

Missouri Petroleum Storage Tank Insurance Fund  
Review of Liabilities and Loss Projections  
as of June 30, 2007

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Missouri Petroleum Storage Tank Insurance Fund  
Review of Liabilities and Loss Projections  
Performed by: Kerper and Bowron LLC

## 1. Executive Summary

This report makes an actuarial estimate of liabilities at June 30, 2007 of 111,175K for the Missouri Petroleum Storage Tank Insurance Fund. Details of the operation of the fund are noted in Section 4. This would include a 71,266K of case reserves and a point estimate of IBNR of 39,909K.

Projections were also made on a fiscal year cash flow basis from 2008 until 2017. Projections include anticipated revenue from transport load fees and expected expenses and claims payments. Claims payments are projected for both existing claims and new claims reported in the future. The program sunsets on December 31, 2010, and no revenue is authorized after this date. This cash flow analysis consists of 2 separate scenarios:

- First, it was assumed that the program would sunset and no revenue would be available after this date.
- Second, it was assumed that the program would be reauthorized in its current form. However, the transport load fee was assumed to drop from \$40 to \$25 on January 1, 2009.

The variance of these forecasts in the outlying years was analyzed and found to be large. This is due to the high amount of loss development on this program, and uncertainty in the future years on the frequency, severity and payout pattern of the fund. We took the additional step of modeling this uncertainty to construct a range around the possible outcomes.

Our simulations show that the range of possible outcomes increases the further into the future we perform projections of fund balances.

### **Projection “A” (Fund Sunsets on December 31, 2010)**

- The fund balance on the sunset date is projected to be approximately \$105 million.
- We would expect that the fund would be solvent in 2017.
- We expect the fund balance to be depleted sometime after 2017, though there is a 25% chance that the fund could be sunsetted without additional funding.
- In 2017, there is an 80% chance that the fund balance will be between \$12.8 million and \$39.0 million.

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

### Projection “B” (Fund Reauthorized at Lower Funding Level)

- The fund balance on the sunset date is projected to be approximately \$91 million.
- We would expect that the fund would become technically solvent in 2016 (Assets of the fund would be greater than the liabilities).
- In 2017, there is an 80% chance that the fund balance will be between \$68.2 million and \$107.0 million. We would expect that the surplus in the fund at this date to be approximately \$3.7 million.

### 2. Purpose of Study

The purpose of this study is to review the reserves and loss projections for the Missouri Petroleum Insurance Fund. The fund’s Board of Trustees contracted with Kerper and Bowron LLC to perform this storage tank review. Loss projections have been made for the years 2008 through 2017.

Actuarial data and guidance for this study were provided by both the Board’s staff and Williams and Company (the third-party administrator of this program).

### 3. Limitations

Actuarial projections rely on extrapolating past trends to make assumptions about future development and emergence of claims. Since these claims are subject to significant random deviations as well as changes in the legal and regulatory climate, it is possible that the actual results may differ significantly from the projections that have been made.

*Consistency* - The conclusions are predicated on the assumptions that the selected reporting, reserving, and payment patterns, frequency and severity trends, and claim distributions apply, and will continue to apply, to the program. The risk exposure covered by the program as well as the claim management and settlement practices are assumed to be consistent over time, except as noted.

*Entire Document* - The study conclusions are developed in the accompanying text and exhibits, which together comprise the report.

*Data Reliance* - the PSTIF Board of Trustee’s staff and Williams and Company provided the data for this study. In the study, we relied on the accuracy and completeness of this data without independent audit. If the data is inaccurate or incomplete, our findings and conclusions may need to be revised.

*Management Reliance* - the PSTIF Board of Trustee’s staff and Williams and Company provided information concerning the program structure and risk exposure. In the study, we relied on the accuracy and completeness of this information without independent verification. If the information is inaccurate or incomplete, our findings and conclusions may need to be revised.

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

*Underlying Assumptions* - In addition to the assumptions stated in the report, numerous other assumptions underlie the calculations and results presented herein.

*Study Foundations* - The study conclusions were based on analysis of the available data and on the estimation of many contingent events. Future costs were developed from the historical claim experience and covered exposure, with adjustments for anticipated changes.

*Significant Digits* - Numbers in the exhibits are generally shown to more significant digits than their accuracy suggests. This has been done to simplify review of the calculations.

*Interpretation of Conclusions* - Some of the assumptions, methods, and conclusions in this report are of a significantly technical nature. The recipient should understand the assumptions, methodology and possible variability in results that are inherent in our conclusions. We are available to discuss our assumptions, methodology and conclusions in greater detail.

*Assets* - We have assumed that valid assets, which have appropriate maturities and sufficient liquidity to meet the cash flow requirements of the Missouri Petroleum Storage Tank Insurance Fund, support the reserves. We make no guarantee that Missouri Petroleum Storage Tank Insurance Fund funds will prove sufficient.

*Uncertainty* - Due to the uncertainties inherent in the estimation of future costs, it cannot be guaranteed that the estimates set forth in the report will not prove to be inadequate or excessive and actual costs may vary significantly from our estimates.

*Unanticipated Changes* - Unanticipated changes in factors such as judicial decisions, legislative actions, claim consciousness, claim management, claim settlement practices, and economic conditions may significantly alter the conclusions.

*Best Estimate* - These caveats and limitations notwithstanding, the conclusions represent our best estimate of the actuarial status and funding requirements of the program as of the date of this report.

#### 4. Terms used in Study

**IBNR.** IBNR stands for claims Incurred But Not Reported. This is the estimated additional amount needed to close all claims currently reported to the fund.

**Loss.** The use of the term loss without modification includes loss and legal costs but does not include unallocated loss adjustment expense (ULAE).

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

**ULAE.** Unallocated Loss Adjustment Expenses. These are claims settlement expenses. There is no provision in the IBNR for claims settlement provisions. However, the cash flow projections include a provision for these.

**Case Reserves.** These are loss reserves set for individual claims by the adjuster.

**Indicated Loss Reserve.** This is IBNR + Case Reserves. This is the estimated total amount to close all claims at June 30, 2007.

**Cash Flow Projection.** This is the projected increase or decrease in cash flow during a calendar year. It is the difference between the projected revenue and the projected losses and expenses.

### 5. Background Information (This has been provided by the Missouri Petroleum Tank Insurance Fund)

The Petroleum Storage Tank Insurance Fund was established by the Missouri Legislature in 1989, (at the time, it was called the “Underground Storage Tank Insurance Fund”). It was originally housed in the Office of Administration. In 1991, the Missouri General Assembly substantially amended the law governing the Petroleum Storage Tank Insurance Fund. A new revenue mechanism - the “transport load fee” - was established, and responsibility for managing and operating the Petroleum Storage Tank Insurance Fund was transferred to the Department of Natural Resources. Petroleum distributors, licensed by the Department of Revenue, paid the transport load fee. It was a “self-reported fee” paid monthly by these distributors and collected by the Department of Revenue for deposit into the Petroleum Storage Tank Insurance Fund. Collection of the fee began on October 1, 1991.

In 1992, after receiving a report and recommendations from Milliman & Robertson, Inc., the Department of Natural Resources engaged an outside contractor to provide third-party administration services (currently Williams and Company) and began operation of the Petroleum Storage Tank Insurance Fund.

In 1992, the Petroleum Storage Tank Insurance Fund had a single purpose: to insure owners and operators of underground storage tanks which contained petroleum for risks associated with cleanup of spills and leaks, and third-party damages which might result from such spills or leaks.

The first insurance policies were issued by the Department of Natural Resources third-party administrator in May 1992. “Participation fees” were collected and deposited into the Petroleum Storage Tank Insurance Fund by the third party administrator.

The first claims were filed later in 1992, and the first claim payment was made in June 1993.

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

In 1993, the Petroleum Storage Tank Insurance Fund cash balance passed \$20 million, triggering cessation of collection of the transport load fee on September 30, 1993.

In 1995, the Legislature expanded the purposes of the Petroleum Storage Tank Insurance Fund by enacting legislation which authorized the Petroleum Storage Tank Insurance Fund to pay, in certain circumstances, the costs of cleaning up contamination which had occurred when underground tanks containing petroleum leaked in past years. This legislation was called House Bill 251 (HB251). In particular, this bill authorized payment of cleanup costs for properties where:

- Underground storage tanks containing petroleum had been operated in the past, but were taken out of use before August 28, 1995; and
- The existence of such property was reported to or documented by the Department of Natural Resources by August 28, 1995; or
- A leak or spill had occurred in the past from an underground storage tank; and
- The owner or operator of that tank - if it was still in use - applied for an insurance policy from Petroleum Storage Tank Insurance Fund by August 28, 1995, and was ultimately insured.

This legislation triggered the receipt, in August 1995, of over 700 additional applications for insurance coverage on sites where there were underground storage tanks in use. In addition, it triggered thousands of communications to the Department of Natural Resources about tank sites, some of which were already known to the Department of Natural Resources.

Overnight, the known liabilities of the Petroleum Storage Tank Insurance Fund grew from liability for about 300 claims made by insured storage tank sites to liability for about 1,100 claims, most of which were for old releases that occurred before the Petroleum Storage Tank Insurance Fund was established. In addition, the Petroleum Storage Tank Insurance Fund became liable for future claims at an unknown number of “out-of-use tank sites” which were “known” to the Department of Natural Resources by August 28, 1995. Because of the increased liabilities, collection of the transport load fee began again on April 1, 1996 and has continued uninterrupted since. The transport load fee was increased from \$25 to \$40 per 8,000-gallon transport load of petroleum on January 1, 2002.

In 1996, the state legislature again amended the law, and “reopened the window of opportunity” for persons to obtain Petroleum Storage Tank Insurance Fund benefits. The August 28, 1995 deadline established by HB251 was extended to December 31, 1997. Again, owners/operators of tank sites with known, pre-existing leaks or spills, who were still doing a cleanup, who applied for insurance coverage from Petroleum Storage Tank Insurance Fund and were ultimately insured, could get benefits for their ongoing costs of cleanup. Also, owners of properties with “out-of-use tanks” could report those properties

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

to the Department of Natural Resources and in so doing, make the property eligible to receive benefits from Petroleum Storage Tank Insurance Fund, if a cleanup was required some time in the future.

The 1996 legislation further expanded the Petroleum Storage Tank Insurance Fund by extending the same two purposes for certain aboveground storage tanks (ASTs). AST owners whose tanks were in service could now apply for and receive insurance coverage, and sites where ASTs were out of use by December 31, 1997 could receive benefits for cleanup, if the site was reported to the Department of Natural Resources by that date.

The 1996 legislation, known as Senate Bill 708 (SB708), also established a board of trustees to manage the Petroleum Storage Tank Insurance Fund, effectively moving administration and responsibilities from the Department of Natural Resources to the board of trustees. The board of trustees took over management of the third party administrator contract, employed an Executive Director, and has managed the Petroleum Storage Tank Insurance Fund since.

Prior actuarial studies on this book include:

- A review of the Petroleum Storage Tank Insurance Fund operations and an actuarial study was performed by Milliman & Robertson in 1996.
- An actuarial study performed by Matthews Actuarial LLC in 2003.
- An actuarial study performed by Pinnacle Actuarial in 2005.

In 2001, the state legislature again amended the law, extending the “sunset date” of the program to December 31, 2010. The legislation (HB453) also gave the Petroleum Storage Tank Insurance Fund board of trustees the authority to raise the transport load fee to a maximum of \$60.00, with no annual increase in excess of \$15.00.

Today, the Petroleum Storage Tank Insurance Fund insures 7,395 underground storage tanks at 2,663 sites. It also insures 2,109 aboveground storage tanks at 515 sites.

Claims filed by persons who are or were insured at the time the contamination was discovered are called “insurance claims”. Many of the insurance claims involve cleanup of historical contamination released into the environment during a lengthy period of operation of the storage tanks, including operation prior to implementation of today’s environmental standards.

The insurance protection provided by the Petroleum Storage Tank Insurance Fund to active tank owners includes coverage for up to \$1 million per occurrence, \$2 million annual aggregate, for costs of cleanup, third-party property damage, and third-party bodily injury. There is a deductible of \$10,000 per occurrence.

Claims filed to clean up a “pre-existing” leak/spill at an insured site, or an “out-of-use” tank site, are called “remedial claims.”

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

For “remedial claims,” the Petroleum Storage Tank Insurance Fund pays up to \$1 million for cleanup costs per site; there is no coverage for third-party property damage or third-party bodily injury. The person doing the cleanup must pay the first \$10,000 of cleanup costs.

A claim reserve is established for each instance where a release is confirmed and the site is eligible to receive benefits from the Petroleum Storage Tank Insurance Fund. The claim reserves are adjusted on an ongoing basis as more information about the site, the extent of contamination, and the planned cleanup is available. No claim reserve for future claims is currently maintained.

A balance sheet and income statement are prepared monthly, using information provided by the State Accounting System and data maintained by the Petroleum Storage Tank Insurance Fund board of trustees’ third party administrator under the provisions of its contract.

In 1998, the Legislature significantly changed the way various fees and taxes on petroleum are collected. As part of House Bill 619, the point of payment of the Petroleum Storage Tank Insurance Fund transport load fee was transferred from the petroleum distributor to the petroleum supplier, resulting in fewer payers.

All claim files of the Petroleum Storage Tank Insurance Fund are maintained at offices located in Jefferson City, MO.

The board of trustees’ third-party administrator provides services in the following four areas:

- Underwriting, including the receipt and review of initial insurance applications and annual insurance renewal applications. This process includes a compliance review of the facility’s operating records, including review of leak detection records, maintenance documents, logs of cathodic protection system readings, etc.
- Inspections, including physical review of a minimum of 10% of the properties insured by the Petroleum Storage Tank Insurance Fund annually.
- Claims management, including the receipt of notices of claims, claims investigation and adjusting services, eligibility determinations, receipt and review of cost estimates from owners and/or their consultants for characterizing and cleaning up contamination, review of invoices, and preparation of payment recommendations.
- Record-keeping and other administrative services, including design and maintenance of software for maintaining official records of the Petroleum Storage Tank Insurance Fund, maintenance of the Petroleum Storage Tank Insurance Fund web site, receipt of and response to public inquiries, technical assistance to

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

tank owners, and other support services for the Executive Director and the board of trustees.

The Attorney General's Office (AGO) annually receives approval from the board of trustees for an appropriation from the Petroleum Storage Tank Insurance Fund to support one-half an FTE. This person provides legal advice and counsel to the board of trustees and the Executive Director.

The board of trustees has also engaged outside counsel to defend insured tank owners/operators when a third-party claimant files litigation against the tank owner/operator.

The Department of Revenue annually receives approval from the board of trustees for an appropriation from the Petroleum Storage Tank Insurance Fund to pay for its services collecting the transport load fee.

The Department of Natural Resources annually receives approval from the board of trustees for an appropriation from the Petroleum Storage Tank Insurance Fund to support its regulatory activities. This is an ongoing administrative expense.

In May 2002, the PSTIF began offering an extended reporting period to AST owners/operators who sold their tanks or took them out of service. In May 2004, the PSTIF began offering this same option to underground storage tank owners. Owners may purchase the extended reporting period annually for a period of up to five (5) years after their tanks are sold or closed. Of the 913 PSTIF participants to whom this offer has been made, 449 purchased the extended reporting period for at least one (1) year. Currently there are 319 such endorsements in effect.

Experience indicates that the majority of covered leaks relate to fittings and joints on pipes. It is less frequent that situated tanks themselves experience failure. In some instances coverage has been expanded for leaks at a gas pump, even when there is no damage to the tank or fittings.

Today, the Petroleum Storage Tank Insurance Fund insures 7,395 underground storage tanks at 2,663 sites. It also insures 2,109 aboveground storage tanks at 515 sites.

### 6. Impact of "Risk Based Guidance" on Actuarial Results

The Department of Natural Resources issued risk-based guidance standards in February 2004. These standards replace the previous standards under which claims were settled and "no further action" letters issued. The purpose of the standards was to replace a rigid system of environmental standards to a more flexible system which reflected the risk that specific contaminants posed for a given site.

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

At the time the standards were implemented, about 1,500 claims were in the process of settlement. Some of these claims were settled under the old standard but the majority were settled under the new “risk based” standard.

While it is difficult to say what the impact of the new standards will be, it might be expected that claim settlement costs could be lower under the new standards since environmentally unnecessary work will not be necessary. Also, there is some concern that claim settlement rates might decrease as claims remain open for longer periods as analysis is taken to determine the amount of remediation necessary for the site.

Even though the risk-based guidance has now been in effect for 3 1/2 years, it is still difficult to accurately gauge the impact of the standards on the overall costs of the system. There is little evidence that reserve adequacy or claim closure rates have changed dramatically under the new system. However credibility issues prevent an accurate measurement of the new standards.

### 7. Actuarial Methodology

#### *Data*

Loss data was developed from a transactional pull from Williams and Company claims systems. Loss data was from inception until June 30, 2007. Data was analyzed on a fiscal year basis. Revenue was generated from reports provided by the MPSTIF. These exhibits showed the transport fees, initial tank fees, and policy premiums.

During the analysis of data, data was segregated into the type of policy (Insurance/Remedial) and the type tank (AST/UST). In addition, it was discovered that development patterns for insured UST tanks differed by the cause of loss. For the purposes of this report UST Insurance claims were divided into 3 separate subcategories: Closure, Release, and Sale/Other. Claims which were the result of a “Sale” appear to develop much slower than other types of claims.

Claim type was not credible for AST claims, and it not available for any remedial claims. Therefore, there are no breakouts for these types of claims.

Summarizing the above classifications, data was analyzed for the following 6 categories:

1. Insurance UST claims – Closure
2. Insurance UST claims – Sale/Other
3. Insurance UST claims – Release
4. Insurance AST claims
5. Remedial UST claims
6. Remedial AST claims

The data was organized on a “report year” or “claims made” basis. The reason for this is that there is not usually credible data on when a leak takes place.

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

### *Projection Methods*

Each of these categories was analyzed for past patterns of loss development. Because of the volatility of these claims, loss development was often not consistent. Loss development was not credible for the later periods, and significant judgment was utilized in selecting loss development for later periods, especially for paid losses.

These losses are developed in Exhibit III. All 6 categories utilized the first two methods, while only the insurance claims were appropriate for the Bornhuetter-Ferguson method.

*“Reported Loss Development”* – Paid losses and case reserves (reported losses) are grouped by age and projected to ultimate

*“Paid Loss Development”* – Paid losses are grouped by age and projected to ultimate

*“Reported Bornhuetter-Ferguson Method”* - This method applies reported loss development to the “expected losses” for a given year.

In this case, expected losses were derived from the participation fees for UST and AST insurance. In these cases, the ratio of claims to the fees will not be meaningful except in establishing a baseline ratio for expected claims.

*“Paid Bornhuetter-Ferguson Method”* - This method applies paid loss development to the “expected losses” for a given year.

*“Frequency/Severity Method”* – This method combines ultimate frequency and severity together. This method was used to project report year losses from 2008 – 2017. It does not yield different results than the reported method since there is no development on claims.

Ultimate losses were judgmentally selected from an average of these methods. In general, paid loss methods were not weighted heavily for the most recent years due to the instability of this method with recent data.

In general, there appeared to be very little development on reported losses after 5 years. Paid losses, however, appear to continue to develop even on years prior to the year 2000. This typically results in the paid loss estimate being higher than the reported loss estimate.

### *Current Case Reserving*

Consistent case reserving is critical for actuarial projections.

- Due to the lowering of development factors in recent years, it appears that case reserving is much more accurate for recent years.

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

- Case reserves at the end of a fiscal year are estimated to be 42% and 72% of ultimate settlement levels depending on the type of claim.
- Development on case reserves would be considered normal or low by industry standards.
- Claim severities, while volatile given the nature of the data, appear to be stable over time. Therefore, there does not appear to be any reason to change baseline reserving practices.
- It is not recommended that any major changes occur to case reserving methodology unless external circumstances dictate. This is due to the adequacy of current reserving, as well as the impact that reserving changes would have on future actuarial analysis.

### *Projected Ultimate Liabilities as of June 30, 2007*

As noted above, this report makes an actuarial estimate of liabilities at June 30, 2007 of 111,175K for the Fund. This includes 71,266K of case reserves and 39,909K of IBNR.

### *Projected Fiscal Year Results*

Balance sheet and income statements were projected for two scenarios through 2017. It was decided to only project losses through 2017 since projections beyond this date are highly subjective.

First, the projections assumed that the fund would sunset as of December 31, 2010. All projections for fiscal year 2011 are estimated at 50% of the level of the fully funded level. No new claims would be accepted after this date. Second, the projection assumed that the current funding level would continue through 2017. In addition, the fund would continue to accept claims in the same manner that it does today.

In general, the Williams and Company projections were used as a basis for these projections for the revenue and expense items. However some minor changes were made to the Williams and Company numbers. These changes include:

- Expenses after the sunset date are estimated at the ratio of the paid claims from the sunset scenario to the fully funded scenario. In this way, it would be assumed that the expenses of the fund would reflect the amount of payments from the fund.
- Interest income is calculated on the average of the prior and current year-end fund balances
- The interest income was selected at 4% due to recent investment experience.,

Losses were derived from the ultimate loss selections as well as the frequency and severity of new claims in the years 2008 through 2017. These claims are paid out according to the selected payout pattern that is based on historical data.

## 8. Issues specific to this RFP

### **Reinsurance**

A brief evaluation of reinsurance has been requested as part of this RFP.

Reinsurance has many functions. Some of them in main functions of reinsurance are:

- Risk transfer -- reinsurance is a tool to transfer large risks from the insurer or fund to the reinsurer.
- Income smoothing -- Reinsurance can be used to absorb large losses and normalize income for the fund.
- Surplus relief -- For insurance companies without adequate capital, reinsurance is often used as a tool to underwrite more risk than their capital structure would permit.
- Arbitrage -- If the rates for the reinsurer are below the rates available in the market, then an insurance company or fund might choose to reinsure the risks in order to guarantee a certain margin

For the purposes of the Missouri PSTIF, only risk transfer would be an applicable reason to purchase reinsurance. Income smoothing and surplus relief are not necessary for a governmental fund. Arbitrage would likely not exist for this type of risk.

Reinsurance is typically purchased either directly from the reinsurer or through a network of reinsurance brokers. Reinsurance can be underwritten in a wide variety of forms. For example, a reinsurance contract might indemnify the fund for a claim amount above a certain level, such as \$500,000. A reinsurance contract could potentially be structured such that the payments from the fund in a specific layer would be covered, such as annual payments between \$25 million and \$50 million might be covered.

Preliminary inquiries indicate that reinsurance might be available for this fund; however, additional analysis would need to be undertaken to determine the terms and conditions that the market would offer.

### **Large Claims (above \$250,000)**

Information concerning large claims is included in Exhibit VI.

While large claims represent a substantial portion of the payments from this fund (similar to many insurance ventures), it is difficult to segregate and analyze these claims in a meaningful way.

This is because most large claims began as small claims and develop to larger claims over time. We've included some statistics as to the amount of large claims and the historical amount of large claims by report year. Not surprisingly the percentage of large

claims increases for older report years. Approximately 50% of all claim payments are expected to be for designated large claims once all the claims close.

### **Extending reporting provisions**

Extended reporting provisions represent a small exposure base for the fund, with approximately 320 in force. There is no discount offered for the extended reporting provision, the endorsement is offered at the same rate as the existing business.

The data does not indicate whether the endorsement has a claim associated with it, and the data would likely not be credible if there was data associated with it. For equity purposes, it would seem fair to offer some sort of judgmental discount for ERPs where there is an associated policy by the new owner.

## **9. Simulations**

Actuarial modeling is a catchall phrase that usually means any type of activity where you use a large volume of historic data to create a representation of a business situation so you can analyze it. Your representation, or model, can be used to examine the situation, and help you understand what the future might bring.

Our analysis builds a model using a technique called "stochastic simulation" (also known as "Monte Carlo Simulation") to combine all the uncertainties in the model. Unlike traditional models, this technique does not force us reduce what we know about an uncertain future event (e.g. inflation, interment sales, etc.) to a single number. Instead, we include all we know about the variable, including its full range of possible values and some measure of likelihood of occurrence for each possible value. We use all this information to analyze every possible outcome. This model simulates 100 year-end balance sheets.

We apply this model to several "input scenarios" and catalog the results of the model. The details of each input scenario are described in *Input Scenarios Used* later in this Section.

Each application of the model is run 3,000 times; it's as if we ran 3,000 "what-if" scenarios all at once. In effect, it's as if you could "live" through your situation over and over again, each time under a different set of conditions, with a different set of results occurring. All this added information sounds like it might complicate your decisions, but in fact, one of simulation's greatest strengths is its power of communication. Our analysis gives you results that graphically illustrate the risks you face. This graphical presentation is easily understood by you, and easily explained to others.

There are some limitations however to an analysis such as this. While we can model the statistical uncertainty in our calculations we are unable to model all the variance associated with the future finances of the fund. This is due to the potential for an external

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event, such as an inflationary shock or a judicial decision, but does not exist in our historical database. Therefore the actual ranges of results for the fund are likely more variable than this analysis suggests. Nevertheless this remains a good tool for planning.

### Description of Actuarial Model

The actuarial model shown in the exhibits included with this report is considered the most likely, “average” outcome. Our model calculated fund balances under 3,000 different claim payment scenarios, each scenario being equally likely as the prior. The results from each individual scenario are not shown, but rather summarized in the simulation graphs and tables in this report.

The most uncertain component affecting our projections of future MPSTIF fund balances are our projections of ultimate claim payments for each individual report year, and the dollar amount of claim payment occurring in each specific calendar year. These are the values we simulated. The process of using simulations to understand the range of likely outcomes is called a stochastic analysis.

Specifically, the payment in each calendar year between 2008 and 2017 emanating from report years 1994 to 2017 were separately simulated for the six types of claims in the study.

Based on the simulated claim payments in each scenario, the year-end fund balances for 2008 to 2017 were recorded. We then re-simulated claim payments for our next scenario, and again recorded, the year-end fund balances for 2008 to 2017. This process was repeated 3,000 times.

### *Technical Description of Simulation Distributions*

In order to simulate the claim payments, a statistical distribution must be chosen in order to reasonably reflect the range of possible results. For the purposes of this study, we chose the lognormal distribution as the distribution type for the claim payments.

- For each simulated payment amount we used a separate gamma distribution with separate parameters. The gamma distribution is widely accepted as a representative distribution of financial information.
- For future frequency of claims we used a Poisson distribution.
- For the future severity of claims we used a lognormal distribution.
- For the investment income rates and trends to severity and frequency, we used a triangular distribution.

## 1. DISCUSSION OF RESULTS

We produced 8 histograms and one distribution summary graph for each projection.

## Loss Projections for Missouri Petroleum Storage Tank Insurance Fund

Our simulations show that the range of possible outcomes increase the further into the future we perform projections of fund balances. .

### **Projection “A” – Fund Sunsets on December 31, 2010**

- The fund balance on the sunset date is expected to be about 105 million. In 2017, there is an 80% chance that the fund balance will be between \$12.8 million and \$39.0 million.
- We would expect the fund to remain solvent even with no further funding through 2017.
- There is a reasonable probability (25%) that the fund could be solvent at sunset with no additional state funding.

### **Projection “B” – Fund Reauthorized at Lower Funding Level**

- We would expect that the fund balance would continue to grow as the rate of new claims is significantly below current funding levels.
- We would expect that the assets of the fund would become greater than the liabilities in FY 2016.

## **GLOSSARY OF TECHNICAL TERMS**

Histogram – A histogram is made from several rectangles plotted on the graph. The left and right position of each rectangle represents a range of possible results (e.g. a rectangle that spreads from \$10 million to \$20 million represents all scenarios that had an output between \$10 million and \$20 million). The height of each rectangle represents the percentage of scenarios with that result. The higher the rectangle, the more likely the result will occur.

Monte Carlo Simulation -- A mathematical simulation of future results where unknown values are selected randomly based on their probability distribution and correlation. Typically, hundreds, or even thousands of simulations are produced through computer analysis. A professional must then compile and analyze the results in order to determine reasonable conclusions. A series of Monte Carlo simulations can provide conclusions such as "There is a 5% chance that revenues will be less than \$500,000", or "If the product launch in Denver is successful, there is still a 2% chance that revenues will be less than \$500,000."

Statistical Distribution -- A mathematical formula indicating the likelihood of a random number taking on a specific value.

Stochastic Analysis -- A type of statistical analysis that relies on the use of statistical distributions of unknown variables rather than "best estimates" of those unknown variables. A stochastic analysis usually relies on Monte Carlo simulations.

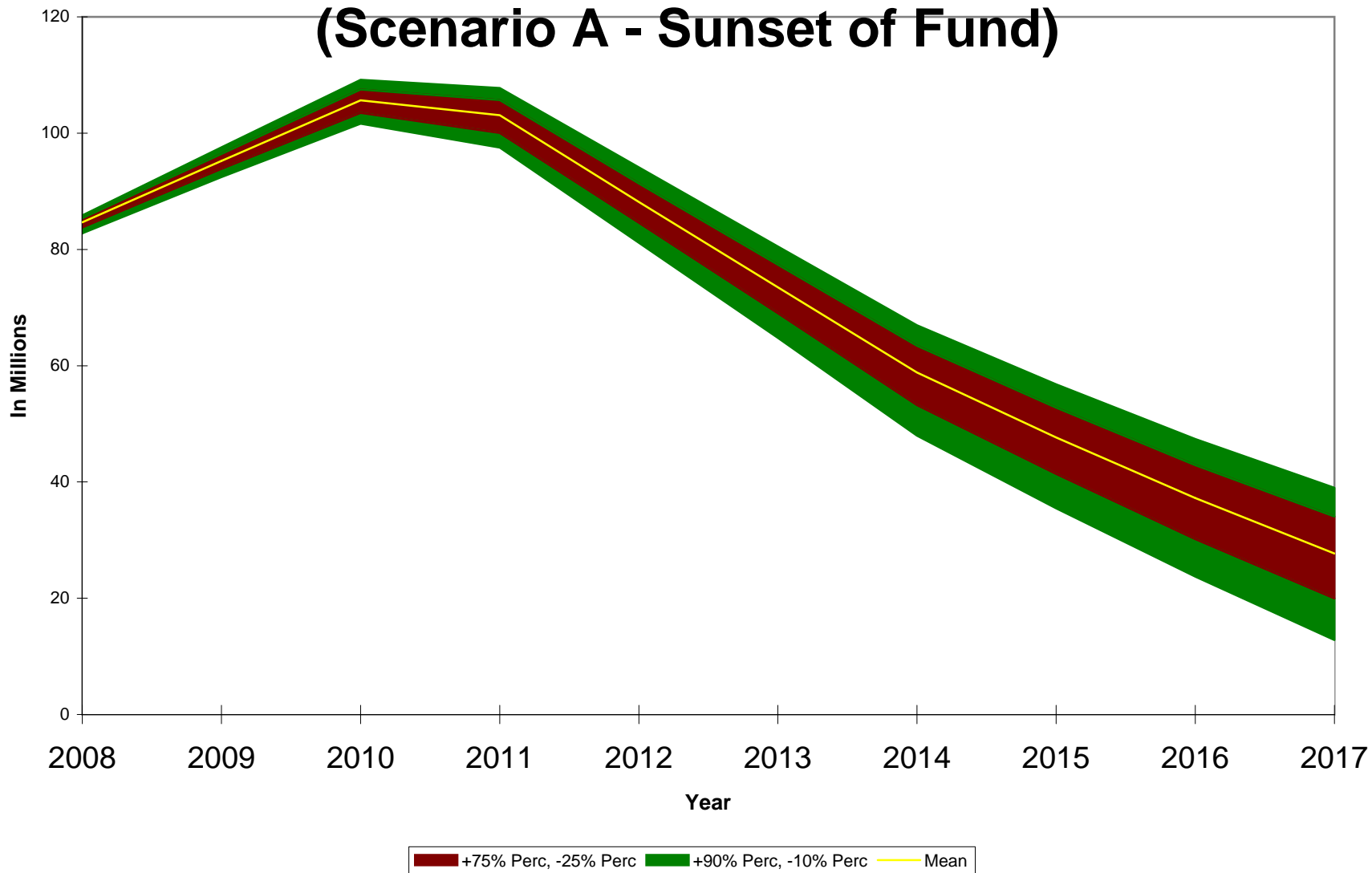
**MISSOURI PETROLEUM STORAGE TANK INSURANCE FUND  
FISCAL YEAR PROJECTIONS  
PROJECTION (Incorporating Sunset Provision of Law)**

	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
<b>Annual Revenues</b>										
Transport Load Fees	\$24,000,000	\$24,000,000	\$24,000,000	\$12,000,000	\$0	\$0	\$0	\$0	\$0	\$0
\$100 Initial tank fees	\$30,000	\$30,000	\$30,000	\$15,000	\$0	\$0	\$0	\$0	\$0	\$0
UST Participation Fees	\$1,042,500	\$1,042,500	\$1,042,500	\$521,250	\$0	\$0	\$0	\$0	\$0	\$0
AST Participation Fees	\$157,500	\$157,500	\$157,500	\$78,750	\$0	\$0	\$0	\$0	\$0	\$0
Interest Income	\$3,250,000	\$3,590,022	\$4,010,139	\$4,164,225	\$3,811,512	\$3,215,861	\$2,621,730	\$2,098,591	\$1,662,226	\$1,260,441
<b>Total Revenues</b>	<b>\$28,480,000</b>	<b>\$28,820,022</b>	<b>\$29,240,139</b>	<b>\$16,779,225</b>	<b>\$3,811,512</b>	<b>\$3,215,861</b>	<b>\$2,621,730</b>	<b>\$2,098,591</b>	<b>\$1,662,226</b>	<b>\$1,260,441</b>
<b>Annual Expenditures</b>										
<b>Administrative Expenses:</b>										
Third Party Administrative Expenses	\$3,048,405	\$3,109,373	\$3,171,561	\$3,234,992	\$2,984,014	\$2,816,938	\$2,714,521	\$2,410,090	\$2,217,952	\$2,010,757
Section 319.107 Expenses	\$25,000	\$25,750	\$26,523	\$27,318	\$25,446	\$24,257	\$23,604	\$21,162	\$20,059	\$18,731
Inspections	\$340,000	\$350,200	\$360,706	\$371,527	\$346,063	\$329,890	\$321,012	\$287,805	\$272,807	\$254,742
Training & Loss Prevention Services	\$25,000	\$25,750	\$26,523	\$27,318	\$25,446	\$24,257	\$23,604	\$21,162	\$20,059	\$18,731
Other Professional Expenses	\$160,000	\$164,800	\$169,744	\$174,836	\$162,853	\$155,242	\$151,065	\$135,438	\$128,380	\$119,878
Legal Expenses	\$45,000	\$46,350	\$47,741	\$49,173	\$45,802	\$43,662	\$42,487	\$38,092	\$36,107	\$33,716
Department of Revenue	\$37,000	\$38,110	\$39,253	\$40,431	\$37,660	\$35,900	\$34,934	\$31,320	\$29,688	\$27,722
Attorney General's Office	\$34,000	\$35,020	\$36,071	\$37,153	\$34,606	\$32,989	\$32,101	\$28,781	\$27,281	\$25,474
PSTIF Board/Staff	\$225,300	\$232,059	\$239,021	\$246,191	\$229,318	\$218,600	\$212,718	\$190,713	\$180,775	\$168,804
Department of Natural Resources	\$1,111,885	\$1,145,242	\$1,179,599	\$1,214,987	\$1,131,713	\$1,078,822	\$1,049,791	\$941,195	\$892,146	\$833,068
<b>Total Administrative Expenses</b>	<b>\$5,051,590</b>	<b>\$5,172,654</b>	<b>\$5,296,740</b>	<b>\$5,423,926</b>	<b>\$5,022,921</b>	<b>\$4,760,557</b>	<b>\$4,605,836</b>	<b>\$4,105,758</b>	<b>\$3,825,252</b>	<b>\$3,511,623</b>
<b>State Government Expenses:</b>	<b>\$131,575</b>	<b>\$135,522</b>	<b>\$139,588</b>	<b>\$143,776</b>	<b>\$148,089</b>	<b>\$152,531</b>	<b>\$157,107</b>	<b>\$161,821</b>	<b>\$166,675</b>	<b>\$171,676</b>
<b>Claim Payments:</b>										
UST Insurance Closure Claims	\$2,632,964	\$2,730,376	\$2,783,782	\$2,853,865	\$2,625,963	\$2,365,345	\$2,198,730	\$2,009,662	\$1,772,281	\$1,584,438
UST Insurance Release Claims	\$546,466	\$576,019	\$601,876	\$629,020	\$661,185	\$661,952	\$648,317	\$588,347	\$489,466	\$395,533
UST Insurance Sale/Other Claims	\$1,909,624	\$2,187,023	\$2,325,851	\$2,442,062	\$2,547,294	\$2,310,816	\$2,235,251	\$2,160,233	\$2,052,814	\$2,036,603
UST Remedial Claims	\$3,595,007	\$5,138,349	\$5,378,277	\$5,790,459	\$6,000,596	\$6,338,439	\$6,378,583	\$3,224,471	\$2,805,175	\$2,096,948
AST Insurance Claims	\$1,621,589	\$1,699,373	\$1,772,581	\$1,706,925	\$1,351,990	\$1,068,036	\$899,175	\$766,155	\$735,115	\$674,513
AST Remedial Claims	\$573,251	\$561,768	\$554,517	\$471,836	\$406,471	\$387,719	\$375,735	\$362,105	\$353,760	\$340,021
<b>Total Claim Payments</b>	<b>\$10,878,902</b>	<b>\$12,892,909</b>	<b>\$13,416,883</b>	<b>\$13,894,167</b>	<b>\$13,593,498</b>	<b>\$13,132,306</b>	<b>\$12,735,791</b>	<b>\$9,110,974</b>	<b>\$8,208,611</b>	<b>\$7,128,056</b>
<b>Total Expenditures</b>	<b>\$16,062,067</b>	<b>\$18,201,085</b>	<b>\$18,853,210</b>	<b>\$19,461,869</b>	<b>\$18,764,508</b>	<b>\$18,045,394</b>	<b>\$17,498,735</b>	<b>\$13,378,552</b>	<b>\$12,200,538</b>	<b>\$10,811,355</b>
<b>Excess Revenue (Expenditures)</b>	<b>\$12,417,933</b>	<b>\$10,618,937</b>	<b>\$10,386,929</b>	<b>(\$2,682,644)</b>	<b>(\$14,952,996)</b>	<b>(\$14,829,533)</b>	<b>(\$14,877,004)</b>	<b>(\$11,279,961)</b>	<b>(\$10,538,313)</b>	<b>(\$9,550,914)</b>
Cash balance @ 7-1-2007	\$72,023,139									
<b>Funds Available at Year End</b>	<b>\$84,441,072</b>	<b>\$95,060,008</b>	<b>\$105,446,937</b>	<b>\$102,764,293</b>	<b>\$87,811,297</b>	<b>\$72,981,764</b>	<b>\$58,104,760</b>	<b>\$46,824,798</b>	<b>\$36,286,486</b>	<b>\$26,735,572</b>
<b>Loss Reserve @ Year-End</b>	<b>110,383,263</b>	<b>108,430,323</b>	<b>106,008,109</b>	<b>97,638,763</b>	<b>84,045,265</b>	<b>70,912,959</b>	<b>58,177,168</b>	<b>49,066,194</b>	<b>40,857,583</b>	<b>33,729,527</b>
<b>Equity at Year-End</b>	<b>(25,942,192)</b>	<b>(13,370,315)</b>	<b>(561,172)</b>	<b>5,125,530</b>	<b>3,766,032</b>	<b>2,068,805</b>	<b>(72,408)</b>	<b>(2,241,396)</b>	<b>(4,571,097)</b>	<b>(6,993,955)</b>

**MISSOURI PETROLEUM STORAGE TANK INSURANCE FUND**  
**FISCAL YEAR PROJECTIONS**  
**PROJECTION (Assuming Transport Fee is Reduced from \$40 to \$25 load on January 1, 2009)**

	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
<b>Annual Revenues</b>										
Transport Load Fees	\$24,000,000	\$19,500,000	\$15,000,000	\$15,000,000	\$15,000,000	\$15,000,000	\$15,000,000	\$15,000,000	\$15,000,000	\$15,000,000
\$100 Initial tank fees	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
UST Participation Fees	\$1,042,500	\$1,042,500	\$1,042,500	\$1,042,500	\$1,042,500	\$1,042,500	\$1,042,500	\$1,042,500	\$1,042,500	\$1,042,500
AST Participation Fees	\$157,500	\$157,500	\$157,500	\$157,500	\$157,500	\$157,500	\$157,500	\$157,500	\$157,500	\$157,500
Interest Income	\$3,250,000	\$3,498,185	\$3,639,044	\$3,660,715	\$3,644,889	\$3,593,560	\$3,512,487	\$3,472,316	\$3,490,163	\$3,522,297
<b>Total Revenues</b>	<b>\$28,480,000</b>	<b>\$24,228,185</b>	<b>\$19,869,044</b>	<b>\$19,890,715</b>	<b>\$19,874,889</b>	<b>\$19,823,560</b>	<b>\$19,742,487</b>	<b>\$19,702,316</b>	<b>\$19,720,163</b>	<b>\$19,752,297</b>
<b>Annual Expenditures</b>										
<b>Administrative Expenses:</b>										
Third Party Administrative Expenses	\$3,048,405	\$3,109,373	\$3,171,561	\$3,234,992	\$3,299,692	\$3,365,685	\$3,432,999	\$3,501,659	\$3,501,659	\$3,501,659
Section 319.107 Expenses	\$25,000	\$25,750	\$26,523	\$27,318	\$28,138	\$28,982	\$29,851	\$30,747	\$31,669	\$32,619
Inspections	\$340,000	\$350,200	\$360,706	\$371,527	\$382,673	\$394,153	\$405,978	\$418,157	\$430,702	\$443,623
Training & Loss Prevention Services	\$25,000	\$25,750	\$26,523	\$27,318	\$28,138	\$28,982	\$29,851	\$30,747	\$31,669	\$32,619
Other Professional Expenses	\$160,000	\$164,800	\$169,744	\$174,836	\$180,081	\$185,484	\$191,048	\$196,780	\$202,683	\$208,764
Legal Expenses	\$45,000	\$46,350	\$47,741	\$49,173	\$50,648	\$52,167	\$53,732	\$55,344	\$57,005	\$58,715
Department of Revenue	\$37,000	\$38,110	\$39,253	\$40,431	\$41,644	\$42,893	\$44,180	\$45,505	\$46,870	\$48,277
Attorney General's Office	\$34,000	\$35,020	\$36,071	\$37,153	\$38,267	\$39,415	\$40,598	\$41,816	\$43,070	\$44,362
PSTIF Board/Staff	\$225,300	\$232,059	\$239,021	\$246,191	\$253,577	\$261,184	\$269,020	\$277,091	\$285,403	\$293,965
Department of Natural Resources	\$1,111,885	\$1,145,242	\$1,179,599	\$1,214,987	\$1,251,436	\$1,288,979	\$1,327,649	\$1,367,478	\$1,408,503	\$1,450,758
<b>Total Administrative Expenses</b>	<b>\$5,051,590</b>	<b>\$5,172,654</b>	<b>\$5,296,740</b>	<b>\$5,423,926</b>	<b>\$5,554,294</b>	<b>\$5,687,926</b>	<b>\$5,824,907</b>	<b>\$5,965,324</b>	<b>\$6,039,234</b>	<b>\$6,115,361</b>
<b>State Government Expenses:</b>	<b>\$131,575</b>	<b>\$135,522</b>	<b>\$139,588</b>	<b>\$143,776</b>	<b>\$148,089</b>	<b>\$152,531</b>	<b>\$157,107</b>	<b>\$161,821</b>	<b>\$166,675</b>	<b>\$171,676</b>
<b>Claim Payments:</b>										
UST Insurance Closure Claims	\$2,632,964	\$2,730,376	\$2,783,782	\$2,988,047	\$3,159,994	\$3,310,987	\$3,397,199	\$3,446,304	\$3,415,352	\$3,392,533
UST Insurance Release Claims	\$546,466	\$576,019	\$601,876	\$638,219	\$703,985	\$751,856	\$775,836	\$754,390	\$707,443	\$658,254
UST Insurance Sale/Other Claims	\$1,909,624	\$2,187,023	\$2,325,851	\$2,470,391	\$2,715,916	\$2,662,710	\$2,735,613	\$2,807,446	\$2,860,020	\$3,004,870
UST Remedial Claims	\$3,595,007	\$5,138,349	\$5,378,277	\$5,805,247	\$6,080,208	\$6,518,301	\$6,661,785	\$3,623,682	\$3,315,952	\$2,697,786
AST Insurance Claims	\$1,621,589	\$1,699,373	\$1,772,581	\$1,873,595	\$1,940,471	\$2,017,012	\$2,105,486	\$2,180,889	\$2,237,793	\$2,242,395
AST Remedial Claims	\$573,251	\$561,768	\$554,517	\$479,780	\$430,975	\$429,649	\$430,775	\$424,773	\$423,037	\$417,406
<b>Total Claim Payments</b>	<b>\$10,878,902</b>	<b>\$12,892,909</b>	<b>\$13,416,883</b>	<b>\$14,255,279</b>	<b>\$15,031,549</b>	<b>\$15,690,515</b>	<b>\$16,106,694</b>	<b>\$13,237,484</b>	<b>\$12,959,596</b>	<b>\$12,413,244</b>
<b>Total Expenditures</b>	<b>\$16,062,067</b>	<b>\$18,201,085</b>	<b>\$18,853,210</b>	<b>\$19,822,980</b>	<b>\$20,733,932</b>	<b>\$21,530,972</b>	<b>\$22,088,708</b>	<b>\$19,364,629</b>	<b>\$19,165,505</b>	<b>\$18,700,281</b>
<b>Excess Revenue (Expenditures)</b>	<b>\$12,417,933</b>	<b>\$6,027,100</b>	<b>\$1,015,833</b>	<b>\$67,735</b>	<b>(\$859,043)</b>	<b>(\$1,707,413)</b>	<b>(\$2,346,221)</b>	<b>\$337,687</b>	<b>\$554,658</b>	<b>\$1,052,016</b>
Cash balance @ 7-1-2007	\$72,023,139									
<b>Funds Available at Year End</b>	<b>\$84,441,072</b>	<b>\$90,468,172</b>	<b>\$91,484,005</b>	<b>\$91,551,740</b>	<b>\$90,692,697</b>	<b>\$88,985,284</b>	<b>\$86,639,063</b>	<b>\$86,976,750</b>	<b>\$87,531,408</b>	<b>\$88,583,424</b>
<b>Loss Reserve @ Year-End</b>	<b>110,383,263</b>	<b>108,430,323</b>	<b>106,008,109</b>	<b>102,802,472</b>	<b>98,875,813</b>	<b>94,345,713</b>	<b>89,455,236</b>	<b>87,490,049</b>	<b>85,859,113</b>	<b>84,831,171</b>
<b>Equity at Year-End</b>	<b>(25,942,192)</b>	<b>(17,962,151)</b>	<b>(14,524,104)</b>	<b>(11,250,732)</b>	<b>(8,183,117)</b>	<b>(5,360,429)</b>	<b>(2,816,173)</b>	<b>(513,299)</b>	<b>1,672,296</b>	<b>3,752,253</b>

# Range of Fund Balances over Time (Scenario A - Sunset of Fund)



### Range of Fund Balances over Time (Scenario B - Reduction of Transport Fee in 2009)

