best measure of workers' compensation terrorism exposure from among the three possible contenders (workers' compensation premium, payroll, headcount). Moreover, the analysis suggested that "reasonably credible" location-specific headcount data are available because of insurers' extensive efforts to gather these data for internal risk management purposes since 9/11. Although the data are far from perfect, they appear adequate to support the exposure measurement process required for the pool; they are also improving over time as insurers enhance their data collection and validation processes.

Agreeing on a terrorism exposure measure is itself a significant accomplishment; a uniform industry measure of terrorism exposure could yield benefits in both efficiency (e.g., by standardizing data protocols for reinsurance proposals/purchase, facilitating responses to state insurance department questions) and effectiveness (e.g., by providing a more reliable basis for developing terrorism loads within the primary rate structure).

Achieving Equity

Having established that reasonably reliable exposure data appear to be available, the next question is whether it is possible to translate the differences in pool participants' terrorism exposure into a fair and appropriate pool "burden" — i.e., a pool reinsurance pricing formula.

The feasibility study suggests that developing an equitable pricing formula appears theoretically possible. (It is also fair to say that the feasibility study sponsors did not reach consensus on the proposed pricing basis for the pool.) The existence of several credible commercial terrorism loss models that could be selected from and/or combined creates a range of possible pricing formulae.

[23] While these impairments/insolvencies may not jeopardize the industry's overall stability, insurer failures often result in market disruptions that affect the continuity of medical care and payments to injured workers, delay reimbursements to medical providers, increase costs to employers, and so on.

But ultimately, implementing a voluntary pool is not a theoretical exercise. Negotiating a mutually agreeable pricing approach among charter pool members would undoubtedly be very difficult. Considerably more work would be needed to determine whether an agreeable pricing formula could be developed. This is clearly an obstacle that must be overcome before a pool could be implemented.

Basis Differences Between Pool Reinsurance Cost and Terrorism Loads in Primary Workers' Compensation Rates

The recommended exposure base for the pool is headcount; moreover, the pool's rates per headcount will vary by geographic location within a state and factor in each insurer's exposure concentration. This rating structure, which the participants agreed was necessary to achieve equity, is quite different from the current terrorism loads typically built into the primary workers' compensation rates. (Generally the latter do not vary geographically within a state and use non-terrorism premiums or payroll as their exposure base.) Unless the primary rating structure is modified, consistent with applicable state laws, the basis for pricing between the primary rates and the reinsurance pool will be inconsistent and, inevitably, misaligned. Insurers that participate in the pool will have the potential for an actuarial gain or loss due to the difference in rating structures.

CURRENT STATUS

So where do things now stand?

The sponsor group decided not to pursue the detailed design and implementation of a voluntary workers' compensation terrorism reinsurance pool at this time. Ultimately, the pool would not offer enough capacity to help the industry absorb losses from catastrophic terrorism events — the primary reason for its formation. This is particularly true given the considerable uncertainty about the future of federal backstop relief. Quite simply, without a more permanent federal backstop, the pool would not materially help.

The sponsors agreed that the effort has provided important insights into the key philosophical, conceptual and practical issues associated with creating a workers' compensation reinsurance pool and laid the foundation for future work on an industry pool, if and when appropriate.

LOOKING AHEAD

Although we can know little about the future, it seems certain that the threat of terrorism will continue for the foreseeable future. Al Qaeda, and those sympathetic to its cause and committed to its methods, views its enterprise as an epic struggle — one with no room for compromise and no end date. Experts agree that the war on terrorism since 9/11 has impaired the planning and execution capabilities of international terrorists, and may well have forestalled another large-scale terrorism attack in the U.S. However, the possibility of a catastrophic terrorism event in the future remains very real.

For the insurance industry, a critical milestone is fast approaching: With TRIA set to expire on December 31, 2005, insurance policies written and renewed beginning in January 2005 will extend beyond the current TRIA federal backstop protection. The expiration of TRIA could dramatically alter the current market equilibrium and cause significant market disruption. Inevitably, insurers will need to reconsider how they compete in a workers' compensation market that mandates terrorism coverage for insureds but leaves them fully exposed to potentially ruinous losses.

While it seems clear that current conditions are not right for a voluntary industry workers' compensation reinsurance pool, if and when the outlines of a federal solution are developed, it may be useful to revisit the pool concept — to consider whether a pool, effectively integrated with the federal backstop, could help some portion of the insurance industry manage its terrorism exposure.

Undoubtedly, between now and when TRIA expires, there will be much discussion about the roles and capacity of individual insurers, the insurance industry and the federal government in managing terrorism exposure. We believe that the results of this feasibility study will contribute to the dialogue aimed at finding a sensible, long-term solution that serves — and balances — the interests of insureds, insurers and taxpayers.

VIII. APPENDICES

APPENDIX 1 — LIST OF STUDY SPONSORS

- ACE USA
- American International Group
- CNA Insurance Companies
- Guard Insurance Group
- The Hartford Financial Services Group
- Kentucky Employers' Mutual Insurance Company
- Liberty Mutual Group
- Missouri Employers Mutual Insurance Company
- The PMA Insurance Group
- Royal & SunAlliance USA
- The St. Paul Companies
- Texas Mutual Insurance Company
- Travelers Property Casualty
- Zurich American Insurance Company

APPENDIX 2 — ILLUSTRATION OF PROPOSED APPROACH TO ENSURING INTERGENERATIONAL EQUITY

LATE ENTRANTS

Since the pool is voluntary, some insurers might decide to join in later years, after the pool is already established. A late entrant could benefit from any accumulated pool surplus resulting from contributions made by existing members in earlier years — potentially giving the late entrants an unfair benefit. The late entrants issue can be addressed by requiring companies who join after several years to contribute capital in addition to their premium.

Capital could be based on the relationship of the accumulated equity in the pool to the current year premium, for example:

- If the projected ratio of pool equity to pool premiums is less than two, no capital charge is required
- If the ratio is between two and four, capital is equal to member premium
- If the ratio is over four, capital is equal to twice member premium.

This approach is illustrated in Exhibit 22.

EXHIBIT 22

Illustration of Additional Paid-in Capital Requirements for Late Entrants to the Pool

Year of Program	Projected Pool Equity at Year-End*	Projected Member Pool Premiums for Next Year (1% of DWP)*	Ratio of Equity to Premiums	New Member Capital Requirement as Percent of Its Pool Premium for Succeeding Program Year
1	227	220	103%	0%
2	467	220	212%	100%
3	721	220	328%	100%
4	991	220	451%	200%
5	1,277	220	581%	200%
6	1,581	220	718%	200%
7	1,902	220	865%	200%
8	2,243	220	1,019%	200%
9	2,604	220	1,184%	200%
10	2,987	220	1,358%	200%
11	2,987	220	1,358%	200%
12	2,987	220	1,358%	200%

*Expressed in $ millions.

POOL MEMBER DEPARTURES

Since the pool is voluntary, prospective members will want to know at the outset what would happen to any accumulated surplus if they subsequently decided to withdraw from the pool. They may be reluctant to join the pool if they would forfeit all contributed funds in those circumstances. A retrospective premium approach could address intergenerational equity for departing members.

Once the overall target level of funding is reached (for example at year 10), excess funds would be returned to participants based on their participation in years without losses.

Each coverage year would have a group experience account associated with it:

- Premiums, less expense allowances, would be deposited
- Any losses for that year would be deducted
- Interest would be credited.

If the experience account for a particular year were depleted by losses, any further losses would be deducted from the experience account of the previous year. Distributions for a particular year would be distributed *pro rata* to the members for that year. Premiums would be "at risk" for a period of ten years, and possibly longer if the overall funding falls below the target level. The use of the retrospective approach may have the added benefit of mitigating taxes, because every dollar collected will either be a loss or a premium liability.

EXHIBIT 23

Group Retrospective Premium Plan: Illustration of Return of Premium, Assuming No Pool Losses

Coverage Year	Pool Premium	Pool Losses	Pool Equity @ End of Year 2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
2004	220	0	227	240	255	270	286	303	321	341	361	383	0	0	0
2005	220	0		227	240	255	270	286	303	321	341	361	383	0	0
2006	220	0			227	240	255	270	286	303	321	341	361	383	0
2007	220	0				227	240	255	270	286	303	321	341	361	383
2008	220	0					227	240	255	270	286	303	321	341	361
2009	220	0						227	240	255	270	286	303	321	341
2010	220	0							227	240	255	270	286	303	321
2011	220	0								227	240	255	270	286	303
2012	220	0									227	240	255	270	286
2013	220	0										227	240	255	270
2014	220	0											227	240	255
2015	220	0												227	240
2016	220	0													227
Total Equity @ End of Year			227	467	721	991	1,277	1,581	1,902	2,243	2,604	2,987	2,987	2,987	2,987
									Target Equity:			2,987	2,987	2,987	2,987
Premium Returns – First Valuation at Ten Years															
2004													406	0	0
2005														406	0
2006															406

Note: Dollar figures are expressed in $ millions.

The exhibits in this section illustrate how the return of premium would work for departing pool members under various pool loss and funding conditions.

As shown in Exhibit 23 on the previous page, in the case where there were no pool losses, member premiums would be returned, with interest after expenses, after the tenth year.

If there were a loss in the first year, the premium returns for that year would be reduced accordingly, as shown below in Exhibit 24.

EXHIBIT 24

Group Retrospective Premium Plan: Illustration of Return of Premium, Assuming a Pool Loss in Year 1

Coverage Year	Pool Premium	Pool Losses	Pool Equity @ End of Year												
			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
2004	220	200	27	28	30	32	34	36	38	40	42	45	0	0	0
2005	220	0		227	240	255	270	286	303	321	341	361	383	0	0
2006	220	0			227	240	255	270	286	303	321	341	361	383	0
2007	220	0				227	240	255	270	286	303	321	341	361	383
2008	220	0					227	240	255	270	286	303	321	341	361
2009	220	0						227	240	255	270	286	303	321	341
2010	220	0							227	240	255	270	286	303	321
2011	220	0								227	240	255	270	286	303
2012	220	0									227	240	255	270	286
2013	220	0										227	240	255	270
2014	220	0											227	240	255
2015	220	0												227	240
2016	220	0													227
Total Equity @ End of Year			27	255	497	753	1,025	1,313	1,618	1,942	2,285	2,649	2,987	2,987	2,987
									Target Equity:			2,987	2,987	2,987	2,987
Premium Returns – First Valuation at Ten Years															
2004													47	0	0
2005														406	0
2006															406

Note: Dollar figures are expressed in $ millions.

As shown in Exhibit 25, a loss in the second year could reduce the returns for that year to zero, and also defer and reduce the first year return.

EXHIBIT 25

Group Retrospective Premium Plan: Illustration of Return of Premium, Assuming a Pool Loss in Year 2

Coverage Year	Pool Premium	Pool Losses	Pool Equity @ End of Year												
			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
2004	220	0	227	67	71	75	80	84	89	95	100	106	113	0	0
2005	220	400		0	0	0	0	0	0	0	0	0	0	0	0
2006	220	0			227	240	255	270	286	303	321	341	361	383	0
2007	220	0				227	240	255	270	286	303	321	341	361	383
2008	220	0					227	240	255	270	286	303	321	341	361
2009	220	0						227	240	255	270	286	303	321	341
2010	220	0							227	240	255	270	286	303	321
2011	220	0								227	240	255	270	286	303
2012	220	0									227	240	255	270	286
2013	220	0										227	240	255	270
2014	220	0											227	240	255
2015	220	0												227	240
2016	220	0													227
Total Equity @ End of Year			227	67	297	542	801	1,076	1,367	1,675	2,002	2,349	2,717	2,987	2,987
									Target Equity:			2,987	2,987	2,987	2,987
Premium Returns – First Valuation at Ten Years															
2004													0	119	0
2005														0	0
2006															406

Note: Dollar figures are expressed in $ millions.

A large loss in later years could cause returns for early years to be deferred until the target funding balance is reached, as shown in Exhibit 26.

EXHIBIT 26

Group Retrospective Premium Plan: Illustration of Return of Premium, Assuming a Large Pool Loss in Later Years

Coverage Year	Pool Premium	Pool Losses	Pool Equity @ End of Year												
			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
2004	220	0	227	240	255	270	286	303	321	341	361	383	406	430	456
2005	220	0		227	240	255	270	286	303	321	341	361	383	406	430
2006	220	0			227	240	255	270	286	303	321	243	257	273	289
2007	220	0				227	240	255	270	286	303	0	0	0	0
2008	220	0					227	240	255	270	286	0	0	0	0
2009	220	0						227	240	255	270	0	0	0	0
2010	220	0							227	240	255	0	0	0	0
2011	220	0								227	240	0	0	0	0
2012	220	0									227	0	0	0	0
2013	220	2,000										0	0	0	0
2014	220	0											227	240	255
2015	220	0												227	240
2016	220	0													227
Total Equity @ End of Year			227	467	721	991	1,277	1,581	1,902	2,243	2,604	987	1,273	1,576	1,897
									Target Equity:			2,987	2,987	2,987	2,987
Premium Returns – First Valuation at Ten Years															
2004													0	0	0
2005														0	0
2006															0

Note: Dollar figures are expressed in $ millions.

APPENDIX 3 — DATA ISSUES AND POTENTIAL TREATMENT BY THE POOL

Exhibit 27 summarizes key issues with the exposure data sets sponsors submitted, and their potential impact on the pool's ability to reliably measure pool participants' relative terrorism exposure.

EXHIBIT 27
Summary of Key Exposure Data Issues

Issue	Potential Impact	Description
Incomplete portfolio data	●	■ Five sponsors provided data for less than their entire workers' compensation portfolio — 72%, 80%, 91%, 95%, 99% of their portfolios ■ Had the exposure data call been "real" (i.e., not for testing within the feasibility study), all companies could likely have provided data for their entire portfolios ■ Because RMS estimates that 2% of U.S. zip codes drive over 90% of the risk, the impact of even relatively small amounts of missing data can be considerable
Incomplete address information	◕	■ In some cases (11% overall from analysis shown elsewhere), companies provided location information at the zip code level rather than high-resolution street addresses ■ Because the probability of a loss is directly related to locations' proximity to terrorism targets, zip code data introduces a relatively large margin for error
Employees coded at home office instead of actual satellite office locations	◑	■ For some accounts, headcount data is not collected at, or allocated to, all company locations ■ This may either overstate or understate a company's exposure, particularly with an excess pool – The impact of concentration is more pronounced; the impact of location may be higher or lower, depending on the relative proximity to terrorist targets of the home office and the satellite offices ■ For small account business, this is an appropriate approach
Large number of mobile workers (e.g., airline and construction workers) in portfolio	◔	■ Because mobile workers are coded to a company location (whereas they often work offsite), headcount concentrations are overstated; again, location exposure may be higher or lower depending on the relative proximity to terrorist targets of the office and the actual work site – In most instances, the location risk will tend to be lower, except perhaps for major construction projects ■ In aggregate this issue is unlikely to be too significant – However, for individual companies that write a lot of this type of business, the overstatement of their exposure could be considerable
Multiple shift workers in count of total workers	◔	■ To the extent that companies are capturing total headcount at a location (versus peak headcount), exposure will be overstated for some types of accounts ■ In aggregate this issue is unlikely to be too significant – However, for individual companies that write a lot of this business (e.g., hospitals, manufacturing facilities), the overstatement of their exposure could be considerable
Mixture of payroll and headcount provided	○	■ While most companies have focused on collecting headcount data as the primary terrorism exposure base, several have been using payroll ■ Translating from account/location payroll to headcount — e.g., using state-average salaries by class — introduces relatively little margin of error

○ Low ◑ Moderate ● High

The pool would establish minimum requirements and standard rules/assumptions to address data issues. The rules would be designed to encourage companies to provide actual data at the greatest level of resolution possible. Where unavailable, decidedly conservative assumptions would be used to reflect the uncertainty introduced by missing or imprecise data.

Exhibit 28 illustrates some of the ways in which the pool could address these data issues.

EXHIBIT 28
Examples of Potential Treatment of Exposure Data Issues by the Pool

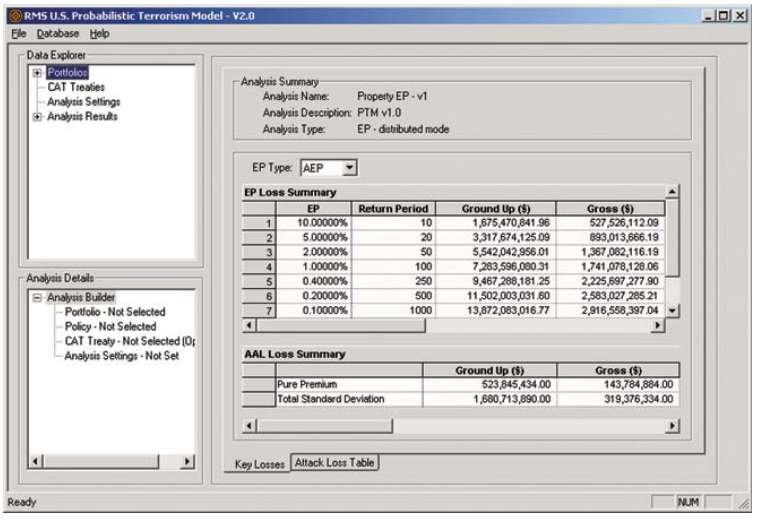
Issue	Potential Treatment
Incomplete portfolio data	■ Require data for entire portfolio ■ Alternatively, if complete data is not provided, scale up exposure assuming missing portfolio data resembles riskiest portion of company's (or any pool member's) exposure
Incomplete address information	■ Require zip code data as lowest level of data resolution accepted ■ Assign missing locations to highest risk locations within the zip code ■ Exclude City/State addresses; scale portfolio as described above
Employees coded at home office instead of actual satellite office locations for some accounts	■ Model exposure at the home office level (i.e., no assumption) ■ Impose exposure multiplier to this exposure to reflect uncertainty, except for small account business
Large number of mobile workers (e.g., airline and construction workers) in portfolio	■ Develop and apply standard discounting factor for selected SIC codes (and, possibly, job classes) ■ In order to qualify for "discount," companies may be required to provide additional data for accounts within the selected SIC codes (e.g., breakdown of employee headcount by class) – Over time may collect peak (versus total) headcount
Multiple shift workers in count of total workers	■ Develop and apply adjustment factor based on SIC code – Over time pool may require peak (versus total) headcount
Mixture of payroll and headcount provided	■ Convert payroll to headcount using pre-agreed state-average wages by class

APPENDIX 4 — OVERVIEW OF THE RMS™ U.S. TERRORISM RISK MODEL

Note: The contents of this appendix were provided by Risk Management Solutions, Inc.

The RMS™ U.S. Terrorism Risk Model provides a comprehensive look at terrorism risk in the U.S., quantifying risk from both foreign and domestic terrorist organizations. It supports multi-line risk analysis for both certified and non-certified events impacting property, business interruption, workers compensation, life, personal accident, and accidental death and dismemberment insurance.

The model employs state-of-the-art methods for quantifying the impact of a range of potential terrorist attacks, from conventional weapons to chemical, biological, radiological, and nuclear (CBRN) weapons. These attack modes are modeled at potential terrorist targets across the U.S. Attack frequency includes consideration of the potential for multiple synchronous attacks — a signature of Al Qaeda.



Probabilistic loss analysis provides key statistics such as return period losses, average annual loss, and standard deviation.

Manage Portfolio Risk

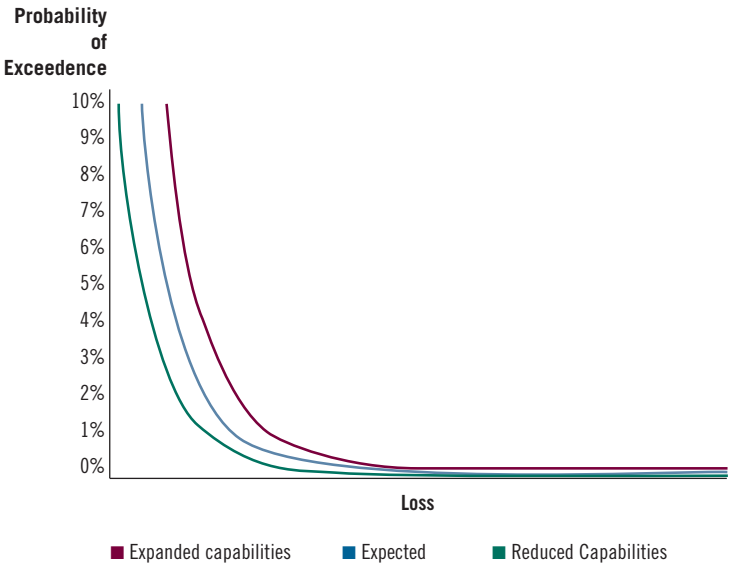
- Generate aggregate exceedence probability (AEP) loss distributions by line of business and in total
- Identify most critical terrorist attack scenarios for your portfolio
- Analyze key drivers of loss by account, location, target type, and city
- Quantify the risk of fire losses following terrorist attacks for policies without terrorism coverage

Examine "What If?" Scenarios

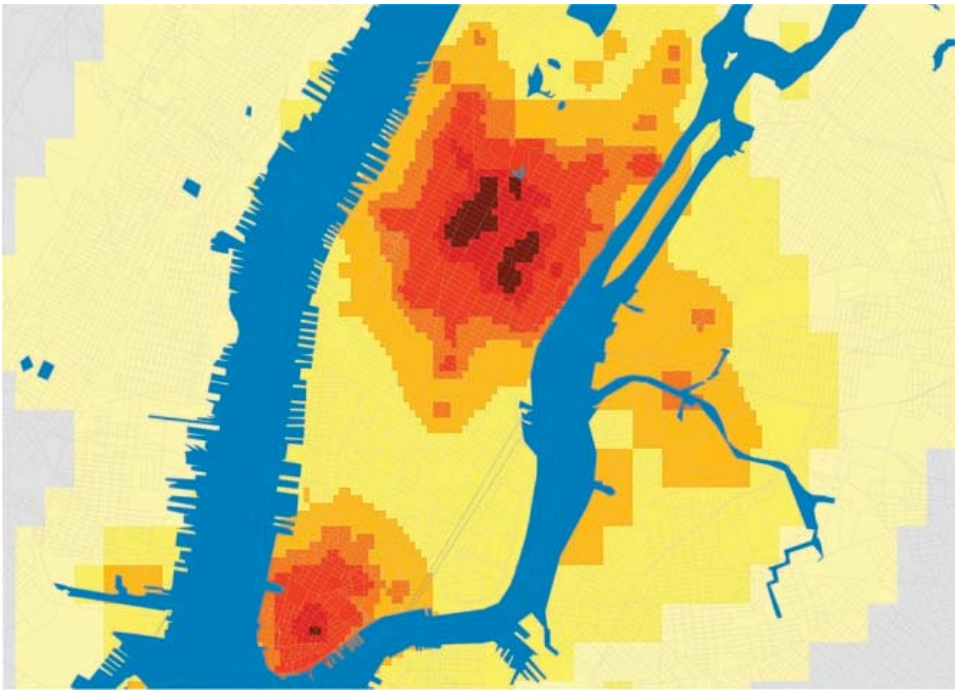
- Consider alternative "Risk Outlooks" to understand sensitivity of results to varying hazard assumptions
- Evaluate alternative treaty reinsurance or securitization structures for risk transfer
- Analyze TRIA impact under various take-up rates
- Examine impact of exclusions (e.g., CBRN) on re/insurance offerings

Implement Underwriting Process

- Develop loss costs by line of business
- Evaluate and price alternative layers for excess policies or reinsurance treaties
- Capture key parameters for risk scoring
- Design and implement underwriting guidelines to diversify portfolio risk



Version 2 of the RMS model includes alternative "Risk Outlooks," representing different underlying assumptions about the development of the terrorist threat and attack frequency.



High-resolution terrorism risk maps provide underwriting guidance in major cities.

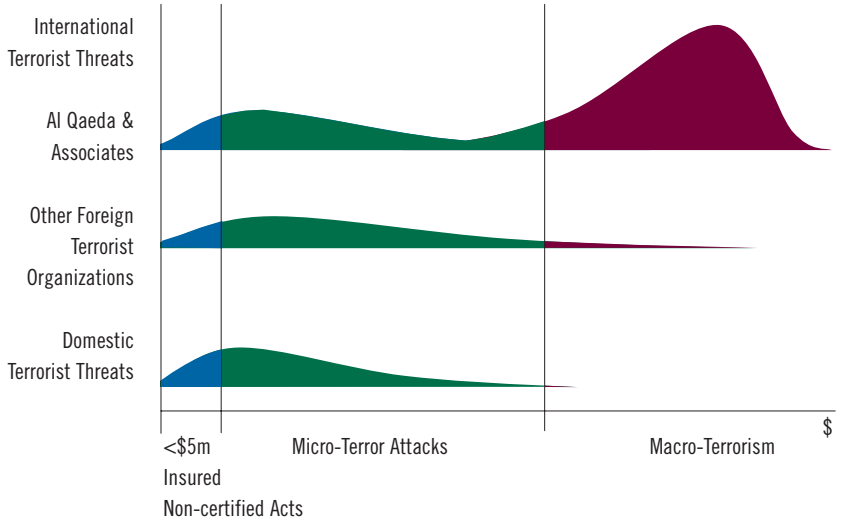
PARAMETERIZING THE EVOLVING THREAT

Terrorists are noted for adaptive learning, and risk modelers accordingly also need this facility, because the terrorist threat is constantly evolving. A review of recent terrorism activity provides an empirical basis for model calibration and updates in version 2 of the RMS U.S. Terrorism Risk Model.

Increased Risk at Soft Targets

A distinctive feature of the RMS model is its use of game theory. Game theory predicts that, as prime targets are hardened, rational terrorists will tend to substitute lesser, softer targets. This prediction echoes the testimony of the CIA director, George Tenet, in February, 2001, "as security is increased around government and military facilities, terrorists are seeking out softer targets that provide opportunities for mass casualties." In terrorism talk, this is called target substitution.

Since September 2002, some significant examples of target substitution have occurred. A notable instance was the holing of the French oil tanker, *Limburg*, off the coast of Yemen. The terrorists admitted that their original target had been a U.S. Navy frigate, but they were happy to strike the softer commercial target, because it was scheduled to supply the U.S. fifth fleet. Explicit admission of this soft target strategy has since come from Khalid Sheikh Mohammed, the Al Qaeda chief of military operations, who was arrested in March 2003.



The RMS model provides a comprehensive view of terrorism risk, quantifying loss across a spectrum of micro- and macro-terrorism attacks, from both domestic and foreign terrorist groups.

Reduced Chances of Al Qaeda Strike

Following the path of least resistance is a law of nature. It also happens to be a guiding principle of Al Qaeda, and influences its choice of weaponry.

The terrorist preference for conventional bombs and ready-to-use military weapons has been demonstrated over the past year in the attacks in Bali, Mombassa, Riyadh, Casablanca, and Jakarta. Each of these target cities has tourist name recognition, another notable aspect of the Al Qaeda *modus operandi.*

The absence of any spectacular Al Qaeda attacks within the U.S. over the past year is consistent with risk estimates in version 1 of the RMS model. Given the increased global counter-terrorism pressure and a correspondingly high interdiction rate for planned attacks, version 2 of the RMS model indicates a yet smaller chance of a spectacular Al Qaeda attack succeeding in the U.S. in 2004.

However, with possible U.S. intervention in Syria and Iran, which may be covert or clandestine, there is an additional risk of these states sponsoring Hezbollah to make a retaliatory attack against the U.S. homeland. In contrast with Al Qaeda, Hezbollah's *modus operandi* involves the concept of proportionate response, so a Hezbollah attack would typically be less damaging than one perpetrated by Al Qaeda. In particular, CBRN attacks by Hezbollah are very unlikely.

Even for Al Qaeda, the possibility of a CBRN attack is somewhat more remote than last year, given the effectiveness of the global security crackdown. The softening of weapon destructiveness and lethality is mirrored in a softening of target choices: more targets in lesser ranked U.S. cities; more infrastructure targets, such as bridges, rail stations, and gas stations. Success by counter-terrorism forces in disrupting the Al Qaeda network is straining its operational capability, and so mitigating the terrorism risk for insurers.

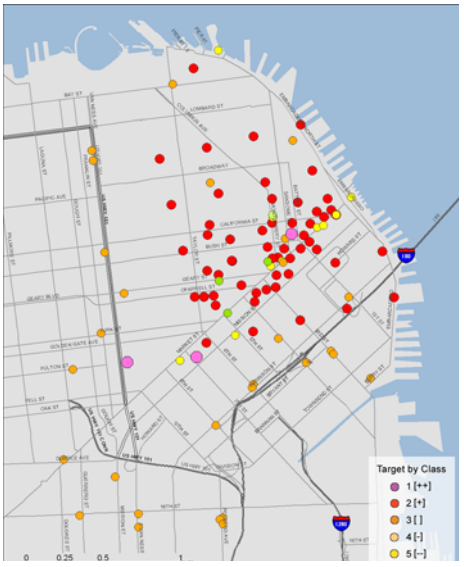
UNDERSTANDING TARGETING

Fundamental to the assessment and management of terrorism risk is the process that terrorists go through to select their targets. Al Qaeda and its associate groups have developed a highly systematic approach to selecting their targets. As more attack case studies emerge we see a process of research and evaluation for targets that fit the terrorists' strategic and tactical objectives.

The planning process for 9/11 has been pieced together from testimony, witnesses, and captured documentation. Following the preparation of an initial list of target candidates, a series of meetings and high-level approvals prioritized them into a short-list. Candidate targets that were considered — nuclear power stations, gas stations, bridges — were not as important as those finally selected to meet the criteria of impact, chances of success, and time and resource availability.

Planned Attacks

Other attacks on U.S. and allied interests overseas — bombings, missile attacks, attacks on ships — were also carefully planned. Criminal indictments against the perpetrators document the detail of the preparation for attacks, including alternative targets considered and the factors that can cause last minute switching of targets. Video footage of reconnaissance shows what features interest them. Even for lesser scale attacks, such as individual suicide bombings, the mind-sets of the bomber and the direction provided by the support team has emerged from interviewing failed bombers and forensic analysis of attacks that succeeded.



The identification of targets that would provide the highest "utility" to the terrorist simulates the decision-making that terrorist groups go through in their targeting.

Documenting the targeting process has provided an understanding of the "utility" of a target to an attacker. The prioritization of targets comes from the amount of economic damage, life loss, and disruption that would be caused, along with how well that target symbolically represents the cause of the terrorist's grievance.

City Prioritization

The city where a target is located is an important consideration for a foreign terrorist that is motivated by anti-national sentiment. The philosophy of striking at the economic engines of U.S. prosperity and symbols of U.S. nationhood and leadership raises attack likelihood in major cities. The larger and more famous the city, and the more target-rich that city is, the higher priority it is to the terrorist. Spectacular attacks are likely to be prioritized in major cities, to maximize the terrorist's political agenda.

Choosing Targets

The RMS target database uses these criteria to select and prioritize targets from the terrorist's point of view. RMS researched several hundred thousand candidate targets across the U.S., prioritizing each target according to the city it is located in, the type of asset it represents, the potential for economic and life loss, its symbolic value, and its level of security.

Based on this method, some 3,400 targets across the U.S. have been selected for modeling specific attacks. These fall into 25 different categories ranging from government buildings and public infrastructure through to commercial and private property. Detailed data have been compiled about them to establish their "utility" to the terrorist, the likely level of security, and other factors that affect target hardness.

The risk to the insurance industry and to the country as a whole depends on how these targets are viewed by the terrorist. Different targeting strategies, developments in the capabilities of terrorist groups, and changes in the relativities of target hardness all affect the risk.

The RMS model recognizes that these factors change over time. It allows users to carry out sensitivity studies through the use of "Risk Outlooks." These include an expected outlook based on our current analysis of the terrorism threat, as well as alternative outlooks reflecting plausible changes to the terrorism environment that would increase or decrease risk. In a fast developing field, this enables risk managers to make use of the latest intelligence in their terrorism risk management decisions.

QUANTIFYING INSURANCE LOSSES FROM TERRORIST ATTACK

What kind of loss would terrorist attacks cause? To accurately model the impact of the full range of potential terrorist attacks, a detailed analysis is required of processes as diverse as explosions, aircraft impacts, fires, decontamination, diseases spread through populations by biological and chemical agents, missile technology, and other phenomena.

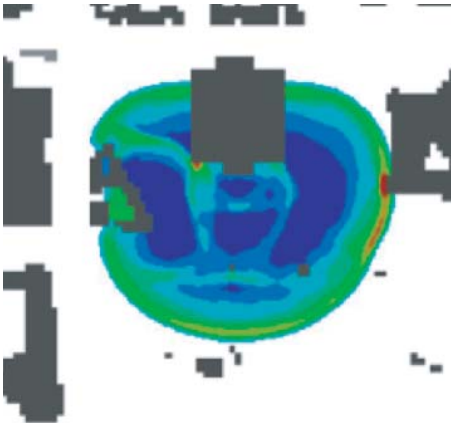
Since the release of version 1 of the RMS U.S. Terrorism Risk Model, an extensive amount of research and development has gone into refining loss modeling for all methods of attack. This work has included advanced physical modeling such as the use of computational fluid dynamics (CFD) models to simulate the effects of explosions in urban environments. High-resolution building data has been used in this effort. Modeling has been brought down to a resolution of 50 meters for attack modes where there is a large variation of loss over a short distance.

Additionally, extensive simulations have been performed for all attack modes in order to quantify the uncertainties in losses as well as the correlation of losses between locations in a given attack.

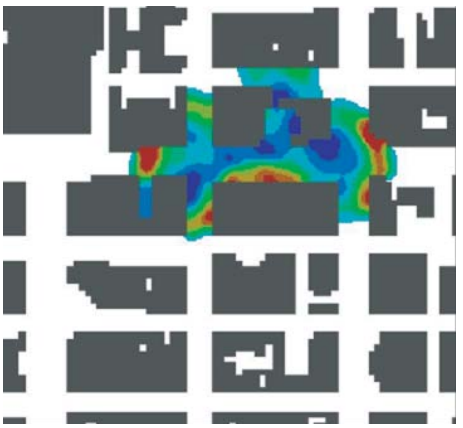
Modeling Explosions in Cities

There is an abundance of information available related to the physical processes associated with explosions. However, almost all testing and research has been concerned with the impacts of blast waves on individual buildings in the open, rather than in the shielded and complex surroundings of a city.

Because most of the target-rich environments are in dense city areas, RMS has developed modeling techniques appropriate for the effects of explosions in a downtown urban environment. CFD simulation models help in understanding how a blast pressure wave progresses through street patterns, and between and around buildings. The shielding effects of one building in front of another, and the focusing effects of blast reflection waves can cause damage and injuries in unexpected places. Districts of cities have different densities and building heights that affect the damage caused by explosions. RMS categorizes the city characteristics that affect bomb blast behavior for each target in the model.



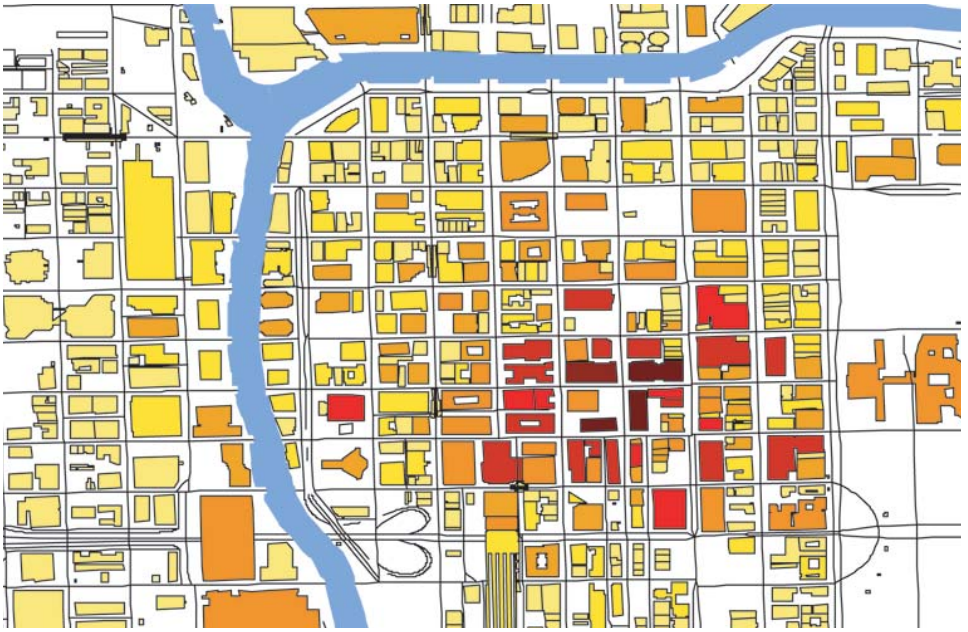
In low-density urban environments a bomb blast sends out symmetrical pressure waves that damage buildings further away from the blast.



In high-density city centers a bomb blast has complex reflections and sheltering effects. Streets focus the blast and cause higher pressures and damage close in.

Detailed City Data

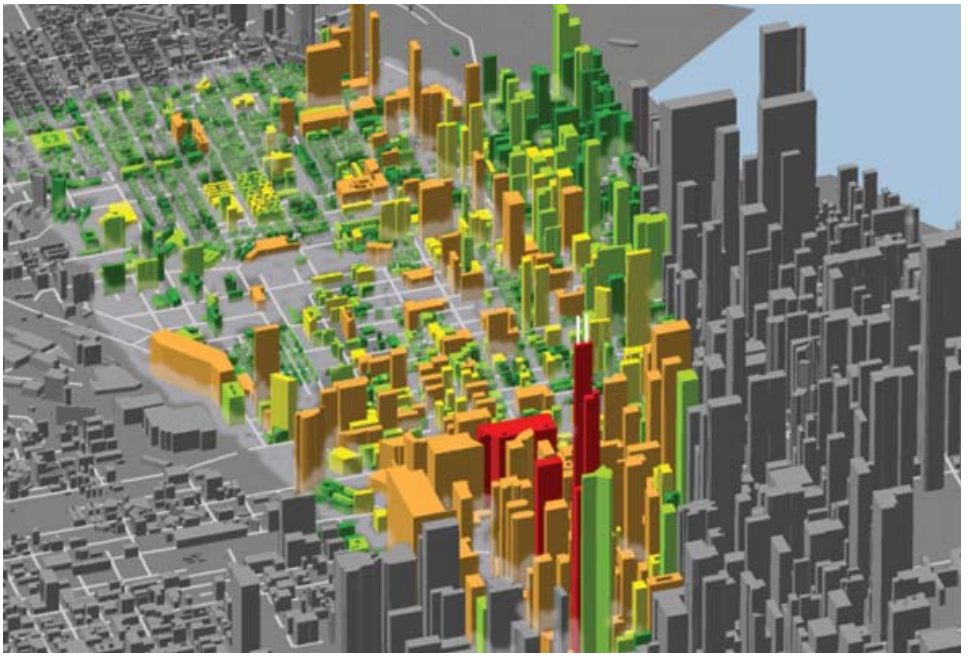
A key component of this development effort has been the compiling of accurate representations of building layouts in urban areas. Unique building-specific data developed in conjunction with the Sanborn Map Company has addressed this need. With this data, we have built computer model replicas of downtown urban areas that are then analyzed using CFD models for a range of bomb sizes. These simulations provide data on the differences in blast wave propagation when comparing dense versus sparsely built up areas, and in both cases provide detailed output related to the horizontal and vertical variations in pressure needed to develop vulnerability functions.



Damage footprint from a truck bomb in downtown Chicago, using detailed building data from Sanborn maps.

Dispersion Modeling

The effects of chemical and biological attacks depend on how the agents are dispersed in the atmosphere. Analytical models compute the dispersion of wind-borne contaminants spread across a city. Advanced dispersion models incorporate transient "puff" (single release) and "plume" (steady-state dissipation) releases across complex weather and terrain conditions to predict the toxic concentration and dosage suffered by the population.



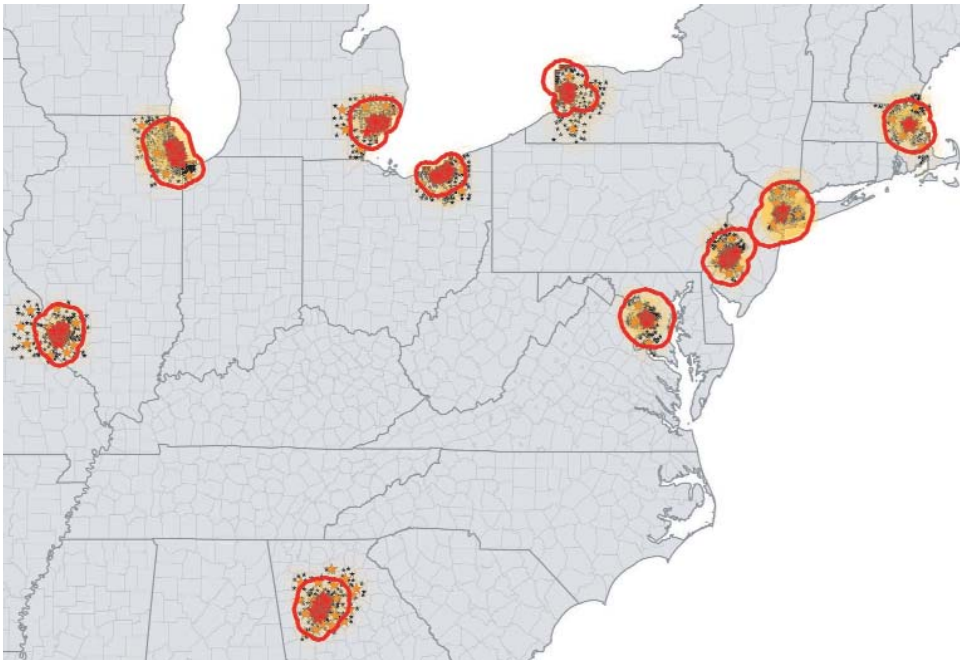
The weather conditions play an important part in the dispersal of an anthrax attack. The RMS model examines attack scenarios using multiple wind directions and windspeeds to determine spore deposition densities across a city.

Contagious Disease Modeling

To reflect a growing concern for the potential of bioterrorism attacks, RMS has introduced a contagious disease model that simulates the effect of smallpox attacks on the U.S. Disease is spread by social interaction and by population movement between cities. Different scenarios for the effectiveness of emergency response in treating, quarantining, and vaccinating the population to contain the outbreak are based on current policies and simulation exercises carried out by government authorities.

Business Interruption Modeling

The World Trade Center disaster resulted in unprecedented business interruption (BI) losses, due to the nature of the attack and its location in a major financial center. To understand the primary factors leading to BI losses in this event, RMS surveyed insurance companies regarding the nature of their claims. Extra expense factors such as relocation costs played a large role in exacerbating BI losses. The RMS model quantifies direct BI including extra expense, as well as BI due to civil authority areas.



Urban population pools subject to smallpox spread in the RMS model.

Casualty Modeling

Injuries to building occupants and population in the streets are critical elements of the effects of terrorist attacks. RMS models human casualties for workers' compensation, life, health, and other lines. Six injury states are used to model casualties resulting from various attack modes. These injury states provide a more refined representation of casualty losses.

APPLICATION OF TERRORISM MODELS TO MANAGE RISK

Since the watershed industry catastrophes of Hurricane Andrew in 1992 and the Northridge Earthquake in 1994, virtually all members of the insurance industry exposed to natural catastrophes have become proficient in the use of probabilistic catastrophe models to manage risk.

While terrorism models can provide the same type of output, it is clear that the nature of this peril demands a somewhat different approach to managing the risk. Rather than rely solely on probabilistic loss analyses, prudent risk managers utilize multiple methods of assessing terrorism risk to triangulate on the magnitude and location of risk. Effective terrorism risk management requires answers to the following questions:

- Where are my greatest multi-line exposure concentrations, and are any of them near high-risk terrorism targets?
- Using benchmark deterministic terrorism scenarios (e.g., 2-ton truck bomb), are there any potential attacks that could result in losses greater than management's prescribed threshold?
- What cities, target types, or accounts are the key drivers of my portfolio loss?
- When considering full probabilities, what is the portfolio loss distribution?

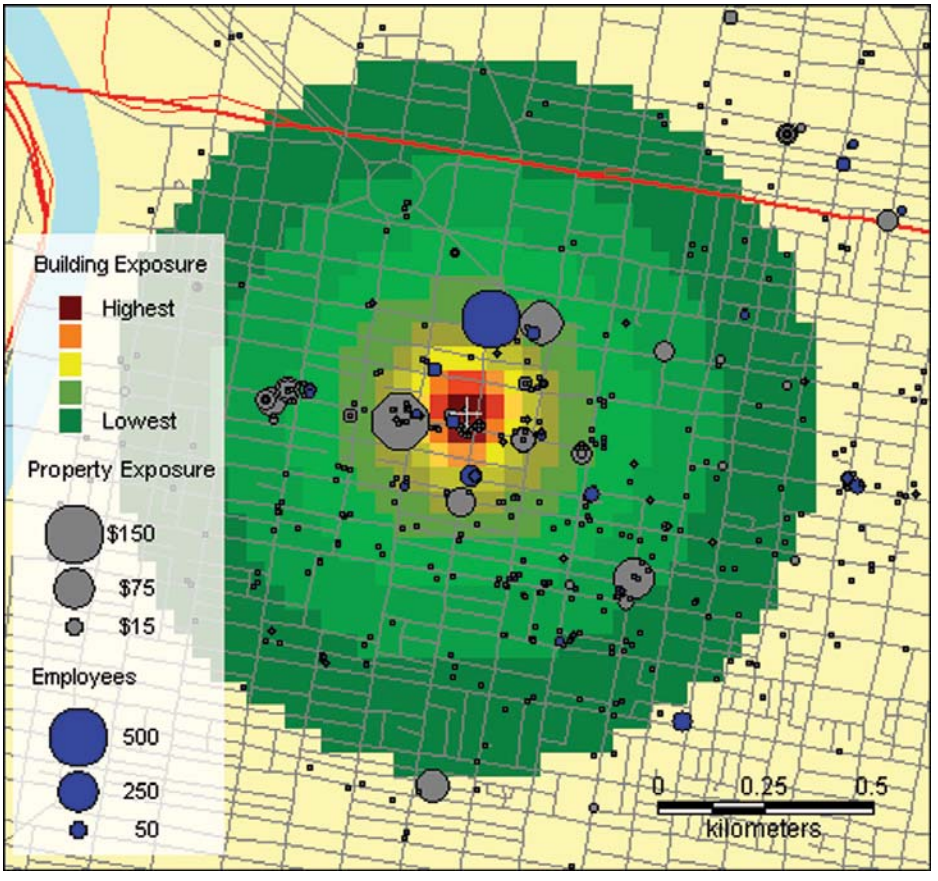
Multi-line Accumulation

The extremely focused geographic area impacted by certain terrorist attack modes highlights the need to capture high-resolution exposure information for multiple lines of business.

Using a 400-meter radius (the range in which most damage occurs in typical conventional weapons attacks), users can identify areas of greatest multi-line exposure concentration anywhere in a portfolio, or around high-risk targets. The fact that 400 meters is significantly smaller than a typical ZIP Code underscores the need for high-resolution building level geocoding.

Deterministic Scenarios

Having identified the areas of exposure concentration, the next step is to analyze loss scenarios at key targets on a deterministic basis. Accumulations are managed by maintaining losses at an acceptable level for benchmark scenarios in high exposure areas.



Application of an attack footprint to portfolio exposures highlights an insurer's potential for loss resulting from a terrorist attack.

Key Drivers of Loss

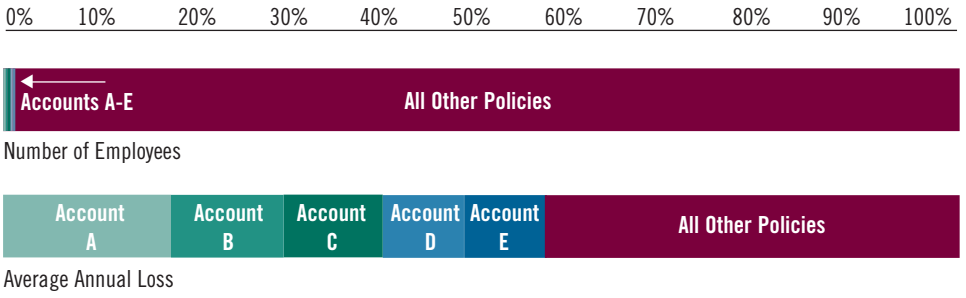
Analysis of a comprehensive event set along with the relative likelihood of event occurrence can be used to understand the drivers of portfolio risk. These results allow the risk manager to drill down to determine drivers of loss by city, account, line of business, and target type.

Hazard: A Moving Target

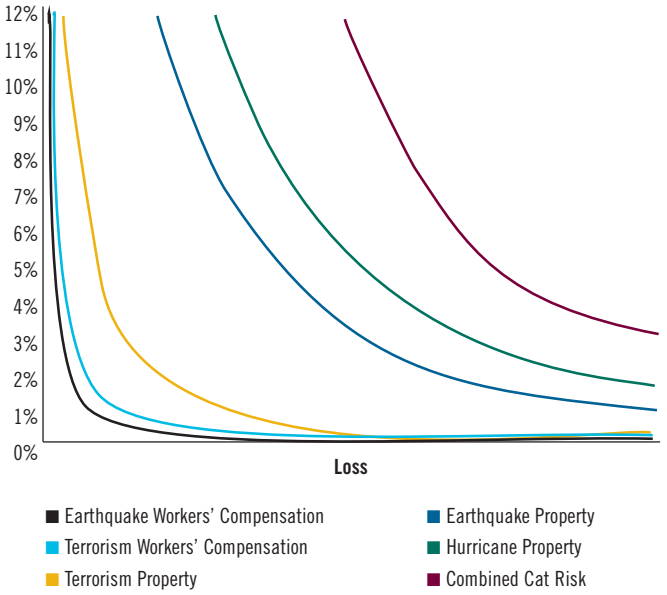
The terrorism hazard is constantly changing as the U.S. fights the war on terrorism. The fact that the hazard fluctuates while insurance premiums are typically fixed for one year indicates that risk managers should evaluate losses using not only the current estimate of hazard, but also alternative high and low hazard estimates that could occur over the next 12 months.

Enterprise-wide Risk

While managing terrorism risk is crucial to the survival of a company, it is only one piece of the catastrophe risk puzzle. RMS technology is compatible across perils, allowing the user to combine natural catastrophe risk with terrorism risk to view "total cat" losses on an enterprise-wide basis.



Detailed loss output highlights accounts and locations that drive overall portfolio risk.



Terrorism loss exceedence probability (EP) curves for individual lines of business can be combined with natural catastrophe perils to view total catastrophe risk.

Probabilistic Terrorism Model History	■ Original release: September 2002 ■ Most recent upgrade: September 2003 ■ Future upgrades: modeled frequency and target prioritization are updated as dictated by changes in the terrorism landscape
Model Scope	■ Geographic scope: United States ■ Lines of business: property (building, contents, business interruption) and workers' compensation; life, health, personal accident, accidental death and dismemberment available on a consulting basis ■ Comprehensive coverage of both foreign and domestic terrorist groups
Exposure Data Resolution	■ Latitude/Longitude, Street Address, or ZIP Code
Probabilistic Event Set	■ Approximately 78,000 events at 3,400 targets ■ AEP with secondary uncertainty considers both event frequency and potential for simultaneous coordinated "swarm" attacks
Attack Modes Modeled	■ Bomb: 600 lb, 1 Ton, 2 Ton, 5 Ton, and 10 Ton ■ Aircraft Impact Attack ■ Conflagration Attack ■ Sabotage-Industrial Explosion: 3 magnitudes ■ Sabotage-Industrial Toxic Release: 3 magnitudes, 4 wind directions ■ Sabotage-Industrial Explosion & Release: 3 magnitudes ■ Sabotage-Nuclear Plant: 3 magnitudes, 4 wind directions ■ Chemical-Sarin Gas: Weaponized Indoors, Outdoors (3 magnitudes, 8 wind directions) ■ Biological-Anthrax: Weaponized Indoors; Outdoors (3 magnitudes, 8 wind directions) ■ Biological-Smallpox: Conventional (3 magnitudes, 3 response scenarios); Genetically Engineered (2 magnitudes) ■ Radiological-Dirty Bomb: 2 magnitudes, 4 wind directions ■ Nuclear Bomb: 2 magnitudes
Special Features	■ Results provided for foreign certified, foreign non-certified, and domestic losses individually and in total ■ Integrated functionality for application of TRIA coverage ■ Ability to combine terrorism AEP/OEP with RMS natural peril output ■ Ability to exclude attack types (e.g., nuclear exclusion)

APPENDIX 5 — DESCRIPTION OF INITIAL TILLINGHAST PROXY EXPOSURE MEASURE

BACKGROUND

The workers' compensation terrorism pool is intended to be voluntary. In order to provide incentive for insurers to join a voluntary pool, each insurer's participation must be determined in an equitable manner. For the workers' compensation terrorism pool in consideration, equity is defined in terms of the expected loss ratio for losses ceded to the pool. The premise is that equity is achieved if all pool participants have the same expected loss ratio, calculated by applying a mutually agreed exposure rating algorithm consistently across all participants.

In order to apply this definition of equity, each pool participant's expected losses to the pool must be determined. Since this is intended to be an excess pool that will provide participants the flexibility to select among several alternative attachment points, each company's workers' compensation terrorism loss distribution must be developed.

There are two fundamental approaches for estimating terrorism losses:

1. Use one of the commercially available terrorism loss models, or
2. Develop a proxy measure for exposure to terrorism losses.

The following table describes these two approaches:

Commercial Terrorism Loss Model	Proxy Measure
A causal model that simulates the physical characteristics of a terrorist event: ■ Likelihood of various types of attacks ■ Attractiveness of sites as terrorist targets ■ Severity of attack (i.e., casualties due to explosion blast or molecule dispersion) ■ Concentration of exposure ■ Indemnity and medical claim costs The output is a loss distribution	A statistical model that approximates the effect of key risk factors: ■ Location of exposure ■ Concentration of exposure ■ Claim severity A mathematical formula is developed to reflect the combined impact of these risk factors. The output is a loss distribution

This appendix describes a proposed approach for developing a proxy measure for workers' compensation terrorism exposure.

GENERAL FORM FOR PROXY MEASURE

There are two parts to the development of the proxy measure:

1. Develop expected loss
2. Develop loss distribution around expected loss.

The *expected loss* reflects the frequency and severity of losses. The *loss distribution* reflects the relative concentration of exposure such that the higher the exposure concentration the fatter the tail of the distribution.

The general form of the proxy formula for determining *expected loss* is:

Expected Loss = Adjusted Employee Count x National Average Annual Loss per Employee

where,

Adjusted Employee Count = Actual Employee Count x State Claim Adjustment Factor x Location Adjustment Factor x Deductible /Excess Coverage Adjustment Factor

and National Average Annual Loss per Employee equals the Average Annual Loss, from the NCCI/EQE nationwide workers' compensation terrorism loss distribution, divided by the total number of employees included in the development of the NCCI/EQE nationwide workers' compensation terrorism loss distribution.

The exposure base used in this formula is the Actual Employee Count. (This is the same exposure base used by the terrorism loss modelers.) The exposure base is subject to several adjustment factors that serve as proxies for the key variables that affect expected loss.

The *loss distribution* around the expected losses reflects the following factors:

- Exposure concentration — reflects the degree to which catastrophic losses are exacerbated due to high correlation of losses for exposures in close proximity to each other
- Company size — reflects the portfolio diversification benefit realized by companies with relatively large books of business.

The following sections provide greater detail on the development of the expected loss and the loss distribution.

Adjustment Factor	Proxy for...
Location adjustment factor	■ Differences in the likelihood of terrorist attacks in various geographic regions
State claim adjustment factor	■ Differences in claim severity by state
Coverage adjustment factor	■ Differences in coverage, such as first-dollar, excess or deductible coverage

DEVELOPMENT OF EXPECTED LOSS

This section describes the calculation of the expected loss based on the general formula noted above. The formula estimates expected loss before reflecting the impact of TRIA or the pool; however, it reflects the type of coverage provided by the workers' compensation policy (i.e., first dollar vs. excess or high-deductible).

The expected loss is calculated in two steps:

1. Calculate the Adjusted Employee Count for each Zip Code by taking the Actual Employee Count for each Zip Code and applying several adjustment factors
2. Multiply the sum of Adjusted Employee Counts across all Zip Codes by the National Average Annual Loss per Employee.

The formula for Step 1 is:

$$AdjEmpCount_z = ActEmpCount_z * LocAdjFactor_z * ClaimSeverityFactor_z * CoverageFactor_z$$

In Step 2, the Expected Loss is determined according to the following formula:

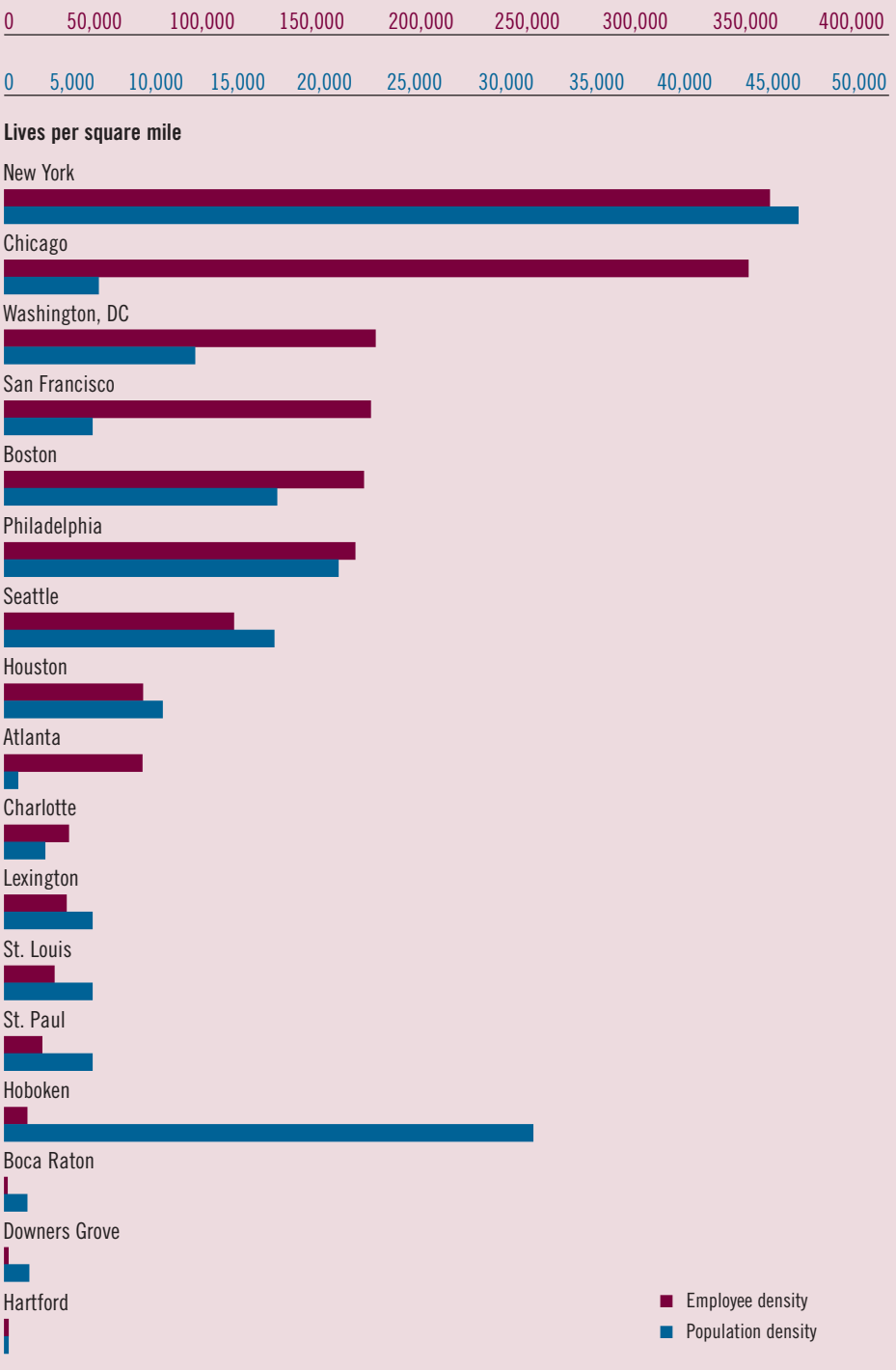
$$ExpLoss = \sum_z AdjEmpCount_z * AvgLossPerEmp$$

Each of the variables in the two formulas is described in the following chart:

Variable	Description
z	Index for Zip Codes.
$ActEmpCount_z$	Actual Employee Count — number of employees during peak period in Zip Code z. The exposure base.
$LocAdjFactor_z$	Location Adjustment Factor — average of the population density and the employee density in Zip Code z. The rationale underlying the use of population and employee densities is that terrorism attacks could occur anywhere there is a concentration of people. Employee density represents daytime concentration and population density represents nighttime concentration. The factors for each Zip Code are scaled such that the weighted-average of the factors across all Zip Codes is equal to 1.0. The weights for each Zip Code are the Actual Employee Counts in the Zip Code summed across all companies participating in the Pool. Exhibit 29 illustrates the magnitude of variation in employee density and population density across randomly selected Zip Codes in some urban, suburban and rural areas.
$ClaimSeverityFactor_z$	Claim Severity Adjustment Factor — NCCI claim severity index by state, reflecting the average indemnity and medical claim costs in each state. NCCI estimated the claim severity for states not covered by NCCI. The factors are scaled such that the weighted-average of the factors across all states is equal to 1.0. The weights for each state are the Actual Employee Counts in the state summed across all companies participating in the Pool. Exhibit 30 illustrates the variation in the NCCI claim severity index across all states. The state claim severity adjustment factor does not have as much variance as the location adjustment factor.
$CoverageFactor_z$	Coverage Adjustment Factor — this factor was not developed since only one company provided coverage data for their excess/high-deductible policies during the Pool Feasibility Study.
$AvgLossPerEmp_z$	Average Annual Loss per Employee — equal to the Average Annual Loss, from the NCCI/EQE nationwide workers' compensation terrorism loss distribution, divided by the total number of employees included in the development of the NCCI/EQE nationwide workers' compensation terrorism loss distribution.

EXHIBIT 29

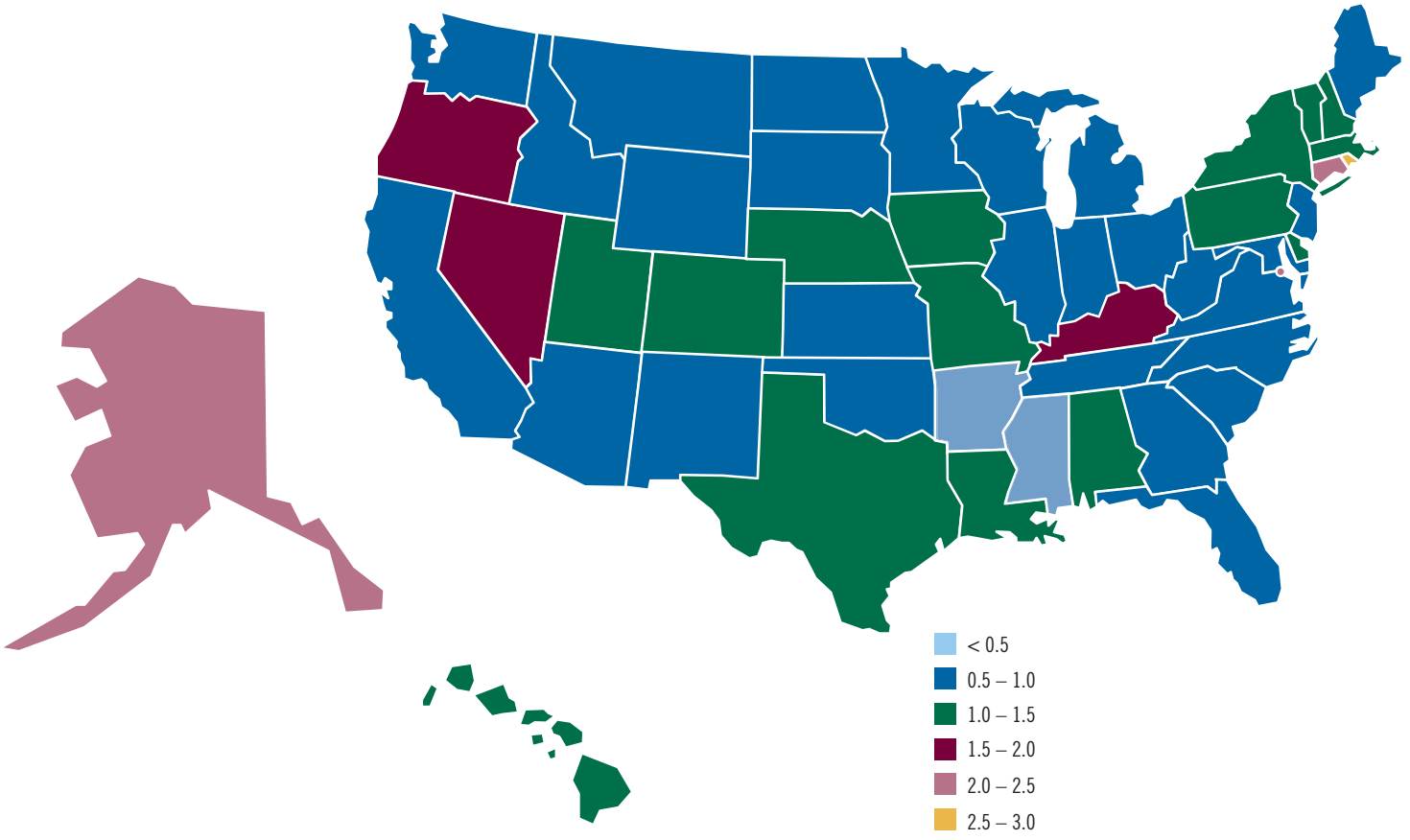
Illustration of Variation in Employee and Population Density by Zip Code



Note: Results are for randomly selected Zip Codes in each city.

EXHIBIT 30

Illustration of Variation in the NCCI State Claim Severity Index



An Adjusted Employee Count was calculated for each of the sponsor companies that provided exposure data. Exhibit 31 illustrates the individual and aggregate effect of the adjustment factors. To maintain confidentiality of the results, the exhibit shows a ratio of Adjusted Employee Count share divided by premium share among the sponsor group. Exhibit 32 provides a comparison of results using the proxy measure to those using the RMS model.

EXHIBIT 31
Illustration of Individual and Aggregate Effect of Adjustment Factors

Company	Headcount Share to Premium Share	Isolated Impact of Adjustment Factor			
		Location	State Claim	Coverage Type*	Total**
A	1.6	1.32	1.00	1.0	1.34
B	0.6	1.55	1.04	1.0	1.60
C	1.4	1.23	0.99	1.0	1.28
D	1.3	1.53	0.97	1.0	1.51
E	1.6	0.79	1.08	1.0	0.86
F	1.0	0.85	0.98	1.0	0.81
G	0.9	0.80	0.95	1.0	0.75
H	0.7	0.64	0.99	1.0	0.65
I	0.7	0.76	1.10	1.0	0.83
J	0.7	0.48	1.14	1.0	0.51
K	1.7	0.18	1.48	1.0	0.25
L	0.7	0.25	1.14	1.0	0.26

*Only one company provided data on its excess/high-deductible business. Therefore, we did not compute a coverage type adjustment factor.
**The total factor does not equal the product of the location and state claim factor shown in the table because it reflects the interaction of the adjustment factors at the zip code level.

DEVELOPMENT OF LOSS DISTRIBUTION

This section describes the method for developing a loss distribution around the expected losses calculated under the proxy approach. The loss distribution is needed in order to estimate expected excess losses ceded to the pool above the pool attachment point. Companies would have a choice in selecting their attachment point. In order to calculate expected excess losses above alternative attachment points, it is necessary to develop the full loss distribution for each member of the pool.

The Pareto distribution is used as a proxy for the loss distribution. The shape parameter of the Pareto distribution is estimated as a function of the following two factors:

1. Exposure Concentration Factor calculated for each company as follows:

$$ExpConcFactor = \frac{\sum_z \max(0, AdjEmpCount_z - 500)}{\sum_z AdjEmpCount_z}$$

where z is the index for Zip Codes.

This factor, based on excess lives above 500, serves as a proxy for excess losses. Companies with higher exposure concentration should have a relatively fatter tail in their loss distribution. The factor can be revised to use excess lives above 100 or 250, for example, instead of 500. Exhibit 33 on the next page shows the relative concentration of employees for each of the sponsors based on thresholds of 100, 250 or 500 employees at a location.

2. Size Factor — the Adjusted Employee Count is used as a proxy for size of company.

The loss distribution for each company is developed as follows:

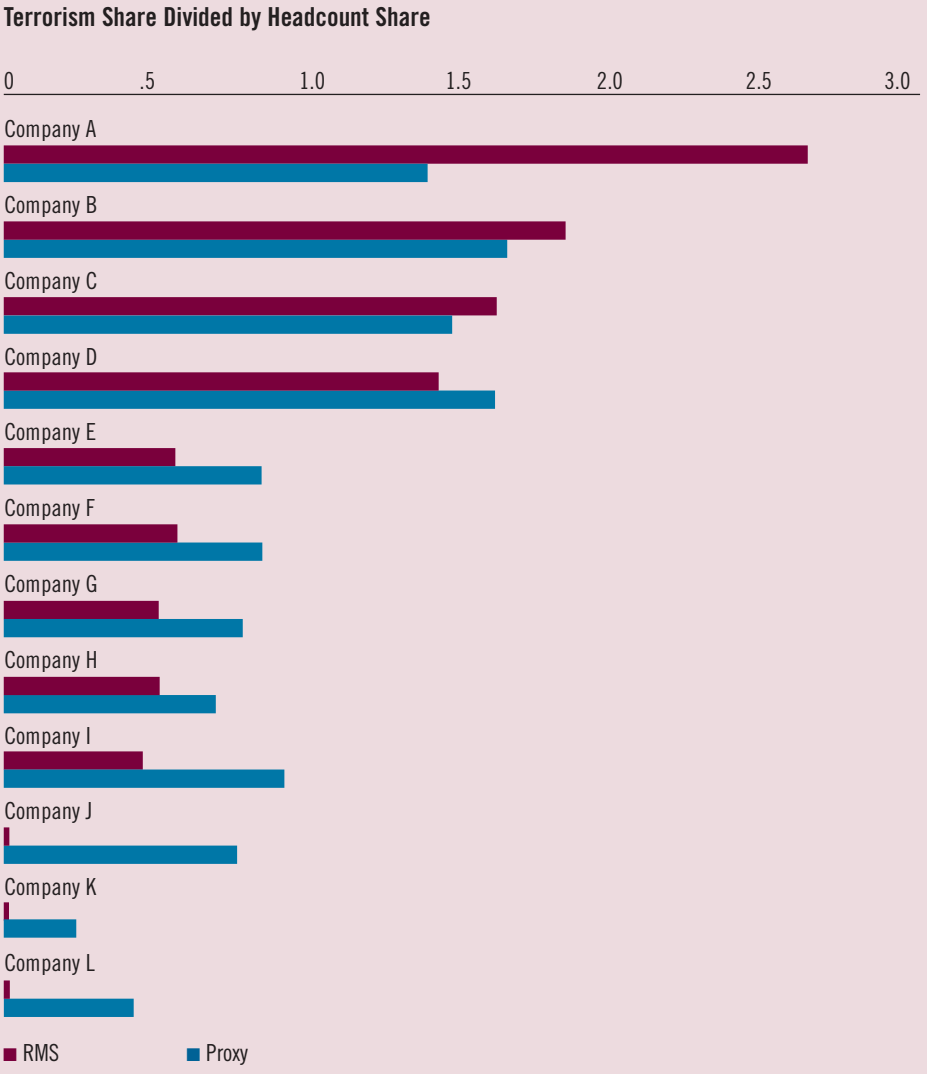
1. The mean of the Pareto loss distribution was set equal to the expected loss determined in the prior section.

2. It is assumed that the 1-in-250 year loss is 10 to 20 times greater than the expected loss for the companies participating in the pool. (Note: the RMS model indicated a range of 0.3 to 30 for the 12 companies they modeled.) The corresponding range for the shape parameter of the Pareto distribution is 1.43 – 3.26.

3. The company with the greatest exposure concentration, as defined above, was assigned a shape parameter of 1.43, which corresponds to a 1-in-250 year loss that is 20 times greater than the expected loss. The company with the lowest exposure concentration was assigned a shape parameter of 3.26, which corresponds to a ratio of 10. The remaining companies were assigned shape parameters between 1.43 and 3.26 by interpolating between the endpoints based on their respective exposure concentration levels. Thus, all companies were assigned a distribution such that the ratio of 1-in-250 year loss to expected loss is within the range of 10 to 20.

EXHIBIT 32

Terrorism Exposure Share Results: Comparison of RMS Model Results and Proxy Measure of Exposure



Note: Reflects first-dollar (i.e., ground up) losses.

For this phase of the study, an adjustment that reflects the relative size of each company was not reflected. The size adjustment is not expected to be too significant, except for very small companies.

The derived annual-aggregate-loss distribution curve is used to estimate expected losses in excess of the pool attachment point selected by the company.

FUTURE REFINEMENTS TO CONSIDER

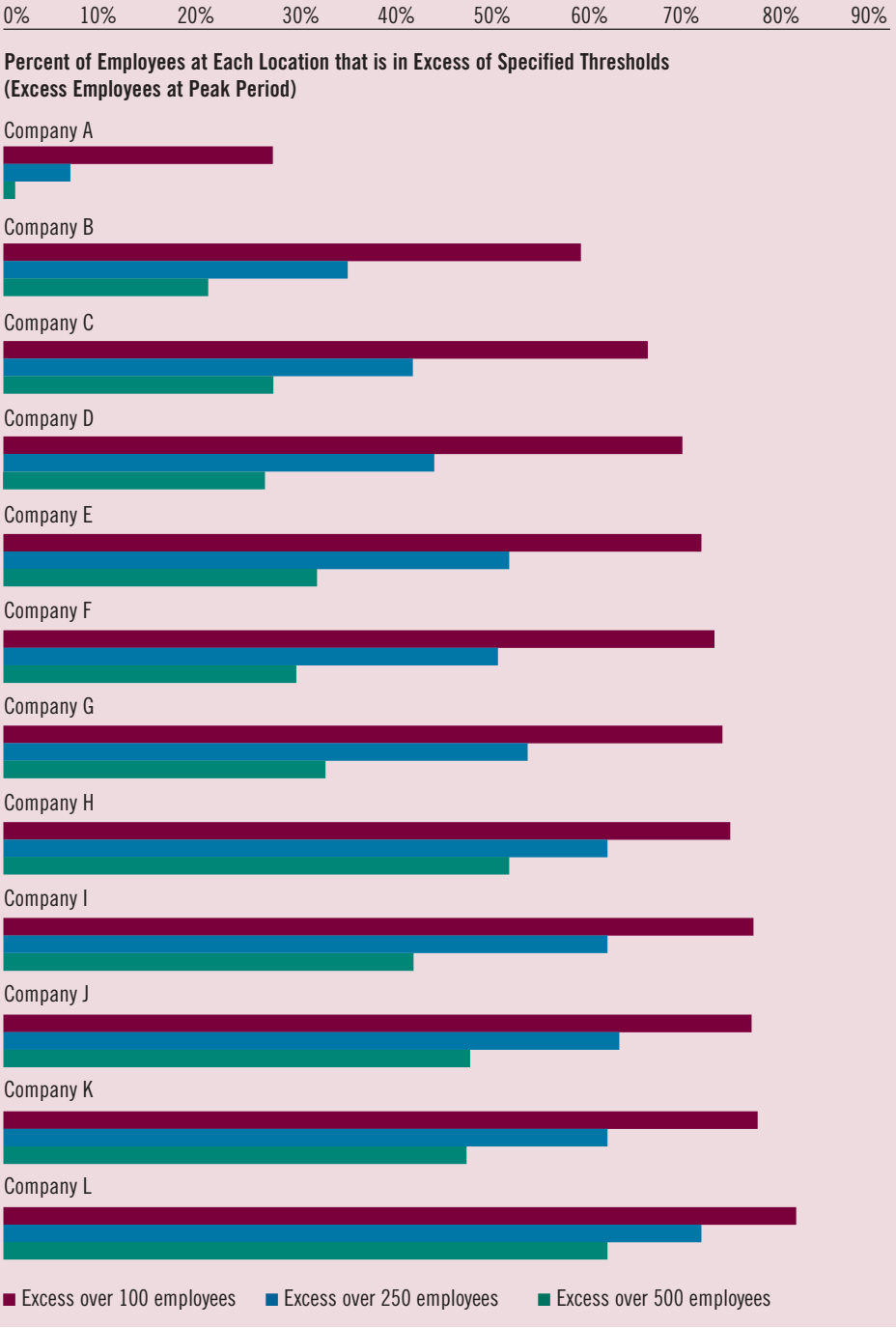
The proxy exposure measurement approach described in this document served the objectives of the Workers' Compensation Terrorism Reinsurance Pool Feasibility Study. The study's objectives with respect to exposure measurement were to determine whether a proxy approach could reflect the key differences in exposure by company. The proxy approach was developed far enough to meet this objective. However, in order to use the proxy approach, additional work must be undertaken.

This section identifies areas of further refinement:

1. The proxy measure and the loss model both use the number of peak shift employees as the exposure base. Although some companies gather these data directly, for most this number is estimated. The method of determining the peak shift employees should be reviewed and agreed to by participating companies for both the proxy measure and the loss model.

EXHIBIT 33

Relative Concentration of Employees Among Sponsor Company Accounts



2. The location adjustment factor used in the determination of expected loss is intended to be a proxy for the relative likelihood of terrorist attacks in different geographic areas. Terrorist attacks are presumed to occur wherever there is a concentration of people and valuable property. The proposed factor reflects the relative concentration of people by basing it on an average of population and employee density. It is worth exploring whether it is also possible to incorporate a proxy for the relative concentration of property values.

3. The expected loss formula is designed to reflect differences in coverage offered by companies, e.g., first dollar, excess or deductible. The Coverage Adjustment Factor is intended to be a proxy for these coverage differences. This factor was not developed during the feasibility study project since only one company provided sufficient data on excess/ deductible coverage terms.

4. The loss distribution curve for each company should be refined to better reflect the relative impact of exposure concentration and company size. An approach for reflecting the impact of exposure concentration is described in this document. However, the impact of size on the shape of the loss distribution was not developed for the feasibility phase, and should be developed during implementation. The appropriateness of the parameters also can be refined based on additional work with modeling firms. Further refinement is needed to reflect the combined effect of size and concentration on the loss distribution.

5. The proxy measure uses zip code as the base level of geographic resolution. Finer levels of resolution should be considered, e.g., census block or a square of grid of 1 square mile. The relative availability of data at the finer level of resolution should be weighed against the increased precision of exposure measurement at that level.

CONCLUSIONS

A proxy measure of exposure can be constructed to reflect the key differences in exposure by company. The proposed approach reflects:

- Differences in exposure location and the relative likelihood of terrorist attacks by geographic location
- Differences in the average claim severity by state
- Differences in the concentration of exposure and its impact on the distribution of losses.

The proxy measure has several advantages over the alternative approach of using a causal model to simulate the physical characteristics of terrorist attacks:

- Greater transparency in the relative impact of each risk factor (i.e., location, concentration, claim severity)
- An analytical approach that is simpler and faster to administer
- Reliance on fewer assumptions requiring less subjectivity; does not require expert input on selecting assumptions.

APPENDIX 6 — SUMMARY RESULTS OF ILLUSTRATIVE POOL OFFER

At the end of the feasibility study, having concluded that the conceptual prototype pool design seemed viable, we sought to test the design further by developing hypothetical quotes and engaging in one-on-one discussions with sponsors to solicit their thoughts and perspectives on the pool.

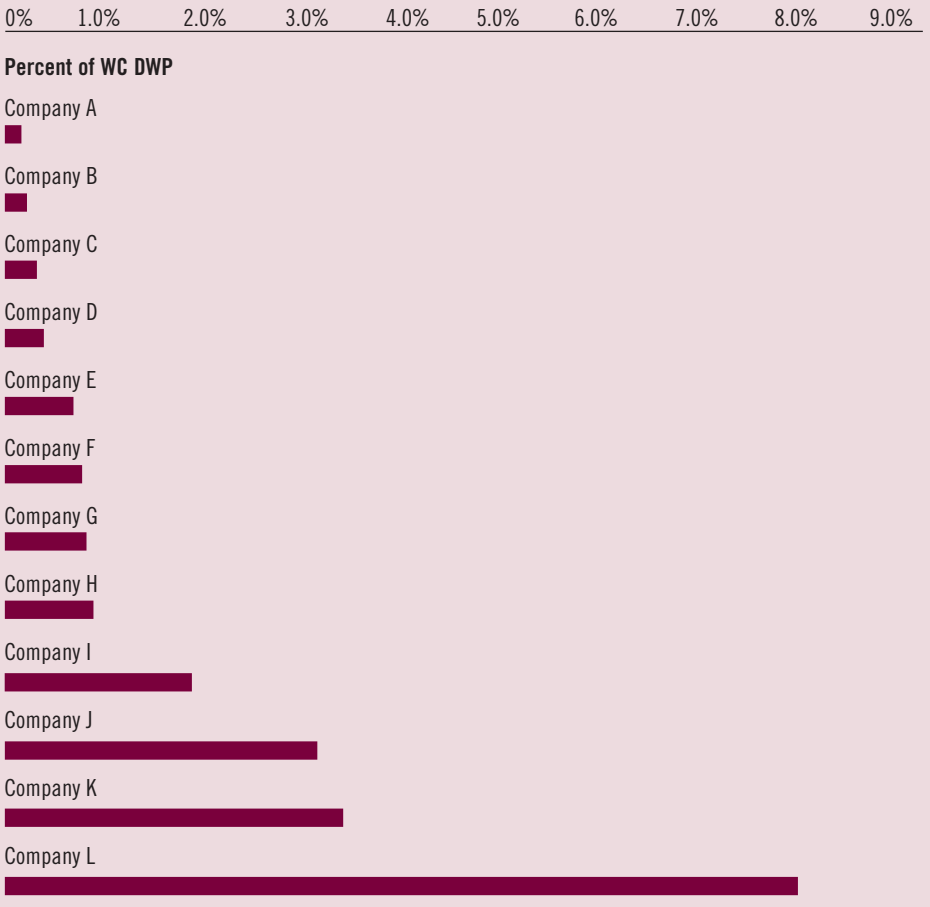
Each sponsor that had submitted exposure data (12 of 14) was given an illustrative "offer," as if they were being solicited to participate in the pool. The intent of this offer was to help translate the conceptual pool design that had been developed with the sponsors into a more tangible "product."

The prototype offer included several different components:

- "Share" in the hypothetical pool — indicated each company's share of total peak shift employees or PSEs (a refined measure of employee headcount), total pool premium (assuming all participants chose the lowest retention option available to them) and expected ground-up terrorism losses
- Financial obligation — the amount of paid-in capital (100% of first-year premium based on the lowest retention/highest premium option available), premium for each of the three possible attachment points available to them, maximum retro premium obligation
- Risk reduction benefit (2004) — for each retention option, the percentage decrease in the company's loss at three different terrorism event probabilities (1-in-100, 1-in-250, 1-in-500), based on a comparison of simulated direct workers' compensation terrorism losses gross and net of pool recoveries.

EXHIBIT 34

Results of Illustrative Pool Offer: Ratio of Pool Premium to Workers' Compensation Direct Written Premium (Sponsors Only)



Note: Based on 2007 premium.

Exhibits 34-38 summarize the range of results from the illustrative offers for the study sponsors and for all 90 members of the hypothetical pool. (Note that the results in the sponsor exhibits, presented only as ratios, have been sorted from low to high, and companies have been labeled "A" to "L". However, the company labels have been scrambled, so a company labeled "A" in one exhibit it is unlikely to be "A" in any of the other exhibits.)

Exhibit 34 shows the relationship between pool premiums and workers' compensation direct written premium (workers' compensation DWP) for the sponsor group. If the ratio of pool premium to workers' compensation DWP were 1 (i.e., pool premium share equals DWP pool share), it would mean that the member's share of terrorism exposure contributed to the pool is the same as its "market share" of the pool based

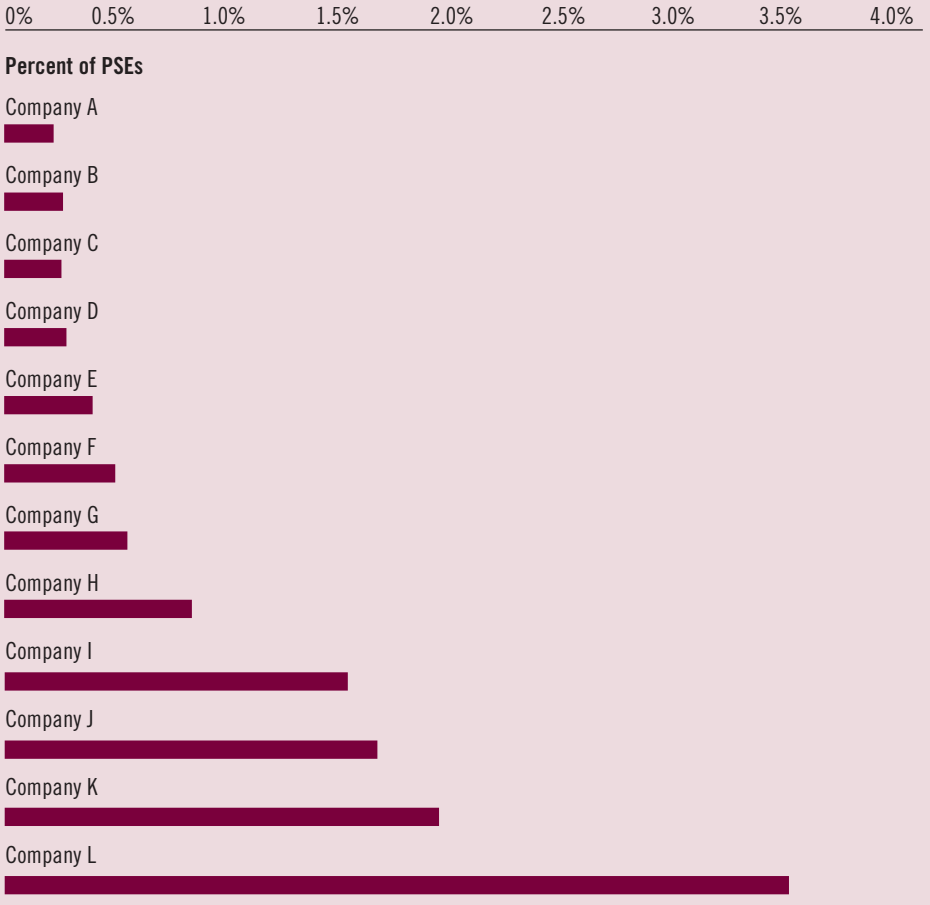
on written premiums. A ratio above 1 means that the company's exposure share (as measured by the 80/20 RMS/proxy blend) is greater than its pool market share. If below 1, the member's terrorism share is less than its premium market share.

The wide dispersion of results reinforces two key conclusions: First, a company's direct written premium represents a poor proxy for its terrorism exposure (i.e., DWP fails to capture the impact of the key determinants of terrorism risk). Second, meaningful differences in companies' relative exposure can be discerned.

Exhibit 35, which shows the ratio of pool premium to headcount, illustrates a similar point with respect to headcount data.[24] While headcount forms the basis for measuring terrorism exposure, simple headcount (i.e., the number of insured lives) is itself a poor indicator of a company's terrorism exposure. The reason is that the location and concentration of that headcount primarily determine the extent of exposure.

EXHIBIT 35

Results of Illustrative Pool Offer: Ratio of Pool Premium to Headcount (Sponsors Only)



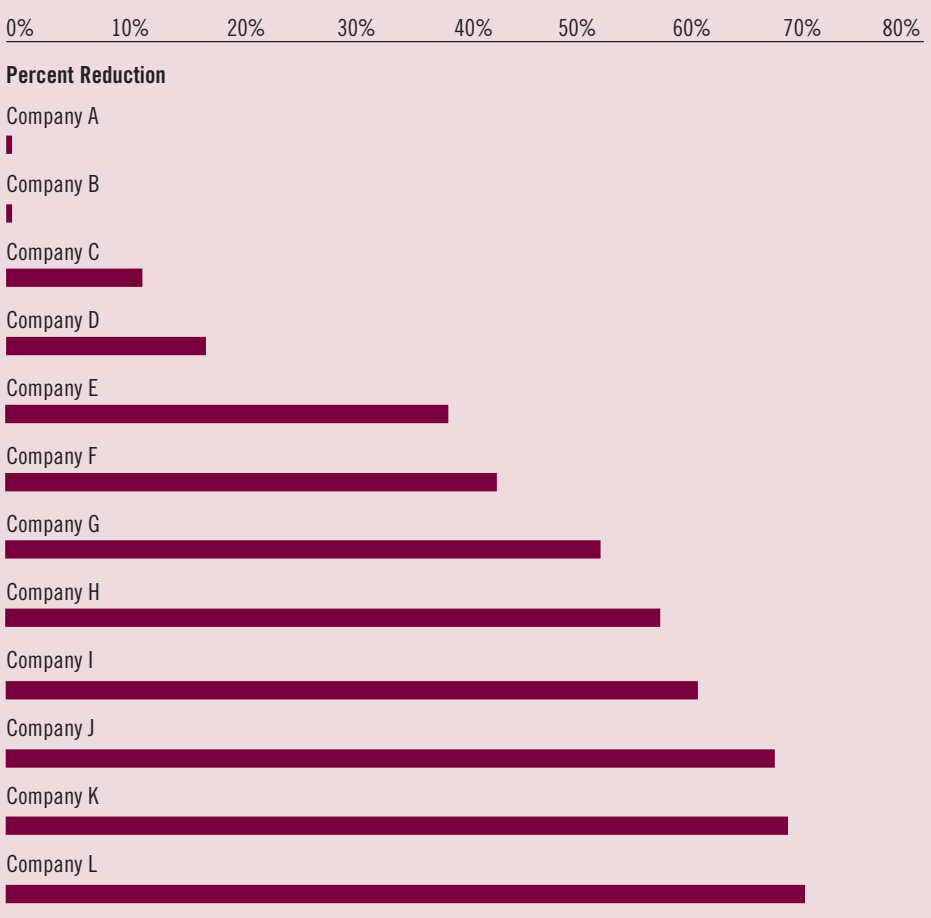
Note: Based on 2007 premium.

[24] Note that "Peak Shift Employees" (PSEs), is used as the specific headcount measure. PSEs, which was calculated by RMS based on companies' submitted headcount data, is intended to account for the fact that not all employees are at the worksite at the same time. For example, if a manufacturing plant runs 24 hours a day using three eight-hour shifts, at its peak the facility is unlikely to have more than, say, one third or one half of its employees exposed.

Exhibits 36 and 37 show sponsors' risk reduction benefit from the pool, based on a comparison of each company's simulated terrorism losses gross and net of pool recoveries, with and without the effect of TRIA, respectively. Excluding the effects of TRIA, most (9 of 12) sponsors receive a risk reduction between 30% and 75%. One company's risk reduction is about 13%, and two companies receive no risk diversification benefit. For these two companies, the risk diversification is realized at points further along their loss distribution (e.g., 1-in-1,000 events) because of the combined effect of their low terrorism exposure and their retention (i.e., the amount of loss they must absorb before they can draw on pool capacity).

EXHIBIT 36

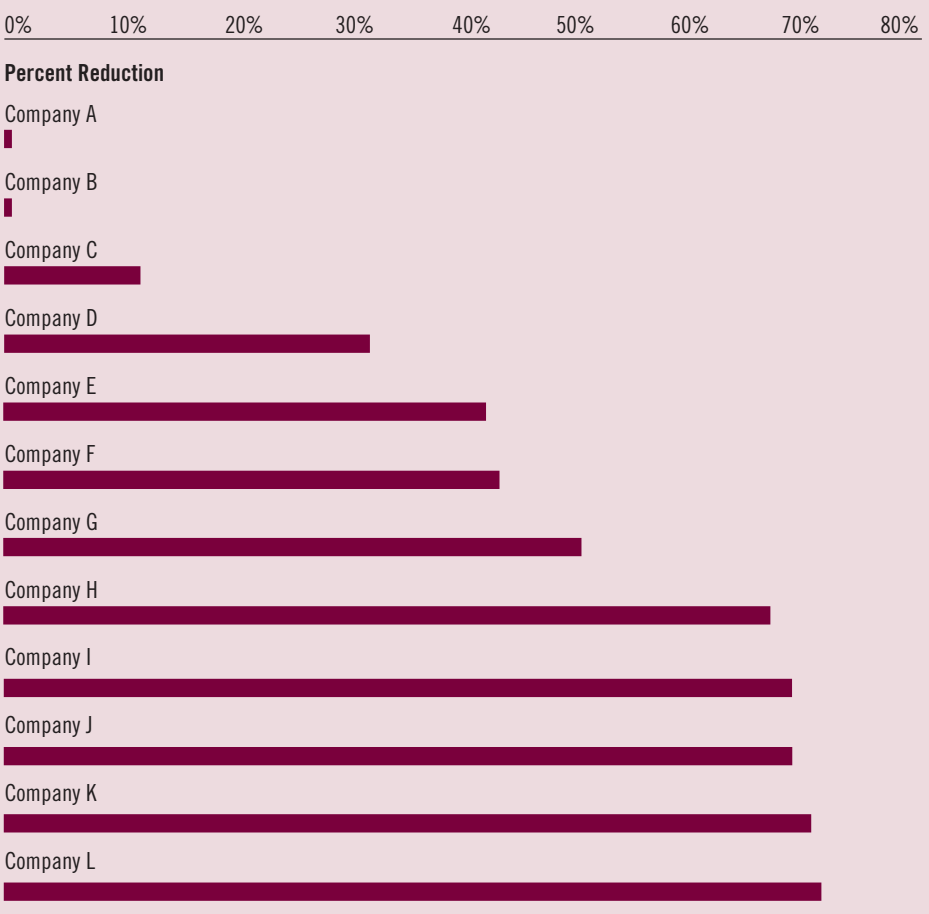
Results of Illustrative Pool Offer: Pool Members' Risk Reduction Benefit, Including Effect of TRIA (Sponsors Only)



Note: Based on 2004 results.

EXHIBIT 37

Results of Illustrative Pool Offer: Pool Members' Risk Reduction Benefit, Excluding Effect of TRIA (Sponsors Only)



Note: Based on 2007 results.

Exhibit 38 shows the range of results from the illustrative offer for all 90 members of the hypothetical pool (excluding one outlier). The dispersion in results is generally consistent with the results from the sponsor group in the previous three exhibits.

EXHIBIT 38

Results of Illustrative Pool Offer for All Members of the Hypothetical Pool

Measure	Minimum	Maximum	Median	Average
Pool Premium/Workers' Compensation DWP	.2%	8.0%	1.0%	1.4%
Pool Premium/PSEs*	.2%	3.6%	.7%	1.0%
Risk Reduction Benefit (1-in-500 loss) (including effect of TRIA – e.g., 2004)	0%	71.1%	0%	16.4%
Risk Reduction Benefit (1-in-500 loss) (excluding effect of TRIA – e.g., 2006)	0%	79.5%	0%	19.6%

*Since headcount information was not collected from non-sponsor companies, their headcount was very roughly estimated based on premium. For the sponsors, loss distributions were developed based on their actual account headcount exposure data; for the other pool participants, loss distributions were synthesized based on industry and sponsor terrorism PML curves.
Note: The figures for pool premium/WC DWP and pool premium/PSEs are shown excluding the effects of TRIA.

LIST OF EXHIBITS

About Towers Perrin

Towers Perrin is a global professional services firm that helps organizations around the world optimize performance through effective people, risk and financial management. The firm provides innovative solutions to client issues in the areas of human resource consulting and administration services; management and actuarial consulting to the financial services industry; and reinsurance intermediary services.

The Tillinghast business of Towers Perrin provides global actuarial and management consulting to insurance and financial services companies and advises other organizations on risk financing and self-insurance. We help our clients with issues related to mergers, acquisitions and restructuring; financial and regulatory reporting; risk, capital and value management; and products, markets and distribution. More information about Tillinghast is available at www.towersperrin.com/tillinghast.

The Reinsurance business of Towers Perrin provides global reinsurance intermediary services and consulting expertise that focus on the creative blending of traditional and non-traditional risk transfer vehicles. Areas of focus include reinsurance strategy and program review, claims management and program administration, catastrophe exposure management, contract negotiation and placement and market security issues. More information about Reinsurance is available at www.towersperrin.com/reinsurance.

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