Report of the Financial Alternatives Workgroup

to the California Earthquake Authority

December 31, 2004

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Executive Summary

The Financial Alternatives Workgroup was appointed by the staff of the California Earthquake Authority (CEA) for the purpose of considering new financing possibilities for providing coverage, consistent with the various relevant statutes and regulations that prevail at the present time, for the CEA's obligations to its policyholders. The Workgroup consisted of Richard A. Cohn, a financial consultant with a wide background in property-casualty insurance, Steve Goldberg, FCAS, MAAA, CPCU, a Senior Vice President of Benfield Inc. with extensive knowledge of, and experience with, catastrophe risk financing alternatives, and Martin M. Simons, MAAA, ACAS, FCA, a public actuarial consultant with particular expertise in catastrophe risks.

The specific activities in which the Workgroup engaged in pursuit of this objective are described in Attachment A. In the course of its efforts, the Workgroup received extensive support and help from the staff and counsel of the CEA and from Shawna Ackerman, FCAS, MAAA, of Pinnacle Actuarial Resources, Inc. The Workgroup wishes to express its thanks for their assistance and encouragement.

In considering what financial alternatives should be the focus of its study, the Workgroup first considered all of the various financial instruments that have not already been adopted by the CEA but that have been employed or proposed for meeting needs comparable to those of the CEA in providing financial capacity for bearing the risk of natural catastrophes. It then identified from this universe the set of alternatives that (1) did not require changes in current statutes and regulations and (2) it regarded as worthy of analysis, based on the following criteria: cost-effectiveness, current and future expected capacity availability, soundness for the CEA from both a legal and regulatory standpoint, and strategic financial considerations that included security of funding, diversification of funding sources, and recent and continuing developments in the capital markets and the reinsurance market.

In consequence, the Workgroup analyzed the feasibility and soundness of the following three financing instruments, which have not previously been employed by the CEA: (1) catastrophe bonds of various types, (2) post-event revenue bonds, and (3) a revenue bond swap facility. These instruments are discussed extensively in the text of the report. Catastrophe bonds are analyzed in Sections III-VI of the report. Post-event revenue bonds are examined in Section VII. Finally, the revenue bond swap facility alternative is explored in Section VIII.

Each of these three instruments has both advantages and disadvantages in comparison with other financing options, including reinsurance, lines of credit, and pre-event revenue bonds. Two of the three instruments, catastrophe bonds and post-event revenue bonds, were viewed by the Workgroup as likely to lower the cost of the CEA's financial structure in the long run. In particular, an extensive cost-benefit analysis of the catastrophe bond alternative is presented in Section V.

In reaching its conclusions and recommendations, the Workgroup adopted a number of working assumptions. It assumed that (1) a major earthquake would not occur in a densely populated area of California prior to the implementation of its recommendations, (2) the CEA would continue to operate on a sound financial basis, and (3) reinsurance costs would be reasonably stable in the near term (though the introduction of catastrophe bonds into the CEA's financing structure may result in the CEA receiving more competitive bids for its reinsurance coverage).

As a result of its investigations and analysis, the Workgroup puts forth the following recommendations:

- The CEA should consider issuing its own catastrophe bonds to replace its current transformer reinsurance coverage and, if the initial issuance proves to be successful, and market conditions with respect to catastrophe bonds continue to be favorable, consider issuing additional catastrophe bonds over the next five to seven years, so that the capacity supported by its catastrophe bonds will be approximately equal in amount to that which will be provided by reinsurance coverage at that time, and that it

- While the CEA would be able to issue revenue bonds based on current revenue in the case of the kind of "earthquake event" described in Insurance Code Section 10089.29, the CEA should consider a modest introduction of the type of "post-event" revenue bonds contemplated by the statute into its financing structure.

The Workgroup has concluded, for the reasons discussed in Section VIII, that the revenue bond swap facility does not contain any clear advantages over the various instruments currently employed or contemplated by the CEA or the two instruments recommended in this report for future use.

The catastrophe bonds and the post-event revenue bonds are likely to provide cost savings with respect to reinsurance, but the catastrophe bonds will add some challenges, as a result of the CEA's unique financial structure, in designing them so as to be good replacements for part of the CEA's current reinsurance coverage. These challenges, which are discussed at length in Section IV, include (1) handling the potential imposition of extra-contractual obligations and/or obligations in excess of policy limits, (2) dealing with additional obligations from long-term adverse claim development, and (3) meeting the CEA's cash flow needs in the event of an earthquake.

The two instruments recommended by the Workgroup would also serve to diversify the current CEA financing structure, thus allowing a lesser degree of dependence on the reinsurance market. Knowledge of the pursuit of these alternatives by the CEA could lead to better terms for the CEA in the reinsurance market, both in the short run and in the long run, as a result of direct competition from the capital markets. Because the capital and reinsurance markets have different price cycles, the CEA would

be in a better position to vary its funding sources over time to its advantage. There are also sound reasons to believe that the catastrophe bond market will become an even more efficient financing source over time than it already is.

I. Members of the Financial Alternatives Workgroup

The staff of the CEA selected three individuals to investigate potential new financing arrangements for the CEA. These individuals were Richard A. Cohn, Steve Goldberg, and Marty M. Simons.

Richard A. Cohn has served for 33 years as a private financial consultant to a wide variety of financial institutions, nonfinancial corporations, and government entities. A graduate of Harvard and Stanford Universities, he concluded a distinguished academic career in 2004, having taught at Massachusetts Institute of Technology and at the Universities of British Columbia, Illinois, and Hartford. At the University of Hartford he held the George Ansley Chair in Finance for nine years. He is the author or co-author of thirty scientific papers. He has done seminal work in a number of areas, including international diversification and residential mortgage design.

He is best known in the field of finance for his work with the late Franco Modigliani of M.I.T. on the relationship between inflation and stock prices. Their work, which spanned the period 1979-1985, is generally referred to in the finance literature as the Modigliani-Cohn hypothesis. Professor Modigliani received the Nobel Prize in Economic Sciences in 1985.

Mr. Cohn is also well-known for his work in the area of property-casualty insurance. Together with Stewart C. Myers of M.I.T., he developed the Myers-Cohn discounted cash flow model for determining, in a regulatory setting, a fair underwriting profit margin. He has testified on cost of capital and underwriting profit issues in Massachusetts, North Carolina, Virginia, New Jersey, California, and Florida. He has testified on behalf of the insurance industry, States, and policyholders. He has been a consultant to Zurich Insurance Group, Maryland Casualty Group, Hartford Financial Services Group, and the California Department of Insurance. He has also served as a financial examiner on behalf of the Commissioner of Insurance of Georgia.

Steve Goldberg is Senior Vice President of Benfield, one of the largest global reinsurance intermediaries. Mr. Goldberg oversees the analytics capabilities at Benfield in addition to consulting directly with clients such as the CEA. His work with the CEA included submitting a paper entitled, “Catastrophe Bond Cost Component Review.” Mr. Goldberg testified on this paper to the CEA Governing Board in March 2002.

Prior to joining Benfield in January 2002, Mr. Goldberg spent his entire career at USAA in San Antonio. In his most recent three years he served as Senior Vice President of Property and Casualty Underwriting and Pricing. His responsibilities included management of USAA’s actuarial and underwriting staff as well as the company’s catastrophe financial management. Mr. Goldberg was responsible for presenting USAA’s underwriting and pricing policy and catastrophe management to various rating agencies. He has extensive experience in personal lines strategic management and

pricing issues in the U.S. For nine years prior to serving in his position as head of Underwriting and Pricing, he was Senior Vice President and Chief Actuary.

Mr. Goldberg led USAA's pioneering efforts to acquire reinsurance capacity through direct access to the capital markets. This catastrophe bond securitization, known as Residential Reinsurance, has been placed annually since 1997 and in 2001 was first placed on a three-year basis. The circumstances behind the initial Residential Reinsurance transaction were published as a case study by the Harvard Business School (USAA: Catastrophe Risk Financing, Harvard Business School, N9-298-007, July 10, 1997). Mr. Goldberg participated as a guest lecturer at the Harvard Business School to help present the case.

Mr. Goldberg graduated from the State University of New York at Stony Brook and holds an M.B.A. from Temple University. He is a Fellow of the Casualty Actuarial Society, a Member of the American Academy of Actuaries and a Chartered Property and Casualty Underwriter (CPCU). He received the CPCU National Standard Setter Award in August 2001. This monthly recognition is given to one of the CPCU society's 30,000 members nationwide who exemplifies the CPCU's commitment to personal ethics, professional conduct and community involvement.

Mr. Goldberg served as a member of the Board of Directors of the Casualty Actuarial Society, the Wharton School Managing Catastrophe Risks Project and the Highway Loss Data Institute. He currently serves as a member of the Board of Trustees of the Actuarial Foundation, a non-profit research group dedicated to applying actuarial techniques to solve social and economic problems. He continues to reside in San Antonio while traveling extensively to support a wide array of Benfield clients.

Martin M. Simons, MAAA, ACAS, FCA, provides actuarial consulting services to public agencies and consumers throughout the United States. From 1985 to 1997, he was the Deputy Director and Chief Actuary for the South Carolina Department of Insurance.

Since 1997, he has been the lead actuary on the Professional Team of the Florida Commission on Hurricane Loss Projection Methodology, and he has participated in the annual on-site audits of each of the catastrophe models used in hurricane insurance rate filings in the State of Florida.

Mr. Simons has been the Property/Casualty Actuary for the Hawaii Insurance Division for the past nineteen years, and he was a member of the Technical Advisory Committee of the Hawaii Hurricane Relief Fund throughout the Fund's existence. He is responsible for having established the process for reviewing catastrophe models used in the property insurance ratemaking system in Hawaii, and he is also a member of the Hawaii Hurricane Model Review Committee.

He has provided actuarial consulting assistance to regulators in several states and provinces as well as to ABC News, and he is currently a member of the American

Academy of Actuaries Task Force to Revise Actuarial Standard of Practice No. 38, "Using Models Outside of the Actuary's Area of Expertise."

He has served on several committees of the National Association of Insurance Commissioners. He has also authored several articles and technical papers on insurance regulation, catastrophe modeling, and insurance company profitability.

II. Merits of Expanding the Role of the Capital Markets in Financing the CEA

The CEA provides capacity to be able to meet, with an extremely high degree of certainty, its potential obligations to its policyholders. By employing a variety of metrics which are used to evaluate potential financial structures, the CEA seeks to be able at the present time to discharge its obligations with an annualized probability of financial survival of 0.999. That is, it arranges for financial resources that will allow it to handle each year a series of earthquakes that will only be exceeded, in terms of the resulting insured losses incurred by the CEA's policyholders, once every thousand years. It thus arranges funding in excess of $5 billion in addition to its capital, which is currently approximately $2 billion. In the past it has relied substantially on the reinsurance market to provide the bulk of its capacity in addition to the two potential capital assessments, provided for by law, on the CEA's participating insurers.

Because it is enlightening to view the CEA's various sources of funds as a set of bars arranged vertically, the CEA's financing structure can be usefully represented as a "layer cake." The CEA often refers to the two potential assessments on its participating insurers as the first and second "industry assessment layers" (or IAL's). The term "layer" will often be employed in the text of the report below in referring to a particular horizontal slice of the CEA financial layer cake.

The capital markets, that is, the markets for financial securities, are many times larger than the reinsurance market.[1] The capital markets thus represent an important opportunity for the CEA to reduce its reliance on the reinsurance market. The CEA has already taken advantage of this opportunity through the use of "transformer reinsurance," which allows investors in the capital market to participate in California earthquake insurance through catastrophe bonds issued on behalf of the CEA's reinsurers. The introduction of additional capital market instruments to broaden the CEA's financial base, as well as a possible replacement of the current transformer reinsurance by more direct participation by the CEA in the market for catastrophe bonds, could tend to reduce the effect of reinsurance market cycles on the CEA's cost of providing capacity over time.

[1] In terms of the U.S. capital market alone, the value of Treasury, federal agency, municipal, corporate, household, and foreign credit market debt and corporate equities was in excess of $35 trillion at September 30, 2004, according to the Federal Reserve's *Flow of Funds Accounts of the United States* (see Table L.4 thereof).

For the reasons discussed below in Section III, the catastrophe bond market has grown and matured substantially over the last three years. The Workgroup recommends, as discussed in Section VI below, that the CEA consider entering this market on its own. By cutting out the "middle-man," the reinsurer, the CEA stands to gain from "unbundling" the reinsurance product.

Because the CEA, as an instrumentality of the State of California, is not subject to federal income tax, it is able to issue catastrophe bonds directly in a tax-efficient manner. Ordinary insurance companies are subject to taxation and thus are precluded from issuing catastrophe bonds directly with any efficiency.

This view on the part of the Workgroup is not meant to imply that there is no place for reinsurance in the CEA's financing structure. There is and probably always will be an appropriate role for reinsurance. Reinsurers do compete with capital market products, and this competition will redound to the benefit of the CEA and its policyholders. The Workgroup anticipates that the CEA will continue to rely to a major extent on reinsurance to fund its obligations. It is possible that the effects of the most recent natural catastrophes experienced by insurers, Hurricanes Charley, Frances, Ivan, and Jeanne, will end up affecting the relative merits of catastrophe bonds and reinsurance. These hurricanes and their potential effects are discussed in Attachment B.

While the capital markets are subject to numerous cycles of their own, these cycles tend to differ in timing and amplitude from the reinsurance market cycle. The potential importance of putting into place a more widely diversified and, hence, more flexible financial structure would seem to be especially important in light of the impending loss of the first industry assessment layer as of December 1, 2008.[2] Such an expansion of financing alternatives could take the form of additional catastrophe bond capacity beyond the current reinsurance transformers. Substituting catastrophe bonds for today's transformer capacity would not in itself add further capital market diversification, but it could improve the economics of acquiring this capacity on behalf of the CEA. However, this potential improvement in the economics of financing the CEA would be accompanied by the challenges, discussed in Section IV below, associated with fitting such bonds into the CEA's financial structure.

As events like this year's hurricanes serve to demonstrate, conditions in the insurance and financial markets change over time, sometimes quite quickly, and the CEA should be in a position to take advantage of such changes. A more variegated and flexible financial structure would allow it to do so. Consequently, the Workgroup very much concurs in the decision to add "pre-event" revenue bond financing to the CEA's financial structure for 2005. Depending on the experience obtained from this innovation, the CEA may well decide to augment the use of pre-event revenue bond financing in

[2] The Workgroup presumes that the CEA will have replaced the first industry assessment layer (IAL) with equivalent capacity as of December 1, 2008, when the first IAL is slated to expire.

subsequent years, as well as consider implementing additional innovations in its financial structure.[3]

III. Changes in the Market for Catastrophe Bonds over the Last Three Years

It has now been almost three years since the CEA Governing Board last considered the catastrophe bond alternative.[4] During this period, the catastrophe bond market has matured substantially. Though it is still quite small by capital market terms, a number of important changes have taken place.

- **Investor demand has increased.** Funds have come into existence that invest exclusively in catastrophe bonds.[5] The Seo brothers fund mentioned in Attachment A is the most prominent example. But currently some $1.5 billion resides in such funds. Since their mandate is to invest in catastrophe bonds, these funds are hungry for new issues to place in their portfolios. Catastrophe bonds are relatively short-term in comparison with corporate and government bonds; consequently, issues mature frequently, and the principal must be put "back to work" on a recurring basis. The indemnity trigger form of catastrophe bonds, which is discussed in Section IV below, is now much easier to place with investors if accurate insurance portfolio data and accepted loss models are available.

- **The market has expanded.** While still in their relative infancy in the world of capital markets, catastrophe bonds outstanding have reached a volume of some $5 billion. This figure represents more than half of the $8 billion in total that has been issued since this market began in 1997.[6] In terms of annual issues, the market has grown substantially, from about $1 billion a year in 2000-2001 to about $1.5 billion in 2002 to almost $2 billion in 2003. While it is currently anticipated that the final figure for catastrophe bond volume for 2004 will come in at about $1.5 billion, the decline from the previous year, if it materializes appears to be attributable more to a lack of risk supply than to a lack of demand on the part of

[3] One potential advantage of pre-event revenue bonds is that a multi-year term to maturity would serve to stabilize the CEA's cost of funds over time, as well as reduce the amount of effort required to "roll over" shorter-term financial instruments, such as reinsurance.

[4] See the CEA Board's agenda and minutes from its March 2002 meeting. It was at this meeting that Steve Goldberg's "Catastrophe Bond Cost Component Review" was presented.

[5] The market for catastrophe bonds is strictly an institutional market.

[6] $5 billion is, of course, a negligible portion of the world capital markets. The catastrophe bond market has considerable opportunity for future growth.

investors. There has been a clear upward trend in the size of the average bond issue over the brief history of this market.[7]

- **A solid performance history has been established.** Many institutional investors are aware that what Wall Street refers to as "alternative investments" have performed well in recent years in comparison with more traditional securities investments. In particular, catastrophe bonds have outperformed corporate bonds, which are subject to credit risk, with equivalent bond ratings. This result reflects the fact, of course, that this period of time saw no set of events of the scale that would trigger substantial losses of principal to investors in catastrophe bonds. In theory, rates of return on catastrophe bonds have a very low correlation with rates of return on other investment classes; they therefore represent opportunities for investors to diversify their portfolios, thus allowing them to reduce their risk without necessarily lowering their expected rate of return. There appears to be a good bit of latent demand for catastrophe bonds on the part of investors.

- **Risk premia are lower.** The result of the growth in demand for catastrophe bonds has been a noticeable decline in the risk premia on such bonds, thus reducing the cost of this kind of financing for their sponsors. The "risk premium" on any bond is the difference between the interest rate on the particular bond and the interest rate on an otherwise identical bond that has virtually no default risk, such as a U.S. Treasury security or a top-rated bank certificate of deposit.

- **Reinsurance quotes play a lesser role.** According to the underwriters consulted by the Workgroup (see Attachment A), risk premia are now independent of what reinsurers would charge for coverage.

- **Catastrophe models are widely accepted.** Investors, underwriters, and the bond rating agencies have become comfortable with the various leading catastrophe models (EQE, RMS, AIR).

- **Transactions costs are lower.** Issuance expenses have also declined as transactions have become more "commoditized."
    - The role of the major bond rating services (Moody's, Standard & Poor's, Fitch) appears to be declining. The recent Residential Re 2004 deal demonstrated that a large ($227.5 million) catastrophe bond offering can be marketed successfully with a rating from only one rating service. While it has not yet closed, a catastrophe bond deal in the

[7] See Christopher McGhee, "Welcome by Conference Chair," 4th Annual Risk-Linked Securities Conference, New York, October 21, 2004.

works at the present time is being marketed without the participation of any of the rating services.

- Shelf registration, which allows corporate issuers to register with the Securities and Exchange Commission potential future securities offerings in advance so as to be able to take advantage of quickly changing market conditions, is now possible for catastrophe bonds, allowing further flexibility and cost savings for sponsors.
- The time required to structure and market a deal has shrunk; a deal can now be done in a period of three months. See Section VI below for a typical sequence of events involved in a successful offering.

- **Liquidity has increased.** The growth in the market has led to an increase in secondary market liquidity for catastrophe bond issues, an important consideration for any investor.

- **Maturity periods have lengthened.** The average term to maturity has lengthened to almost four years; 3-5 year maturities are now the norm for new issues. Longer maturities allow fixed costs of issuance to be amortized over a longer period of time, thus reducing further the annualized cost of catastrophe bond financing.

- **Investor reactions are stable.** There has now been some (partial) default experience with catastrophe bonds. There have been at least two defaulting issues. The largest loss occurred in the case of the Kelvin Ltd. transaction. The principal payment made to investors in the first event notes "tranche"[8] on February 14, 2003, represented redemption of only 76.5% of the par value, implying a loss of 23.5%. In the case of the George Town Re issue, the holders of the preference share tranche ended up with 97.75% of their par value redeemed, for a loss of 2.25%. There may have been, in addition to the experience of these two issues, losses to holders of some privately-placed catastrophe bonds, but there is no publicly available information to indicate that such has been the case.[9] It seems that investors in defaulting catastrophe securities have taken their losses in stride. The investor community has accepted these defaults without reacting adversely with respect to new issues, thus clearly indicating a maturing of the market for bonds with returns that depend on unusual natural events. As discussed in Attachment B, it is not currently anticipated that there will be any defaults on catastrophe bonds resulting from the four hurricanes that have ravaged the United States during the

[8] In the parlance of the financial markets, a distinct portion of a bond issue is often referred to as a "tranche," which is the French word for "slice."

[9] See Mike Millette, "Weathering storms," *insurance securitization quarterly*, vol. 1, issue 2, at pages 4-5, for a detailed history of default experience on catastrophe bonds.

2004 hurricane season, which ended officially on November 30. Furthermore, the secondary market in catastrophe bonds in general, and hurricane bonds in particular, reacted fairly calmly as Charley, Frances, Ivan, and Jeanne approached and invaded the United States.

Defaults on catastrophe bonds are qualitatively different from defaults on bonds backed by the credit of corporate or foreign government issuers. In the case of catastrophe bonds, defaults represent a result of the very design of the instrument. In the case of bonds based on the credit of the issuer, defaults almost invariably reflect the result of human failure of one kind or another. In this sense, defaults on catastrophe bonds may be less disappointing to investors than defaults on other types of bonds.

IV. Catastrophe Bonds and the CEA

Past Experience

The CEA has already benefited, at least indirectly, with catastrophe bonds as a source of financing its insurance capacity. As noted above, this benefit has been obtained as a result of the use of transformer reinsurance. The transformer involves the issuance of a catastrophe bond by the reinsurer to place part of the catastrophe risk associated with California homeowners earthquake insurance in the hands of investors, thus "laying off" part of the reinsurer's risk in providing reinsurance to the CEA.[10] The result of the transformer is presumably an ability on the part of the reinsurer to offer better terms to the CEA for reinsurance. It also can be presumed to add potential underwriting capacity without requiring a change in the CEA's traditional financing structure.

Given the use of transformers by reinsurers, it follows that it made sense for the Workgroup to consider the use of catastrophe bonds as a potential substitute for reinsurance on the part of the CEA. The Workgroup was also aware of the strong recommendation for the use of catastrophe bonds rather than reinsurance made by J. Robert Hunter in his report to the CEA in 2003; this recommendation was based on cost considerations.[11]

The Basics of a Catastrophe Bond

A catastrophe bond represents a commitment by the investor to place his capital at risk in the event of a defined natural catastrophe. If there is no catastrophe, the investor

[10] The Workgroup has discovered that a number of investors, and even investment bankers, regard these bonds as "sponsored" by the CEA, despite the fact that they are not.

[11] See "Actuarial Report Regarding the California Earthquake Authority's 2002 Rate Proposal," by J. Robert Hunter, FCAS, MAAA, in association with J.W. Wilson & Associates, Inc., dated March 13, 2003, which was submitted to the CEA. This report is referred to below as "the Hunter – Wilson & Associates report."

receives back his principal at the specified maturity date of the bond, together with interest during the term of the bond at a variable rate tied to the so-called LIBOR ("London interbank offered rate") 3-month interest rate.[12] The investor receives a risk premium over LIBOR. The investor's principal is at risk in the event of a catastrophe. The bond indenture specifies the conditions under which and to what extent the principal will not be repaid to the investor but inure instead to the ceding insurer.[13]

Potential Forms of Issuance

The Workgroup considered three forms of issuance of catastrophe bonds on behalf of the CEA. In the standard catastrophe bond arrangement, a "ceding insurer" sets up an "off-shore special purpose vehicle" ("SPV"), which is a reinsurance company established in a foreign domicile, one which allows the SPV to be treated as tax-exempt. It is the SPV that represents the issuer of the bond. The proceeds from the bond issue are placed through the SPV in a trust arrangement so as to remove all credit risk from both investors in the bonds and the ceding insurer. The SPV provides reinsurance to the ceding insurer, which pays a reinsurance premium to the SPV. There is a U.S. federal excise tax of one percent on the premium paid by the ceding insurer.[14] A "swap arrangement" is made between the trust and a "counterparty" to allow the trust to invest in high-grade bonds, which are held for the benefit of both the investors and the ceding insurer, while also allowing for the LIBOR base interest rate to be paid to the investors. The counterparty agrees to pay LIBOR in return for receiving the interest earned by the trust from the bonds in its portfolio. The LIBOR payment is passed through to the investors. Market conditions usually require that the counterparty be paid a fee over the life of the bond issue in order to compensate it for entering into the swap arrangement. It is the trust arrangement that eliminates the credit risk. In other words, the money is put "up front" and safeguarded.

The Workgroup was aware that the Governing Board of the CEA in the past has expressed reservations about the off-shore form of issuance. The Workgroup therefore also considered using an "on-shore," or domestic SPV. The on-shore version had the disadvantage that the SPV would be subject, as a property-casualty insurance company, to federal taxation on its net investment income. In order for the SPV to be able to deduct the interest paid to the holders of its catastrophe bonds, under current interpretations of the position of the Internal Revenue Service, the SPV would need to be capitalized by equity to the extent of 15%-20%, and a taxable equityholder would be

[12] To date the use of the 3-month LIBOR as the base rate is standard practice in the case of catastrophe bonds.

[13] For a fuller discussion of the mechanics of catastrophe bonds, see "Review and Application of Capital Market Products," a report by Lehman Brothers Inc. to the CEA, May 2001.

[14] It is the premium paid by the ceding insurer that provides for the spread over LIBOR received by the investors in the catastrophe bond.

subject to taxation on dividends received.[15] A foreign investor would be exempt from withholding tax on interest received from bonds issued by an on-shore SPV but would be subject to federal withholding tax on dividends. This withholding tax rate can be as high as 30%, though it can be lower in the case of nations with bilateral tax treaties in place with the United States. The clear tax inefficiencies associated with the on-shore form of issuance have caused it to have been used very little; to date there have been only two issues structured in this fashion out of a total of more than 100 different catastrophe offerings.[16]

The third method of issuance would be direct issuance of catastrophe bonds by the CEA. These would be CEA revenue bonds with principal repayment contingent on the future history of earthquakes in California. One potential drawback to such an arrangement is that there has never been a direct issuance of a catastrophe bond by a sponsor. However, while the direct form of issuance would be novel to investors, the novelty is quite limited and could easily be explained and justified to investors.[17] It appears to have substantial practical and procedural advantages over either the off-shore or on-shore techniques.

In order to eliminate any credit risk that might otherwise be associated with the bonds, the CEA would need to establish a collateral trust in which the bond proceeds would be placed. The trust would hold the securities acquired with the proceeds. The creation of the collateral trust by the CEA would be a relatively simple matter.

As bonds issued by the CEA, the catastrophe bonds would provide investors with interest that would by law[18] be exempt from California income tax. This fact should have a favorable impact on the cost of the bonds to the CEA. The interest on the bonds would not be exempt from federal income tax, however. As is the case with the on-shore form of issuance, foreign investors, such as hedge funds domiciled abroad, would be exempt from federal withholding tax on the interest received from the CEA's catastrophe bonds.

The principal advantages of direct issuance over the standard off-shore arrangement would be the elimination of the need to establish the SPV and the requirement that strategic decisions be made outside the borders of the United States so

[15] A tax-exempt entity, such as a pension fund, might possibly be interested in providing the required equity if the CEA reimbursed the SPV for its federal tax liabilities (otherwise the rate of return to the equityholder would not be sufficiently attractive). In principle, the CEA could itself provide the equity funds and finance its attendant catastrophe exposure through some other means, such as reinsurance, meanwhile earning a safe, albeit modest, rate of return on its investment.

[16] The question has arisen as to whether the purchase of a "domestic" catastrophe bond would constitute an act of underwriting reinsurance. The Workgroup has been advised that, so long as the investor pays for the bond "up front" and the bond issue is clearly structured and marketed as debt, the investors in catastrophe bonds need not fear being treated as unlicensed reinsurers.

[17] The Workgroup's investigations revealed that investors have a high regard for the CEA as an entity.

[18] Insurance Code Section 10089.48.

as to meet the strictures of federal tax law. The clear advantages of the direct issuance route over the on-shore form are related to the various tax inefficiencies identified above, including the federal excise tax on the premiums paid by the ceding insurer.

It is the CEA's status as a State government instrumentality, which precludes it from being subject to federal income tax, that would allow it to engage in the direct issuance of catastrophe bonds in an efficient manner.[19] A taxable insurer would not be in a similar position. It would be subject to income taxation on the investment income produced by the funds maintained in the collateral trust. It might also not be able to deduct the interest that it paid on its catastrophe bonds for tax purposes; the Internal Revenue Service might treat such bonds as equity securities as a consequence of the contingent nature of the payment of the principal. This concern would not apply to catastrophe bonds issued by the CEA. Foreign investors would therefore rest assured that their income from these bonds would be treated as portfolio interest, which is exempt from federal withholding tax, rather than as dividends from equity, which are not exempt from withholding tax.

Catastrophe Bond "Triggers"

There are four types of catastrophe bonds that differ with respect to the conditions under which the ceding insurer is able to obtain the use of funds held by the trustee, that is, to achieve access to the bond principal.

- The *indemnity* design is based on the actual losses experienced by the ceding insurer.

- The *modeled-loss* design is based on the extent of loss to a notional or hypothetical portfolio of risks as measured by a specified damage model, such as the one employed by EQECAT.[20]

- The *indexed* design is based on an insurance industry-wide index of damage, such as the Property Claims Service index, from an "event."

- The *parametric* design is based on physical measures. In the case of earthquake damage, these measures include such items as magnitude, location, and depth. In this design the extent of the investors' loss is measured relatively quickly.

The clear advantage of the indemnity trigger from the standpoint of the ceding insurer is that it eliminates the so-called "basis risk," which refers to the difference between the extent of the ceding insurer's actual losses and the amount of bond principal

[19] The Workgroup has been advised by counsel that a direct issue of catastrophe bonds by the CEA would not impair the CEA's status as an entity that is not subject to federal income tax.

[20] The modeled-loss design has seldom been employed in practice.

available to the ceding insurer. This makes the indemnity trigger form most resemble traditional reinsurance; in both cases the recovery follows the actual claims payments.

Differences Between Indemnity Bonds and Reinsurance

The Workgroup identified a number of structural differences between the aggregate reinsurance coverage currently employed by the CEA and existing indemnity bonds. These salient differences included the following: (1) security of funding, (2) term of coverage, (3) treatment of extra-contractual obligations (E.C.O.), (4) coverage for payments in excess of policy limits (X.P.L.), (5) "tail risk," (6) retention/erosion risk, (7) changes in take-up rates, and (8) the timing of recovery by the CEA. The first two of these differences tend to favor catastrophe bonds relative to reinsurance while the other six must be regarded as challenges to be met in replacing reinsurance coverage with indemnity bonds.

- Security of funding and the term of coverage

By the very nature of catastrophe bonds, they provide completely secure funding because of the collateral held by the trustee. This collateral eliminates the credit risk associated with non-collateralized reinsurance. Catastrophe bonds also provide the potential availability of longer-term financing than does reinsurance. They can therefore serve to stabilize the CEA's financing costs over time and also reduce to an extent the burden associated with the periodic renewal of reinsurance coverage.

- E.C.O./X.P.L.

Reinsurance can provide coverage for E.C.O. and X.P.L.[21] In principle, an indemnity bond could be designed to allow for some amount of E.C.O. or even X.P.L. Investors are likely to charge more for such coverage than reinsurers do. The reason is that investors are more likely to assume a worst-case scenario.

- Tail risk

While earthquake reserves develop over time, bond investors demand some certainty as to when their bonds will repay the remaining principal. Earthquake bonds normally allow an 18-month extension period beyond the stated maturity date in the case of a covered event occurring during the risk period in order to allow for claims development.[22] At the end of the extension period an independent specialist third party

[21] It is not altogether clear that the CEA would be liable for E.C.O. It is not easy to envision a scenario in which losses would exceed the expected level as a result of E.C.O.

[22] The bond indenture may also allow for a limited number of further 3-month extensions under certain stated conditions. Hurricane indemnity bonds typically allow for claims development with a 6-month extension beyond the risk period, which is defined as a period ending May 31. Thus the development period actually extends much longer than six months because the hurricane season ends at the end of November, that is, several months prior to June.

estimates the appropriate amount of reserves for unpaid claims, and the bonds are paid off, or "commuted," with the appropriate amount of remaining principal being returned to the bondholders together with the final interest payment.

But an indemnity bond, while eliminating basis risk, does have "tail risk" associated with it to the extent that claims may develop adversely after the end of the extension period. There is also a potential interaction between E.C.O./X.P.L. and the tail. E.C.O. and X.P.L. payments can result in a longer tail.

There may well be economies resulting from "unbundling" E.C.O./X.P.L. and tail risk from the reinsurance product. E.C.O./X.P.L. payments and long-term adverse claim development are additions to other claim payments. This addition takes place only once per insured event. But an allowance for these payments must be built into the cost of each layer of reinsurance coverage.

- Retention/erosion risk and changes in take-up rates

Retention/erosion risk refers to the effect of earthquake events on expected losses for financing layers that are not penetrated by the events. Such events do cause a rise in expected losses for the intact higher layers, however; the reason is that their attachment and exhaustion probabilities increase as lower layers are "eroded" by losses.

The CEA has historically contracted for its reinsurance coverage early in the year before year of risk coverage. Consequently, the CEA's reinsurers bear retention/erosion risk during the period between the time coverage is bound and the beginning of the risk period.

Changes in take-up rates refer to growth in risk exposure from the sale of additional insurance policies beyond the expected level. Such growth increases the probability that a particular layer of coverage will be penetrated because it increases the chance that lower layers will be exhausted. The CEA's reinsurers bear the risk of growth in exposure up to 10%. For growth beyond the 10% level, there is an additional premium payment required to compensate the reinsurer. If growth is negative, the reinsurers benefit as a result, though there is a reduced premium payment for shrinkage greater than 10%.

The Workgroup is concerned that the take-up rate may increase substantially subsequent to a major earthquake. The CEA should prepare a standby plan to increase its capacity quickly if such proved to be the case. The reason is that while substantial additional premium revenue would flow into the coffers of the CEA in such an event, if another major earthquake followed on the heels of the first event, the CEA's financial resources could be substantially eroded.

There is another point of difference between the CEA's reinsurance and indemnity bonds. The CEA's reinsurance coverage is unusual in that the CEA is paid by its reinsurers not only with respect to paid claims but also with respect to reserves. If it

turns out, once reserves are settled, that the CEA received too much, the "over-recovery" is repaid to the reinsurers. In contrast, most reinsurance contracts pay only when claims are paid. In this sense indemnity bonds mimic the typical form of reinsurance.

- Timing of recovery

Indemnity bonds provide for payment by the trustee to the ceding insurer only when claims are paid by the ceding insurer. In the event of an earthquake that results in losses to the CEA, however, its reinsurers make funds available to it in advance of claim payments. The reinsurers provide two weeks' worth of such payments in advance.

V. Design and Cost Analysis of Catastrophe Bonds in Comparison with Transformer Reinsurance

Bond Design

Based on its investigations and analysis, the Workgroup determined that the natural starting point for an issue of catastrophe bonds by the CEA would be for it to replace the current transformer reinsurance layers.

The Workgroup has determined that, of the various structural forms and triggers available to the CEA, the catastrophe bond design that would make the most sense for the CEA, should the CEA Governing Board decide to proceed with this kind of financing instrument, is an indemnity bond issued directly.

The Workgroup has considered the various structural considerations identified above in Section IV in attempting to design an issue of catastrophe bonds as an effective substitute for the current transformer reinsurance layers. In order to cover the potential E.C.O./X.P.L. and tail risk problems, the Workgroup determined that, along with indemnity bonds to replace the existing transformer layers, the CEA consider issuing a parametric bond in the amount of $47 million. This figure, for reasons that are discussed below, represents approximately one percent of the midpoint of the second indemnity layer. This parametric bond would be designed to provide additional coverage if either the first or the second of the two indemnity bond layers were penetrated but not exhausted.

The Workgroup's catastrophe bond design is based, in terms of changes to the financing structure that the CEA Governing Board has adopted for 2005, on replacing the transformer reinsurance layers with indemnity bond tranches of equivalent size, that is, $150 million and $200 million. There is also an accompanying parametric tranche, which would have two triggers. Each trigger would relate directly to one of the two indemnity bond layers. The triggers would be specified so that their activation would be highly correlated with the respective indemnity bond losses. The parametric triggers would be set so that, with a high degree of confidence, if the $150-million indemnity tranche was penetrated but not exhausted, the CEA would receive $37 million from the

parametric tranche. If the $200-million indemnity tranche was penetrated but not exhausted, the full $47 million would become available.[23]

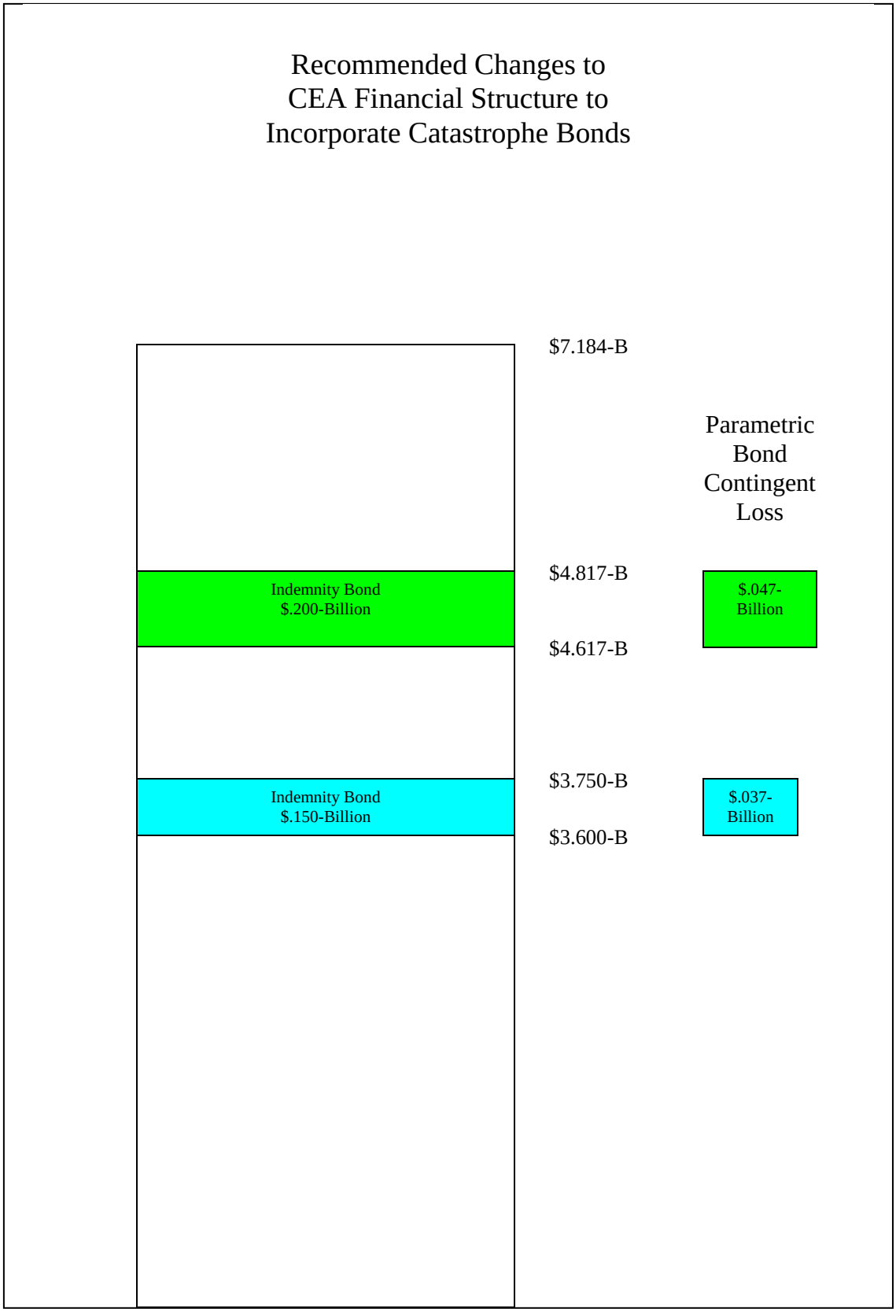
In each of the two cases, the parametric tranche, if triggered, would yield approximately one percent of total losses. One percent of total losses would represent much more than one percent of the respective indemnity bond layer. If earthquake losses penetrate, but do not exhaust, an indemnity bond layer, the uncertainty with respect to ultimate losses would be small in relation to total losses but quite large in relation to that layer.

If the first parametric trigger were to be hit, the bond would provide a release of principal of $37 million, approximately one percent of the midpoint of the loss range covered by the first indemnity tranche, unless losses were expected to exceed the top of the loss range for that layer.[24] This figure of one percent represents about 25% of the first layer of $150 million. If the second trigger were hit, the full $47 million of principal, which also represents about one percent of the total loss, would be released. The $47-million figure would represent, however, about 24% of the second indemnity bond layer of $200 million. Once again, if total losses were expected to exceed the top of the second layer, there would be no release of principal.

The role of the parametric tranche in relation to the two indemnity tranches is illustrated in the diagram on the following page:

[23] In the extremely unlikely event that—within the life of the recommended catastrophe bond issue—the first parametric trigger were hit as the result of an earthquake or a series of earthquakes and that the second parametric trigger was then subsequently hit, the second payout from the parametric tranche would be only the $10 million remaining after the earlier first payout of $37 million. The Workgroup regards the likelihood of the occurrence of such a sequence of events as astronomically small.

[24] In such case the E.C.O./X.P.L. and tail risk problems would not apply to the first indemnity bond layer but would adhere, rather, to a higher layer.


Recommended Changes to
CEA Financial Structure to
Incorporate Catastrophe Bonds
$7.184-B
Parametric
Bond
Contingent
Loss
$4.817-B
Indemnity Bond
$.200-Billion
$.047-
Billion
$4.617-B
$3.750-B
Indemnity Bond
$.150-Billion
$.037-
Billion
$3.600-B

Note that one-percent of the midpoint of the first indemnity tranche, $.03675 billion, is $36.75 million, or about $37 million, and that the midpoint of the second indemnity tranche is $47.17 million, or approximately $47 million

The Workgroup's cost analysis, which is discussed in detail below in this section of the report, suggested that the appropriate term to maturity for the catastrophe bond issue to serve as an efficient replacement for the existing transformer layers would include a three-year risk period corresponding to a three-year calendar period. In order to assure that funding will be in place at the beginning of the risk period, the bonds could be issued a number of months prior to the commencement of the risk period. Investors would bear no catastrophe risk, that is, no potential loss of principal, during the "stub period" between the issuance of the bonds and the following January 1, when the risk period would begin. Because the risk premium for the first year of the risk period would be determined at the time of the closing of the transaction, that is, at the beginning of the stub period, the bondholders would bear retention/erosion risk during the stub period. In the cost analysis presented below in Section V, the risk premium during the stub period is expressed in terms of a "standby fee." This fee, in addition to the LIBOR base interest rate, serves to compensate the investors for giving up the use of their risk capital during the stub period.

Risk Premia and Bond Ratings

The biggest portion of the cost of a catastrophe bond is the risk premium paid to the investors. The risk premium associated with a particular tranche will relate to a large extent on the bond rating accorded to the tranche.

Bond ratings are important to potential investors in debt instruments. The bond ratings represent expert, independent assessments of the likelihood and extent to which the holder of a bond may fail to receive, in full and on time, the stated interest and principal underlying the issue in question. The two principal bond rating agencies in the United States are Moody's Investors Service and Standard & Poor's Corporation.

The Workgroup met with appropriate representatives of both of these firms. In each instance, the rating agencies were informed that the Workgroup was an advisor to the CEA and did not represent the CEA. The Workgroup believes that the probability of a successful first issuance of catastrophe bonds directly by the CEA would be augmented by obtaining bond ratings for each tranche from both Moody's and Standard & Poor's. While, as noted in Section III above, there is precedent for the issuance of catastrophe bonds with only one bond rating having been obtained, the novelty of a direct issuance by the CEA would suggest that two ratings would provide considerable comfort to investors. The two ratings may result in the CEA paying a lower premium over LIBOR. Whether this point is correct at the time of an actual issue should be verified by the selected underwriting team.

When the Workgroup questioned the representatives of Moody's and Standard & Poor's about potential drawbacks associated with rating a direct issue of catastrophe

bonds by the CEA, especially in view of the fact that a state instrumentality had not previously issued or even sponsored such a bond, the reaction in both cases was that there should be no attendant difficulties as a result. Indeed, both services appeared to appreciate the inherent simplicity of direct issuance, which would clearly obviate the need for an SPV. There appeared to be no inherent structural difficulties associated with a direct issue of catastrophe bonds by the CEA, and this view specifically encompassed the type of issue analyzed in this section of the report.

One major concern on the part of the rating agencies, however, as a result of the absence of an SPV, was that the investors' funds be immune from bankruptcy concerns. This concern appeared to be completely alleviated by the concept of the collateral trust described above in Section IV.[25] A representative of Moody's did suggest that investors would also value a prepayment of the annual risk premium over LIBOR into the trust. Given the CEA's high level of liquidity, this idea would appear to have merit because the cost should be very modest, perhaps even negligible. Presumably, it would not be difficult to arrange for the CEA to be paid interest in return for the prepayment of the annual risk premium.

Another concern on the part of the bond rating services that was not so easily addressed was that of "moral hazard." This reservation related to presumed fears on the part of investors in indemnity bonds that claims adjustors for the insurers participating in the CEA would have little incentive to make sure that claim payments would be no more than reasonable in the event of earthquake losses to residential property covered by the CEA. The fear was that the claims adjustor would try to make his or her employer and the homeowner happy by paying claims with CEA funds that would in turn be reimbursed through investors' losses on bond principal.

This concern was largely alleviated when the Workgroup made the representatives of Moody's and Standard & Poor's aware that the CEA participating insurers potentially had much to lose as a result of overly generous claim payments because the resulting erosion of CEA funds would increase the likelihood of industry assessments. The Workgroup also brought to the attention of the rating agencies the facts that not only are the claims adjustors trained by the CEA in the assessment of earthquake damage, but also that the CEA has a program to audit claims paid by the participating insurers. Comfort was also derived from knowledge that the preponderance of premiums written by the CEA was accounted for by such large personal lines writers as State Farm, Allstate, USAA, and Farmers.

One possibility that was raised in order to reduce investors' concerns about the potential moral hazard problem was that reinsurance identical to a vertical 11.11% slice of the respective financial layer might serve to bear the same risk per dollar as the catastrophe bond issue, which would bear 90% of the combined risk.[26] This vertical slice

[25] The term of art used on Wall Street to describe the desired safety of the collateral underlying a catastrophe bond is "bankruptcy remoteness."

[26] 100%/111.11% = 90%.

could be incorporated into the CEA financial layers by increasing the width of the tranche by 11.11%, allowing any benefits obtained through the transaction to be unaffected by the entrance of the reinsurance slice. In a more typical indemnity catastrophe bond, the ceding insurer might retain the remaining 10% exposure[27] so as to convince investors that it had "skin in the game." This option is not open to the CEA.[28]

A salient difference in the approaches to rating catastrophe bonds on the part of the two rating agencies is that Moody's tends to concentrate more on expected annualized loss rates[29] than attachment probabilities while Standard & Poor's places relatively more emphasis on the attachment probability. Standard & Poor's appears to view, not inappropriately, the attachment probability of a catastrophe bond as analogous to the default probability of a bond with credit risk.[30]

Both rating services made it quite clear to the Workgroup that their primary concerns lay in both (1) the quality of the CEA's management and credit and (2) the structural aspects of the bond issue(s) in question. Investors need to know what the rules are and why they can expect the relevant parties to follow the rules. To this end the legal aspects of a catastrophe bond issue are all-important. Collateral is of little comfort if it is not available when needed. One of the values provided by a rating service is another set of eyes to examine the legal aspects and documentation surrounding a bond issue. This value would be further enhanced by the employment of a second rating service.

Both rating services emphasized to the Workgroup that a bond rating is not something that is awarded just prior to the issuance of a bond and remains the same until the bond matures. The rating is monitored continually. If a significant covered event transpires, a catastrophe bond, even one that specifies a higher risk premium at the time the annual coupon rate is reset, is likely to have its rating lowered because the expected loss has increased. Similarly, if an earthquake model used in the determination of the initial bond rating is superseded by a newer version of the model, the bond rating may be affected, depending upon the differences in attachment probabilities or expected annual loss rates between the initial and revised versions of the model.[31] The risk of a rating change is borne by the bondholder, and it is undoubtedly one that could affect the value

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[27] 11.11%/111.11% = 10%.

[28] Except for the statutory reservation placed on $350 million of CEA capital, all other CEA equity would have been paid or reserved for losses prior to attachment of investors' funds. Consequently, it is not possible for the CEA to have its own "skin in the game."

[29] See "Moody's Approach to Rating Catastrophe Bonds Updated," by Rodrigo Araya, Ph.D., Moody's Investors Service, January 23, 2004, at page 9.

[30] Standard & Poor's is sensitive to the fact that losses on catastrophe bonds occur suddenly while most bonds are subject to gradual declines in credit quality. See "Insurance Risks: Capital Solutions & Rating Implications," Standard & Poor's Corporation, 2004, at page 53.

[31] For the purpose of resetting the annual risk premium on an outstanding tranche, it is normally the practice to employ the model used at the time the bond issue was originated.

of the bond in the secondary market. This kind of risk is one that investors would easily grasp and understand, however.

The costs associated with bond ratings from Moody's and Standard & Poor's are included in the cost analysis presented below in this section of the report. There are both up-front and continuing fees involved. Bond rating agencies are the result of information economics. It does not make sense for all investors to engage in complete analyses of the risks of a security because much of their work would represent duplication of effort. The bond rating agencies perform analyses on behalf of all of the investors in a rated security. The trust placed by investors in these services results in a lower cost of funding to the borrower (as well as a higher effective rate of return to the investor).

Representatives of Standard & Poor's made it quite clear to the Workgroup that if the structural (legal), valuation (modeling), and process issues involved in issuing a catastrophe bond were, as they would anticipate, handled by the CEA in a proper and timely fashion, an appropriate rating would be forthcoming. And one of them, noting the current shortage of supply in the catastrophe bond market, indicated that the CEA would have no difficulty selling its bonds in the market if a rating of double-B or higher was obtained for them.

Cost Estimation and Comparison

The current transformer layers, with magnitudes of $150 million and $200 million, have expected annual losses of 0.67% and 0.36%, respectively. Current bond market conditions suggest, according to the investment bankers consulted by the Workgroup, that indemnity bonds in the same amounts with equivalent expected losses would require risk premiums in the ranges of 3.40-5.00% and 2.20%-3.30%, respectively, at the present time. It would be anticipated at the present time that the first indemnity tranche would receive bond ratings of Ba2 from Moody's and BB+ from Standard & Poor's and that the second indemnity tranche would be rated Ba1 and BBB-, respectively. It is reasonable to believe that the parametric tranche, with an expected annual loss of 0.05%, would require a risk premium of 1.20-2.50% at the present time. The anticipated ratings by Moody's and Standard & Poor's for the parametric tranche would be Baa1 and BBB+, respectively; in the case of Standard & Poor's, the rating might possibly be as high as A. For equivalent expected annual loss ratios, investors tend to charge lower risk premiums for parametric bonds than for indemnity bonds[32] because there is greater certainty as to the magnitude of the loss associated with a covered event.

[32] Historically, investors in indemnity bonds have been concerned about adverse selection and moral hazard, problems which do not arise in the case of a parametric bond. Given the governmental nature of the CEA and the fact that the CEA has more than 60% of the market for residential earthquake insurance in California, the Workgroup believes that this concern should not arise with respect to indemnity bonds issued by the CEA. The investment bankers consulted by the Workgroup concur in this view.

The investment banking firms put the expected initial expenses associated with the three bond tranches at about $9.0 million. These costs, which include the costs of two rating agencies, are detailed in the following table:

Up-Front Expenses ($thou)

Service Fees	
Underwriting and Placement	$4,500
Issuer's Counsel	500
Underwriter's Counsel	20
Modeling	275
Rating Agencies	475
Claims Review Specialist	40
Loss Reserve Specialist	40
Trust and Trustee	100
Other Deal Expense	50
Subtotal:	$6,000
Standby Fee*	3,000
Total:	$9,000

*Assumes a six-month stub period. A four-month stub period would require a standby fee of $2 million, or two-thirds as much.

A number of these costs, including—among others—underwriting and legal fees, should be regarded as negotiable. While the other costs are relatively invariant with respect to the size of the offering, it is reasonable to regard the underwriting and placement expense, as well as the standby fee, as varying proportionately with the size of the issue. Estimated ongoing annual expenses appear in the next table:

Annual Ongoing Expenses ($thou)

Swap Fee	$650
Trust and Trustee	80
Rating Agencies	15
Modeling	130
Legal and Other	25
Total:	$900

These costs represent the most likely figures. On an annualized basis, the initial and continuing costs correspond to a cost on line of 1.05%. This figure is obtained by

converting the initial expenses into an equivalent annualized cost for each year of the three year-risk period, where the total present value of the three years' worth of annual expenses has the same value as the sum of the initial expenses of $9 million. The resulting equivalent annual cost is $3,275,000. The ongoing annual expenses, as shown in the chart, are an estimated $900 thousand. Thus the total annualized cost comes to $3,275,000 + 900,000 = $4,175,000. Dividing this figure by the total bond issue of $397 million (the sum of the three tranches of $150, $200, and $47 million) yields the ratio of 4.175/397 = 1.05%.

This annualized cost per dollar of the bond issue, together with the ranges for the risk premia associated with the various tranches as obtained from the investment banking firms consulted by the Workgroup, are combined in the following table to provide a measure of the potential annual savings that would result from substituting the catastrophe bonds for reinsurance:

CEA Sponsored Catastrophe Bond Cost Comparisons
Annual Costs -- Three Year Risk Period

	Tranche 1 Indemnity	Tranche 2 Indemnity	Tranche 3 Parametric
Capacity ($mil)	$150	$200	$47
Excess of Attachment Point ($mil)	$3,600	$4,617	See
Exhaustion Point ($mil)	$3,750	$4,817	text.
Prob. At Attachment	0.70%	0.38%	0.06%
Expected Loss	0.67%	0.36%	0.05%
CEA Sponsored Catastrophe Bonds			
Risk Premium	3.40-5.00%	2.20-3.30%	1.20-2.50%
Expenses (Annualized)	1.05%	1.05%	1.05%
Total -- All in Costs RATE ON LINE	4.45-6.05%	3.25-4.35%	2.25-3.55%
Total -- All in Costs ($mil)	$6.68-9.08	$6.50-8.70	$1.06-1.67
Total -- Costs Including Parametric ($mil)	$7.74-10.75	$6.50-8.70	
Savings from Traditional Reinsurance ($mil)	($0.89)-2.12	$1.24-3.44	
Savings from Transformer Renewal ($mil)	$0.29-3.30	$2.52-4.72	
Expected Cost of Traditional Reinsurance			
Reinsurance Brokerage ($mil) @ 0.22%[33]	$0.33	$0.44	
Reinsurance RATE ON LINE[34]	6.35%	4.75%	
Total -- All in Costs ($mil)	$9.86	$9.94	
Savings from Transformer Renewal ($mil)	$1.19	$1.28	
Expected Cost of Transformer Layers			
Reinsurance Brokerage ($mil) @ 0.11%[35]	$0.17	$0.22	
Reinsurance RATE ON LINE[36]	7.25%	5.50%	
Total -- All in Costs ($mil)	$11.04	$11.22	

[33] This allowance is based on the August 2003 CEA Governing Board Agenda Item 3, Attachment C, "Reinsurance Intermediary Fee Schedule." This brokerage allowance is incremental to the flat fee and incremental fees already embedded in and scheduled to be paid to the intermediaries in 2005-2007. It reflects the "Meets Expectations" direct placement fee.

[34] These estimates were provided by the current reinsurance intermediary team.

[35] This allowance reflects the amortization of the 0.22% direct placement fee over the two-year life of the transformer layers.

[36] These figures reflect the ROL of the transformer layers for 2005.

The total cost figures in dollars for the catastrophe bonds are obtained by multiplying the magnitude of each tranche by the total cost measured as a rate on line. The total cost figures for the two types of reinsurance, traditional and transformer, are obtained by multiplying the magnitude of each indemnity tranche by the associated rate on line and then adding the corresponding allowance indicated for reinsurance brokerage.

In order to compare the cost of the catastrophe bonds with the respective costs of reinsurance, the cost of the parametric tranche is arbitrarily added to the cost of the first indemnity tranche. One can then obtain, as is shown in the chart, a range of cost savings for each indemnity tranche.

For example, in the case of the first indemnity tranche, Tranche 1, the indicated range for the risk premium goes from 3.40% to 5.00%. If one then adds the expense loading of 1.05% to this range, one obtains a rate on line that ranges from 4.45% to 6.05%. The size of the tranche is $150 million. Thus the total cost per year ranges from 4.45% of $150 million, or $6.68 million, to 6.05% of $150 million, or $9.08 million. The corresponding range of costs for the parametric tranche is $1.06-1.67 million. Adding this range to the cost range for Tranche 1 results in a total cost range, as shown in the chart, of $6.68 million + 1.06 million = $7.74 million to $9.08 million + 1.67 million = $10.75 million.

The respective total cost figures for traditional and transformer reinsurance in the case of Tranche 1, are shown in the chart as $9.86 million and $11.04 million, respectively. To obtain the estimated range of savings from the catastrophe bond with respect to reinsurance, one then subtracts the total cost of the catastrophe bond from the total cost for reinsurance. Thus, if one takes the figure of $9.86 million for traditional reinsurance and subtracts it from the cost range of $7.24 to $10.75 million for the catastrophe bond, the result is a range of savings, as shown in the chart, goes from a low of ($0.89) million to a high of $2.62 million.

If one then adds the respective ranges of savings for both of the indemnity tranches, the resulting indicated ranges of total cost savings are given in the following table:

CEA Sponsored Catastrophe Bonds
TOTAL ANNUAL COST SAVINGS
With Respect to Traditional Reinsurance
= $ 0.35-5.56 million
MAXIMUM ANNUAL COST SAVINGS
With Respect to Transformer Reinsurance
= $2.81-8.02 million

The figures presented on the previous page serve to indicate that the CEA is likely to achieve a substantial cost saving as a result of replacing one or both of the transformer layers with its own directly issued catastrophe bonds. While the indicated ranges in cost savings are quite wide, they reflect the fairly wide ranges in estimated risk premia. The expected values of the risk premia for Tranches 1, 2, and 3, are 4.46%, 2.99%, and 1.61%, respectively. The expected value of the range of annual cost savings with respect to traditional reinsurance is $2.20 million. The corresponding expected value of the range of annual cost savings with respect to the transformer reinsurance is $4.67 million.

One must be careful in interpreting the comparison of the estimated cost of the catastrophe bonds with the rates on line for the current transformer layers of 5.50% and 7.25%, respectively, not only because these are historical costs that do not reflect current conditions in the reinsurance market but also because the recommended catastrophe bonds are, as noted above in Section IV, not exactly equivalent to reinsurance. One should therefore regard the range of cost savings with respect to transformer reinsurance, as shown in the table, as a maximum.

The analysis is somewhat conservative, however, in the sense that, while it reflects the cost of the parametric tranche, it does not reflect the expected additional funds provided by it. Given the estimated annual loss of 0.05% associated with the $47-million parametric tranche, the expected proceeds to the CEA would be 0.05% x $47 million = $23,500 annually.

VI. Catastrophe Bond Recommendation

Based on its research, particularly the cost analysis presented in Section V above, the Workgroup recommends that the CEA consider introducing its own directly issued catastrophe bonds into its financing structure. The appropriate first step would be to issue the bonds described in Section V above as replacements for the two transformer layers.

A successful first offering is likely to whet the appetite of investors for future CEA issues, as well as put the reinsurance market on notice that the CEA is willing to go directly to investors in assembling its sources of capacity. On the other hand, a failure to go directly to the capital market is likely to result, in the long run, in poorer terms for reinsurance coverage.

The CEA would be well advised to keep catastrophe bonds in play over time as a substitute for reinsurance. Reinsurers would thus be on notice that they must remain competitive with other potential capacity sources that could ultimately become available to the CEA. This strategy would yield another strong incentive for reinsurers to provide the CEA with most favored terms.

Depending on the CEA's initial experience with catastrophe bonds, if it decides to go ahead with the Workgroup's recommendation to replace the transformer layers, the

CEA may well wish to expand its use of catastrophe bonds over the intermediate-term future. If market conditions continue to favor catastrophe bonds over reinsurance, not only in terms of cost savings but also in terms of security of funding and incentive effects, it would be reasonable to anticipate that, looking five to seven years out into the future, catastrophe bonds might provide approximately the same amount of capacity as reinsurance at that time. It is reasonable to assume that the catastrophe bond market will continue to expand. In the seven years ending with 2004, the market grew from almost nothing to some $8 billion of outstanding securities. While the rate of growth in the volume of catastrophe bonds outstanding will inevitably decline over the next seven years, there is likely to be ample room for the CEA to expand its presence well beyond the level currently represented by its transformer reinsurance over that time frame.

It is clear from the Workgroup's studies, especially the cost analysis presented above, that the argument in the Hunter – Wilson & Associates report to the effect that the cost of catastrophe bond financing was *substantially* less than that of the reinsurance actually purchased by the CEA was grossly incorrect. That report states, at pages 12-13, "The cost of [catastrophe] bonds would vary depending on whether they were issued in a taxable or non-taxable market, but even in a taxable market, the net annual cost of bonds (the interest payable less the investment proceeds) would likely be less than 2% per year." The report states at page 35, "The Tax-Free Catastrophe Bond Financing of CEA's claims paying capacity could replace reinsurance coverage costing nearly 8% annually with trustee-held funds costing less than ½ percent annually – a savings over $100 million per year." The Workgroup's research and analysis has found that the lowest spread over LIBOR ever provided to investors in an off-shore (i.e., tax-free) California earthquake indemnity bond was the recent Redwood IV deal by Swiss Re (the "transformer") with an expected annual loss of 0.216%. It had a spread of 2.30% over LIBOR. The corresponding Redwood III issue with an expected loss of 0.522%, which came out at the same time, had a spread of 3.85% over LIBOR. These spreads do not reflect any of the other costs of issuing the bonds, nor are these bonds identical, as discussed above, to reinsurance. In addition, the Hunter – Wilson & Associates report appears to have ignored the need for the parametric tranche described in Section IV above, and its associated cost.

The Hunter – Wilson & Associates report, which suggests that the capital markets would support a much lower cost of capacity for the CEA than reinsurance, does not seem to appreciate that the capital markets require risk premia that loom large for low expectations of loss. Even corporate bonds provide yields that are substantially greater than the expected default losses associated with them by investors. Double-B corporate bonds over the business cycle tend to experience, according to recent history, annualized default losses of 0.30-0.35%. The current spread on double-B corporate bonds is approximately 1.50% over LIBOR. These figures correspond to insurance loss ratios of 0.30-0.35%, divided by 1.50%, or a range of only 20-23%.

One question that arose during the course of the Workgroup's efforts was why the spreads on catastrophe bonds, compared with corporate bonds generally, are larger in relation to the associated expected annual losses, especially given the fact that

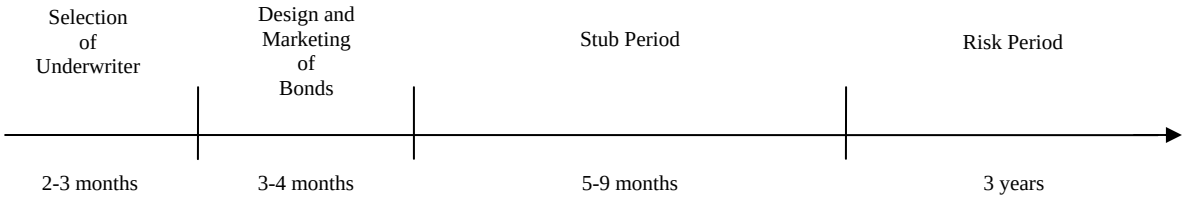
catastrophe losses are more easily diversified away by investors than are credit cycle losses. The answer seems to be that the portfolio managers of the institutional investors that buy catastrophe bonds demand a premium for the fact that their careers are literally "on the line" in the event that a major default occurs in a deal in which their employers have a substantial investment. The managers fear that they will be potential victims of hindsight. Compensation for this "behavioral risk" appears to show up in the form of higher risk premiums on the bonds in question. As the catastrophe market grows, and the investor base for them broadens, this "career risk" premium can reasonably be expected to shrink as a result of competition among portfolio managers. (Given the current level of the perceived quantity of catastrophe risks of various kinds around the world, it seems unlikely that the market for catastrophe bonds will expand to the point at which it would make economic sense for them to be marketed to individual investors, who would not charge a premium for "career risk.")

Issues of Implementation

With respect to the risk premia for the second and third years of the risk period, the Workgroup recommends that the bonds have a variable coupon rate to be specified in the indenture according to a matrix or formula relating the risk premium for each tranche to the expected loss. A "reset" would take place at the end of the first year to determine the risk premium for the second year and at the end of the second year for the third year. The pricing matrix or formula would reflect retention/erosion risk and changes in take-up rates. These factors can affect the attachment points for the tranches and, hence, the expected losses associated with the new attachment points, which must be reflected in the risk premium promised the investors in the bonds. One advantage of such a structure is that the CEA would benefit directly from take-up rates lower than the expected level in the form of a lower risk premium. Conversely, the CEA would not benefit if take up rates were higher than expected.

An example of the reset process for a particular tranche will serve to illustrate this concept. The risk premium for the first year of the risk period, based on an annualized expected loss of 0.37%, might be 3.15%. If the risk premium for the tranche was reset at the beginning of the second year of the three-year risk period, based on an expected loss of 0.45% resulting from an erosion of CEA capital during the first year of the risk period, the expected loss table might specify a risk premium for this tranche for the second year of 3.30%.

The process that would be involved in issuing catastrophe bonds is illustrated by the following timeline:



In lieu of a stub period, an option to buy reinsurance could be substituted. There would be a cost associated with this option in the form of a "reservation fee" if the option is not exercised.[37]

It should not be a difficult matter to allow for the recommended indemnity bonds to meet the CEA's usual requirement that funds be available, two weeks in advance. According to the underwriters consulted by the Workgroup, it would not be a difficult matter to arrange for such an advance payment to be made to the CEA from the collateral trust.

The actual activity of issuing the bonds would tend to proceed according to the following tasks:

Task 1 – Select service providers (e.g., deal counsel, modeling firm); provide modeling firm with data.

Task 2 – Develop transaction structure; review model; brief rating agency(ies); begin marketing process.

Task 3 – Begin rating agency discussions; finalize transaction structure; resolve legal issues.

Task 4 – Prepare final presentation to rating agency; circulate first draft of offering circular; receive risk analysis from modeling firm; begin work on investor materials; schedule "road show."

Task 5 – Make presentation to rating agency(ies); rating agency performs due diligence; circulate draft of offering circular; meet with underwriter syndicate; begin "premarketing."

Task 6 – Rating agency performs sensitivity analysis; form of Purchase Agreement; feedback from potential investors on structure of deal.

Task 7 – Receive preliminary bond ratings; prepare final draft of offering circular.

[37] In 2002 the CEA paid a reservation fee of 50 basis points (0.50%) for a nine-month period.

Task 8 – Provide complete draft documentation to rating agencies; draft swap confirmation and schedule; distribute preliminary offering circular to investors; complete preparation for road show.

Task 9 – Follow up with rating agencies; select swap counterparty; road show; investor conference call**.**

Task 10 – Negotiate transaction documents; follow up with investors.

Task 11 - Receive final rating letters; complete final offering circular; execute purchase agreement; price issue and allocate to investors.

Task 12 - Settle purchase of collateral; execute swap agreement; distribute final offering circular; settle transactions with investors.

It is customary for underwriters in the United States to require securities issuers to indemnify them with respect to acts of negligence. The CEA would presumably not be willing to provide such an indemnification. This reservation on the part of the CEA should be made clear to potential underwriters. It would seem unlikely, however, that this constraint would prove to be a "deal breaker" for the underwriters.

If for any reason the market for the CEA's bonds proves to be unduly limited, this fact would be known in time to continue the use of reinsurance for the planned second indemnity bond layer. The investment bankers consulted by the Workgroup were unanimously convinced that there would be sufficient demand for the first indemnity bond layer. However, if the catastrophe bond issue was restricted to the first indemnity bond layer, including the relevant portion of the parametric tranche, the savings would be lower than that estimated in Section V above with respect to the entire recommended issue.[38] The smaller size issue would be feasible but not as efficient as the entire recommended issue because many of the categories of issuance costs identified in the cost analysis are essentially fixed in nature.

VII. Post-Event Revenue Bonds

As part of its charge from the staff of the CEA, the Workgroup was asked to investigate the extent to which the CEA would be able to issue post-event revenue bonds supported by surcharges imposed on policyholders. If such bonds were to become part of the financing structure for the CEA's capacity, under California Insurance Code Section

[38] As noted in Section V above, the analysis of expected savings from a catastrophe bond issue to replace the two transformer layers shows expected annual cost savings with respect to traditional reinsurance of $2.20 million and with respect to the existing transformer reinsurance of $4.67 million. If the issue is limited to the first indemnity tranche and the corresponding portion of the parametric tranche, the annual expected cost savings would be approximately minus $170,000 and a positive $1.02 million, respectively.

10089.29, the post-event revenue bond layer would lie just below the second industry assessment layer. An important constraint on the issuance of such bonds is the statutory requirement that they be investment-grade, that is, at least either BBB- as determined by Standard & Poor's or Baa3 by Moody's. If the proceeds of such bonds were used to pay losses, then the interest paid on the bonds would be exempt from federal income tax as well as California income tax.

The Workgroup was aware that revenue bonds based on current revenue could be issued after an earthquake event. Such bonds would, in principle, be the same as the pre-event revenue bonds already planned as part of the CEA's financial structure. Given the criteria adopted by the Workgroup for identifying the financial alternatives it chose to study (see Executive Summary, at page 2), no analysis was made of the extent to which the CEA might be able to take advantage of this type of bond in such an event.

Analysis of Bonding Capacity

The results of the Workgroup's analysis of the CEA's post-event revenue bond capacity are presented in Attachment C. The starting point in the analysis was an estimate of future aggregate premium revenue provided by Shawna Ackerman at the request of the Workgroup. The revenue figures were based on the CEA's Dynamic Financial Analysis (DFA) model, with the exception that the maximum annual rate change was raised from 20% to 30%. As is the case with the base DFA model, it was assumed that it takes a year to implement a rate change.

It was then assumed that policyholder surcharges equal to the legal maximum of 20% of the premium were imposed. It was also assumed, in order to provide a conservative estimate of post-event revenue bonding capacity, (1) that the cost of issuing the bonds is equal to 2% of the amount of funds raised, (2) that a reserve fund equal to 10% of the bond issue must be maintained at all times prior to the final maturity date, (3) that the bonds paid an interest rate of 6%, and (4) that the expected surcharge revenue must equal twice the amount of debt service in each year that the bonds will be outstanding. The purpose of imposing of a debt service coverage ratio of 2.0 is to ensure that the bonds would be eligible to receive an investment-grade rating. The final step in the analysis was to solve for the maximum amount of bonds that could be issued, given the assumed parameters and constraints.

The thrust of the analysis can be illustrated by considering, for example, the calculations that appear in Attachment C in the column in Table II for Year 3. At the beginning of Year 3, the amount of post-event revenue bonds outstanding is $195 million. The expected maximum surcharge revenue for that year is $116 million. The required debt service coverage ratio of 2.0 implies that one-half of the surcharge revenue, or $58 million will be available for debt service, that is, to pay interest and principal. Given the assumed 6% interest rate, $195 million in bonds would require a $12-million interest payment. Of the $58 million of funds available for debt service, $46 million would be available, after payment of interest, to repay bond principal, and it is assumed

that the $46 million is employed for this purpose. The amount of bonds outstanding at the end of the year is therefore shown as $149 million, which represents the beginning-of-year value $195 million less the $46-million repayment.

The analysis presented in Tables I-III of Attachment C shows that the CEA could issue up to $260 million in a 5-year serial bond issue or as much as $546 million in a 10-year serial issue and meet the requirements for the bonds to be rated investment-grade. The Workgroup believes that these amounts are so small in relation to the market for tax-exempt California municipals that the CEA's issues would likely not be "crowded out" by those of other California governmental entities (including the State itself) in the aftermath of a major earthquake, particularly if the necessary underlying legal documentation has already been prepared.

Public Policy Considerations

While the probability of such an event or series of events is minuscule, it is possible that an earthquake or sequence of earthquakes would result in the exhaustion of the CEA's financial resources. If such an eventuality did arise, one method allowed by current law that could be called upon to augment the CEA's ability to meet legitimate policyholder claims is inherent in the statutory provision for issuance of "post-event" obligations. Section 10089.29 does allow the CEA to consider the use of financing based on post-event surcharge revenue of up to 20% "of the annual basic residential earthquake insurance premium in any one year for the policy."

One could thus view the potential opportunity for issuing post-event bonds as part of the current financial structure of the CEA. In the event that all other funds are exhausted, recourse to issuance of post-event bonds could be sought. At the present time the legal limit on surcharge-supported post-event financing of all kinds is $720 million.

While the CEA does not currently contemplate the use of post-event financing, it has done so in past years. It took the form of committed lines of credit.

The Workgroup considered whether the CEA should build the kind of contingent financing that post-event revenue bonds would represent into its financial structure. Given that such bonds might well be used as a last resort, it seems reasonable for the CEA to prepare to be able to use this option by building a modest quantity of such bonds into its capacity. The Workgroup therefore recommends that the CEA consider building into its financial structure a $50-million layer of surcharge-supported post-event bonds, which could be inserted between the planned pre-event revenue bond layer and the second industry assessment layer. As shown in Tables IV and V of Attachment C, the Workgroup estimates that a 5-year serial issue of $50 million in post-event revenue bonds would require a 3.84% surcharge to be imposed and maintained during the life of the bond issue. The corresponding surcharge figure for a 10-year serial issue would be 1.83%. While the analysis in Attachment C assumes an interest rate of 6%, the Workgroup estimates that 10-year post-event revenue bonds, which would be sold by the

Treasurer of the State of California as agent for the CEA, would require an interest rate of approximately 4% if it became necessary for them to be issued at the present time.

The following steps would be involved in preparing to use this layer:

1. Preparation of legal documentation.
2. Selection of an underwriter.
3. Working with the bond rating agencies to develop an indication as to the rating that would be accorded an issue by the CEA of this size.

This recommendation of $50 million in post-event bonds represents the result of a compromise among the members of the Workgroup.

Investors would require the imposition of surcharges throughout the life of the bond issue. It is ultimately the surcharge revenue that represents the security for their claim. If the Governing Board were to adopt the Workgroup's recommendation, it would be stating, in effect, that the CEA is committed to imposing the necessary surcharges if and when the CEA's financial capacity is eroded to the point that the need for issuing the post-event revenue bonds arises. Such a commitment implies that the CEA will be willing to impose surcharges on its policyholders for a substantial length of time after they have incurred, as a group, enormous losses, retained as well as insured.

If the surcharges were not charged, the CEA would not be able to obtain the funds needed to support the post-event bond layer. Insurance Code Section 10089.30 indicates that the second industry assessment layer cannot be accessed until all funds have been obtained for contracts that lie beneath the second IAL. Adoption of the Workgroup's recommendation of $50 million of post-event revenue bonds subjects the CEA to the risk that the bonds, while not marketable in the absence of surcharge revenue, would be regarded as having been "set up" in advance and thus as meeting the condition of being "under contract."

If the CEA does decide to contemplate the use of post-event debt financing, the Workgroup wishes to point out the important differences between what may be called "contingent debt financing" (e.g., post-event revenue bonds) and risk transfer (e.g., reinsurance or catastrophe bonds).

The most important distinction between these two forms of financing for the CEA is that under risk transfer there is no contractual obligation to repay the funds employed to pay losses. The funding source, to the extent of the creditworthiness of the counterparty, is assured. In order for subsequent events to be covered, risk transfer does require reinstatement, but in no event would the CEA need to ask policyholders to "pay back" the proceeds that have already been paid out to cover losses incurred. In other words, with risk transfer there is no formal payback requirement.

Contingent debt financing, by definition and in contrast, demands a future payback. Contingent debt financing is not fully funded in advance. Following a large

earthquake, reliance only on the universe of future CEA policyholders to repay these obligations implies loading at least a portion of their premiums going forward to fund an event that has already happened. Consideration under the insurance contract, then, is not entirely used for the insurance coverage that is purchased.

Other forms of post-event financing, such as that used to fund the Florida Hurricane Catastrophe Fund, have a much broader policyholder assessment base upon which to rely. Florida, by statute, may assess premiums from almost all lines of insurance in the state, not just homeowners and not just homeowners with hurricane coverage. In California, the legislature has not permitted this form of assessment, thus leaving the only source of payback for CEA post-event financing to be from future CEA policyholders.

From a cost standpoint it is very attractive to substitute risk transfer with contingent debt financing. But in light of the thin assessment base, and the voluntary nature of this base, insurance premiums following a major event may include a substantial "anchor" of payback.

The Workgroup debated this issue at length and came up with a reasonable compromise of recommending $50 million of post-event financing for the foreseeable future. However, the CEA should be advised that, unless a broader assessment base is permitted as a result of future legislation, the wisdom of a larger amount of post-event financing should be questioned.

VIII. The Revenue Bond Swap Facility Alternative

This potential financing alternative consists of the CEA first issuing pre-event revenue bonds. It would then, either at the same time or subsequently, enter into an agreement with a counterparty (or set of counterparties) that would serve to transfer part of its earthquake risk to the counterparty. Under this type of arrangement, the counterparty would be required to provide an amount of collateral in the form of U.S. Treasury securities to support the payment of claims in the event a specified trigger point is reached. This amount would be specified, in terms of market value, in the agreement, and the trigger point would be fixed in terms of the magnitude of earthquake losses incurred by the CEA over a particular future period. The amount of the collateral would relate to the extent of the risk that the counterparty agrees to bear. The transfer of the collateral from the counterparty to the CEA would be contingent on the trigger being hit.

The interest on the bonds provided by the counterparty as collateral to support its contingent obligation to the CEA would be available to the CEA for any purpose, including payment of interest on its pre-event revenue bonded indebtedness. Thus, in effect, under the facility the CEA could be viewed as agreeing to swap, to the extent specified by the agreement with the counterparty, its requirement to service its revenue bonds for its requirement to pay claims to policyholders. That is why this risk transfer arrangement is referred to as a "revenue bond swap facility."

To allow for fluctuation in the value of the collateral, "overcollateralization" to the extent of an additional 5% would be required. The swap facility would be, from a legal standpoint, entirely separate from the revenue bond issue itself. Once the counterparty's financial obligations to the CEA had been met, the remaining collateral would be returned to the counterparty.

In order to compensate the counterparty for entering into the facility, the CEA would be required to compensate the counterparty in advance of a triggering event. At the time the facility is created, the counterparty would, in effect, be selling the CEA a put option, a type of derivative security. A put option is a financial instrument that specifies the transfer of an asset or liability, over a defined future period, at the option of the holder of the instrument in return for the payment of a specified price, which is usually referred to as the "exercise price." In this case the CEA would be purchasing from the counterparty an option to "put" to the counterparty the obligation to pay claims. The exercise price is the assumption by the counterparty of this obligation.

One serious drawback to the swap facility is the fact that there would be credit risk associated with the ability and willingness of the counterparty to perform when its performance is required.

The Workgroup chose not to perform an explicit cost-benefit analysis of this alternative. Not only was it concerned about the credit risk associated with this financing choice, but it was also strongly dissuaded that the idea has potential merit because of the regulatory concern voiced above (see footnote 16) that the counterparty might be regarded as an unlicensed reinsurer. The population of counterparties might therefore be limited to insurers and reinsurers. This prospect suggests that the revenue bond swap facility is very unlikely to prove to be a preferable alternative to traditional reinsurance.

The Workgroup recommends that the staff of the CEA not pursue the potential merits of this financing alternative.

IX. Summary of Recommendations

The Workgroup recommends that the CEA

1. Consider the direct issue of catastrophe bonds. Should the CEA choose to do so, it should begin with the replacement of the two transformer reinsurance layers as indicated in Section VI above;

2. Consider using post-event revenue bond financing of $50 million as the penultimate layer of the financing structure, to fit just below the second industry assessment layer; and

3. Not pursue the revenue bond swap facility alternative, which is described in Section VIII above.

A table presenting the principal features of each of the three alternatives studied by the Workgroup appears as Attachment D. It also provides a list of the major pros and cons, as well as an overall cost/benefit assessment, of each alternative.

The first recommendation is supported by the Workgroup's analysis of the cost-effectiveness of catastrophe bonds, their inherent security of funding, the well-established and growing market for such securities, their regulatory soundness, the increased flexibility they would introduce into the CEA's financial structure, and the positive incentive effects that they would have on the reinsurance market.

The second recommendation is grounded in the Workgroup's belief that a modest introduction of post-event revenue bonds into the CEA's capacity would pave the way for the CEA to be able to employ in an efficient manner much larger amounts in the event that such funds will be needed to allow the CEA to maintain its ability to perform its mission subsequent to major earthquakes in densely populated areas.

The third recommendation reflects the Workgroup's concerns with respect to creditworthiness and regulatory soundness.

Attachment A—Activities of the Financial Alternatives Workgroup

The Workgroup first met on May 20, 2004. It decided to consider the following alternatives: (1) catastrophe bonds and (2) "post-event" bonds. In order to study the catastrophe bond alternative, Workgroup members met in New York City on June 4 with the following investment banking firms: Lehman Brothers Inc., AON Capital Markets, and Goldman, Sachs & Co. These firms were selected on the basis of their demonstrated expertise in catastrophe bond design and marketing. The Workgroup members also met that day with Messrs. John and Nelson Seo; they are brothers who manage, on behalf of Fermat Capital Management, LLC, the largest fund devoted exclusively to investing in catastrophe bonds.

The results of this fact-finding visit were conveyed to the staff of the CEA in a teleconference on June 15 and were discussed at the Workgroup's meeting on June 21. At the June 21 meeting the Workgroup also met via teleconference with representatives of BNP Paribas Securities Corp., another investment banking firm with catastrophe bond expertise. In addition, the Workgroup began to discuss a plan for analyzing the post-event bond alternative.

The Workgroup met again on July 22-23. At this meeting the Workgroup added a third financing alternative for consideration, one that employed features of both catastrophe bonds and reinsurance. It eventually gave the name "revenue bond swap facility" to this third alternative. At the July meeting the Workgroup also received formal presentations of various amounts and types of catastrophe bonds, to meet potential CEA financing needs, from the four investment banking firms with which it had previously consulted. It was determined at the end of this meeting that the Workgroup should meet again with some of these firms to attempt to find answers to remaining questions about the scope of potential catastrophe bond financing for the CEA. This fact-finding visit took place in New York City on August 16-17. On August 16 the Workgroup met with representatives of Goldman, Sachs & Co. On August 17 meetings were held with representatives of AON Capital Markets and BNP Paribas Securities Corp. In addition to two individuals who appeared in person, two of the representatives of the latter firm participated from London via telephone. The Workgroup also met that day via teleconference with representatives of Goldman, Sachs & Co. to discuss post-event revenue bonds.

At the conclusion of its August 16-17 meeting, the members of the Workgroup decided that it would be prudent to discuss its potential catastrophe bond recommendations with appropriate experts at the principal bond rating firms, Moody's Investors Service and Standard & Poor's Corporation. The Workgroup then proceeded to prepare a working draft of its written report. This draft was distributed to staff of the CEA and was discussed via teleconference on August 31.

The Workgroup met in New York City with representatives of Moody's and of Standard & Poor's on September 14. At these respective meetings the Workgroup sought

to learn more about the process that would be involved in the CEA obtaining ratings for any catastrophe bonds that it might decide to issue. In the course of these discussions the representatives of the two bond rating agencies also described their respective methods, both quantitative and qualitative, for assessing ratings for catastrophe bonds.

In preparing to develop the second draft of its report, the Workgroup met via teleconference with CEA staff and counsel on October 4. The Workgroup then requested information with respect to a possible issue of catastrophe bonds by the CEA from the three investment banking firms with which it had been working since August. After receiving information reflecting current conditions in the financial markets, the Workgroup prepared and submitted its second draft to CEA staff on October 18.

Based on the comments that were subsequently received from the staff of the CEA, the Workgroup proceeded to prepare the next draft of its report. This draft was submitted by the Workgroup to the staff of the CEA on November 1. This draft was discussed by the Workgroup with CEA staff and counsel at a meeting on December 15. After subsequent revisions, the next draft was submitted to CEA staff on December 23. Following the receipt of written comments from CEA staff, the Workgroup prepared the final draft of its report, which was submitted on January 6, 2005.

Attachment B—The 2004 Hurricanes and Their Aftermath

Midway into the deliberations of the Workgroup, the first major hurricane of the 2004 season, Hurricane Charley, slammed into Florida's gulf coast. Charley was followed by Hurricanes Frances, Ivan, and Jeanne. On October 4 the Insurance Information Institute put a preliminary figure of $22-23 billion on insured losses from these four hurricanes.

In terms of 2004 dollars, this figure rivals the previous record experienced in 1992. In 1992 Hurricane Andrew, the worst in U.S. history in terms of insured losses, caused insured losses of $20.9 billion, and Hurricane Iniki, the tenth worst, caused $2.1 billion of insured losses in 2004 dollars.

The four hurricanes that invaded the United States in 2004 are four of the six worst hurricanes in U.S. history, in terms of insured losses measured in 2004 dollars. These six hurricanes are listed below in descending order:[39]

Year	Name	Insured Losses (2004 Dollars)
1992	Andrew	$20.9 Billion
2004	Charley	6.8 Billion
1989	Hugo	6.4 Billion
2004	Jeanne	5.0-7.0 Billion*
2004	Frances	4.4 Billion*
2004	Ivan	4.0-5.0 Billion*

*Preliminary estimates.

Florida over the years has developed an elaborate financial network of state-run facilities to help deal with hurricane losses. The Florida Hurricane Catastrophe Fund (FHCF), which serves as a reinsurer of first resort for most residential insurance carriers, exists to provide reinsurance of $15 billion in excess of $4.5 billion. With a cash balance of $5.6 billion at the beginning of the current hurricane season, the balance of the authorized funding comes from post-event bonds, which may be tapped if necessary. Citizens Insurance Company, the second fund used in Florida, was formed as a merger of the former Joint Underwriting Association and Windstorm Pool in order to write policies that were not acceptable in the voluntary market. Citizens itself is reinsured by the FHCF.

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[39] Matthew Lubanko, "Harshest Hurricane Season?" *Hartford Courant*, October 5, 2004, at page E1.

With much of the loss being borne by the FHCF, the reinsurance markets were shielded to a great extent from the losses that it would ordinarily have paid if this protection was not available. Therefore there is likely not to be a major reduction in capacity for the CEA, at least based on the events thus far.

The secondary markets for catastrophe bonds currently in effect that are based, in whole or in part, on Florida windstorm losses appear to have withstood these storms remarkably well. It now appears that none of the catastrophe bonds in effect, including indemnity bonds, will be triggered as a result of this season's hurricanes. Indemnity catastrophe bonds were not triggered because the losses have not exceeded their thresholds.

About $15 million of catastrophe bonds were traded in the secondary markets while Hurricane Charley was approaching the United States. Market participants said that there were more investors interested in buying than in selling. Secondary market trading was largely confined to U.S. hurricane bonds. In past disasters, such as September 11, some investors were interested in selling all of their catastrophe bonds. One market observer was quoted as saying, "People are much more focused now on which bonds have a possibility of getting triggered. Investors are more sophisticated now. You don't see the casual buyers you used to."[40]

Perhaps even more notable was the issuance of $53.3 million in catastrophe bonds by Swiss Re in mid-September after Charley, Frances, and Ivan had hit the United States. These bonds were well-received by the primary market. Market observers indicated that there was good demand for all tranches of the issue, which was part of Swiss Re's Arbor shelf program. This program covers losses from a mixture of U.S. windstorm and earthquake, Japanese earthquake, and European windstorm perils.[41]

While to date there have not been losses to holders of catastrophe bonds from this season's hurricanes, some investors are undoubtedly taking a hard look at whether they want to enter or continue to participate in this asset class. But it seems that others are encouraged as a result of the ability of Florida windstorm catastrophe bonds to have weathered this particular storm.

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[40] "$15m of bonds traded during Charley," *insurance securitization quarterly*, vol. 1, issue 2, 2004, at page 3.

[41] "Swiss Re proves investors are still hungry for cat bonds," Weekly News, *Reactions*, September 24, 2004.

Attachment C—Analysis of Post-Event Revenue Bond Capacity

Note: All dollar figures in the tables below are in millions.

Table I.

Expected aggregate premium revenue (not including surcharges that may be imposed on policyholders) if funds below the second industry assessment layer are exhausted; assumes no change in policy growth from the CEA DFA base model, that the maximum rate increase is limited to 30%, and that it takes a year to implement a rate change (that is why the figure for Year 2 is so much larger than the figure for Year 1):

Year	1	2	3	4	5
	$405	$550	$578	$666	$703

Year	6	7	8	9	10
	$754	$797	$874	$925	$1,048

Resulting maximum surcharge revenue at 20%:

Year	1	2	3	4	5
	$81	$110	$116	$133	$141

Year	6	7	8	9	10
	$151	$159	$175	$185	$210

The analysis presented below, which is based on the maximum policyholder surcharge revenue shown above, attempts to provide a conservative estimate of the CEA's maximum post-event revenue bonding capacity. It is assumed that issuance costs are 2% of the bond issue, a reserve fund equal to 10% of the issue must be maintained at all times prior to the final maturity, and that the interest rate on the bonds is 6%. It is also assumed that expected surcharge revenue must equal twice the amount of debt service in each year that the bonds will be outstanding. The imposition of a debt service coverage ratio of 2.0 is to ensure that the bonds would be eligible to receive an investment-grade rating.

Given these assumptions, the analysis indicates that the CEA should be able to sell as much as $260 million worth of post-event bonds with a 5-year serial term to maturity or $546 million in bonds with a 10-year serial term to maturity. Each issue is designed to be fully retired by the final maturity date.

Table II.

Bonding capacity, assuming a coverage ratio of 2.0x and a 5-year Serial Term

Year	1	2	3	4	5
Initial Debt	$260	$236	$195	$149	$91
Cost of Issuance at 2%	5				
Reserve Fund at 10%	26				
Amount Available for Paying Claims	229				
Surcharge Revenue	$81	$110	$116	$133	$141
Available for Debt Service at 50%	$41	$55	$58	$67	$70
Debt Service:					
Interest at 6%	16	14	12	9	5
Principal Repayment	25	41	46	57	65
Release of Reserve Fund					26
Debt at Yearend	$236	$195	$149	$91	$0

Table III.

Bonding capacity, assuming a coverage ratio of 2.0x and a 10-year Serial Term

Year	1	2	3	4	5	6	7	8	9	10
Initial Debt	$546	$538	$516	$489	$451	$408	$357	$299	$230	$151
Cost of Issuance at 2%	11									
Reserve Fund at 10%	55									
Amount Available for Paying Claims	480									
Surcharge Revenue	$81	$110	$116	$133	$141	$151	$159	$175	$185	$210
Available for Debt Service at 50%	$41	$55	$58	$67	$70	$75	$80	$87	$93	$105
Debt Service:										
Interest at 6%	33	32	31	29	27	24	21	18	14	9
Principal Repayment	8	23	27	37	43	51	58	69	79	96
Release of Reserve Fund										55
Debt at Yearend	$538	$516	$489	$451	$408	$357	$299	$230	$151	$0

The following two tables present the analysis identifying the required surcharge levels, as a percentage of the expected aggregate premium revenue given in Table I, associated with the $50 million issue of post-event revenue bonds recommended by the Workgroup (see Section VII). In every other respect, the same assumptions underlying Tables II and III are reflected.

Table IV.

Resulting surcharge revenue at 3.84%:

Year	1	2	3	4	5
	$15.6	$21.1	$22.2	$25.6	$27.0

Bonding capacity, assuming a coverage ratio of 2.0x and a 5-year Serial Term

Year	1	2	3	4	5
Initial Debt	$50.0	$45.2	$37.4	$28.5	$17.4
Cost of Issuance at 2%	1.0				
Reserve Fund at 10%	5.0				
Amount Available for Paying Claims	44.0				
Surcharge Revenue	$15.6	$21.1	$22.2	$25.6	$27.0
Available for Debt Service at 50%	$7.8	$10.6	$11.1	$12.8	$13.5
Debt Service:					
Interest at 6%	3.0	2.7	2.2	1.7	1.0
Principal Repayment	4.8	7.8	8.9	11.1	12.5
Release of Reserve Fund					5.0
Debt at Yearend	$45.2	$37.4	$28.5	$17.4	$0.0

Table V.

Resulting surcharge revenue at 1.83%:

Year	1	2	3	4	5	6	7	8	9	10
	$7.4	$10.1	$10.6	$12.2	$12.9	$13.8	$14.6	$16.0	$16.9	$19.2

Bonding capacity, assuming a coverage ratio of 2.0x and a 10-year Serial Term

Initial Debt	$50.0	$49.3	$47.2	$44.8	$41.3	$37.4	$32.7	$27.4	$21.0	$13.8
Cost of Issuance at 2%	1.0									
Reserve Fund at 10%	5.0									
Amount Available for Paying Claims	44.0									
Surcharge Revenue	$7.4	$10.1	$10.6	$12.2	$12.9	$13.8	$14.6	$16.0	$16.9	$19.2
Available for Debt Service at 50%	$3.7	$5.0	$5.3	$6.1	$6.4	$6.9	$7.3	$8.0	$8.5	$9.6
Debt Service:										
Interest at 6%	3.0	3.0	2.8	2.7	2.5	2.2	2.0	1.6	1.3	0.8
Principal Repayment	0.7	2.1	2.5	3.4	4.0	4.7	5.3	6.4	7.2	8.8
Release of Reserve Fund										5.0
Debt at Yearend	$49.3	$47.2	$44.8	$41.3	$37.4	$32.7	$27.4	$21.0	$13.8	$0.0

Attachment D—Summary Comparison of Financial Alternatives

Financial Instrument	Principal Features	Pros	Cons	Cost/Benefit Assessment
Catastrophe bonds issued directly by the CEA	Provides funds when needed by the CEA to pay losses and loss adjustment expenses as a result of a major event	Is cost effective in comparison with reinsurance Provides longer-term financing Security of financing	Must be carefully integrated into CEA financial structure Novel form of issuance	Should be introduced into the CEA's financial structure
Post-event revenue bonds	Not issued until an earthquake event has caused all other resources than the second IAL to be set aside to pay losses	Inexpensive source of funds if access is not required Interest is exempt from both U.S. and California income tax Provides capacity diversification	Must be financed by surcharges on policyholders May be difficult to sell when the funds are needed Must be investment-grade	Should be employed to the extent of $50 million
Revenue bond swap facility	Serves as a substitute for traditional reinsurance	May be cost effective in comparison with traditional reinsurance Provides capacity diversification	Subject to default risk May raise regulatory concern	Should not be employed