

Review of Standard Portfolio Analysis of Risk
("SPAN")
Margin System

as Implemented by the

Chicago Mercantile Exchange
Board of Trade Clearing Corporation
and the
Chicago Board of Trade

Commodity Futures Trading Commission
Division of Trading and Markets

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Review of Standard Portfolio Analysis of Risk (“SPAN”) Margin System as Implemented by the Chicago Mercantile Exchange, Board of Trade Clearing Corporation and the Chicago Board of Trade

I. Purpose and Scope of the Review

The U.S. commodity exchanges and numerous foreign commodity exchanges calculate margin requirements using the Standard Portfolio Analysis of Risk (“SPAN”) margin system developed and maintained by the Chicago Mercantile Exchange (“CME”). The purpose of the current review was to obtain further understanding of the workings of SPAN and of the procedures used by the CME, the Board of Trade Clearing Corporation (“BOTCC”), and the Chicago Board of Trade (“CBT”) in setting margin requirements. BOTCC and CBT have the same margin requirements, and both participate in the margin setting process for products traded on CBT.¹

In carrying out this review, staff:

- Interviewed CME, BOTCC, and CBT staff to obtain an overview of their margin setting process.
- Examined the SPAN operator’s manual titled “SPAN User’s Guide” and SPAN-related documentation contained on CME’s Internet web site (<http://www.cme.com/span/span.htm>).
- Reviewed PC-SPAN, the Windows-based software version of SPAN created by CME. PC-SPAN allows users to calculate an individual account’s maintenance and initial performance bond requirement and to view on-line or print the individual components of the margin requirement.

II. Summary of Findings

The Division’s review disclosed that:

- SPAN calculates margin for a portfolio of positions based on margin parameters determined by individual exchanges/clearinghouses. SPAN has no built-in requirements as to the level of these input values. Therefore, identical futures contracts traded on more than one exchange may have different SPAN-calculated margin requirements.

¹ CME, BOTCC, CBT, and the National Futures Association (“NFA”) have adopted a margin-based (sometimes referred to as “risk-based”) capital requirement for their members. Under these rules, the net capital requirement is computed as a percentage of a firm’s total customer and noncustomer (excluding proprietary) risk maintenance margin requirements. The Division of Trading and Markets (“Division”) has recently completed a study of risk-based net capital requirements which will recommend that the Commission adopt a risk-based net capital requirement.

- The maintenance margin level is one of the major input values. One of the main factors that the CME and CBT/BOTCC use in determining those maintenance margin levels is review of contract price movement for periods ranging from one month to, in some cases, as much as ten years. The CME and CBT/BOTCC attempt to set maintenance margin levels that exceed the one-day price change for 95%-99% of the trading days based on statistical analyses of day-to-day price changes over a varied number of trading days. Other factors taken into consideration include implied volatilities on options and liquidity risk.²
- The SPAN-calculated margin requirement is the largest loss a portfolio of futures or option positions is likely to incur from one day to the next at a statistical confidence level ranging from 95%-99%. It does not represent the largest one-day loss possible. Even at a confidence level of 99%, the SPAN-calculated margin would be exceeded two to three times in a year of 250 trading days.
- SPAN also includes a Initial/Maintenance Margin Ratio which increases the initial margin required. The Initial/Maintenance Margin Ratio at CBT/BOTCC is 1.35 for all contracts, while it ranges from 1.25 to 1.50 (depending on the product) at CME.
- The SPAN-calculated margin requirement is not the largest margin requirement that may be imposed. Clearinghouses may impose increased margin requirements where they believe it prudent as part of their risk management programs. For example, CME has recently introduced a “Concentration Margining System” under which certain positions are subject to stress tests and, if the losses exceed specified levels, the member’s margin scan range for those affected products will be increased 25%. Similarly, firms may require customers to post greater margin than implied by the results of SPAN calculations.
- SPAN was developed and is licensed by CME. Changes to the basic SPAN software program are made by the CME. After CME makes certain enhancements, users can elect to use either the enhanced or the prior version.
- PC-SPAN software allows FCMs to determine the margin requirement of the positions of individual traders. Since the product is available to everyone, it also allows individual investors to ascertain the exchange minimum margin

² Implied volatility is a measure of the expected variability of the price of the underlying futures contract. Greater implied volatility of an option contract results in an increased value for the long option, all other items being equal. This translates into higher loss potential for short options, with again, all other option components being equal. Liquidity risk accounts for the fact that, in a thinner market, holders of certain positions may be unable to liquidate those positions in a timely manner.

requirement for their portfolio. The software also allows Commodity Futures Trading Commission ("Commission") staff to determine these requirements, and to verify and to test margin systems used by FCMs.

III. Background

CME developed and implemented the SPAN margin system in 1988. SPAN was the first industry-wide margining system to calculate margins on the basis of the overall risk of the portfolio. Under portfolio margining, exchanges allow margin credit for offsetting positions in related markets. For example, the CME has determined that there is a high correlation in the price fluctuations of the S&P 500 and the NASDAQ 100 futures contracts, and a trader holding offsetting positions in each contract is not subject to as great a market risk as an account not holding risk reducing positions. As a result, the portfolio receives a reduction in margin requirements over what would have been otherwise calculated.

The SPAN margining process begins with each exchange or clearing organization determining the appropriate parameters, such as margin scan ranges and volatility scan ranges, for each underlying futures contract traded on the exchange. An exchange may elect to change its margin requirements as often as daily, or may never change them after they have been initially set if the underlying contract price is stable.

The second step in the SPAN margining process is for the exchange or clearing organization to create a risk array for each futures contract and, by using any of the available option pricing models in SPAN, each option contract. A risk array is a table showing the gain or loss on the contract for each one of a specified set of changes in the underlying price and volatility. These risk arrays are then combined to create a risk parameter file.

The actual margining of an account's portfolio takes place after a firm or service bureau³ receives the risk parameter file from the exchange's Internet web site or through a direct file transmission.

SPAN can be used to calculate margin requirements at the clearinghouse or customer/account level. This review concentrates on the customer or account level.

IV. Step One – Creating a SPAN Risk Parameter File

A. SPAN Input Variables

Each exchange or clearinghouse that uses SPAN has to determine the levels of several variables that SPAN then uses to determine margin requirements. SPAN does not require that any of the variables be set within certain bounds. Each exchange

³ The term "service bureau" refers to a provider of back-office computer services for futures firms.

assesses its risk management goals and objectives when setting the values of the variables. The variables do not have to have a value, and may be set to zero.

There are eight major margin related variables that the exchange may set. The margin interval rate (minimum maintenance margin requirement) and the volatility scan range (options volatility) have the greatest impact on margin calculations. The eight variables are:

1. Margin Interval Rate

The margin interval rate is the minimum maintenance margin requirement for the underlying contract. One of the tools that the CME and CBT/BOTCC use to determine maintenance margin requirements is to review historical price movements of the specific contract for different periods.

The specific procedures used by the CME and CBT/BOTCC to set minimum maintenance margin requirements are detailed in Section IX.

2. Volatility Scan Range

Volatility is a measure of price variability and can be used to calculate a range within which an underlying contract price might reasonably be expected to move in a given time period. The implied volatility of an option is the expected price variability implied by an observed option price, given an option pricing model. The volatility scan range is a range within which the implied volatility might reasonably be expected to move in one day.

In a recent enhancement, the CME and CBT/BOTCC have adopted individual strike level volatility. This enhancement allows the implied volatility specific to the strike to be used in calculating the risk arrays. Before this enhancement, the same implied volatility figure was used for all strikes in an option month.

3. Extreme Move Multiplier

To capture the risk in deep-out-of-the-money short option positions, SPAN provides two scenarios that test the effect of a move of a multiple of the normal scanning range, and then capture a percentage of the resulting gain or loss. Each exchange or clearing house may set its own multipliers and percentages. Currently, most exchanges set the multiplier to 3 and the percentage to approximately 30 percent.

4. Inter-Commodity Spread Credits

The inter-commodity spread credit recognizes that an exchange may list contracts whose prices tend to be correlated. As such, positions in the two contracts on opposite sides of the market may be risk reducing, because losses from one instrument may be offset with gains in the related instrument. The exchange or clearing organization may set an inter-commodity spread credit in recognition of the fact that the combined positions do not carry the same risk as the sum of the risk for the two

positions measured separately. The inter-commodity spread credit reduces the total maintenance margin requirement for the combination of positions, and may result in the margin for the two positions being less than that for either or both of the individual positions. Each exchange or clearinghouse that uses SPAN identifies the types of spreads that qualify for the credit and the amount of the credit. For example:

| Effect of Inter-Commodity Spread (Margins as of April 12, 2001) | |
|---|------------|
| Short 1 S&P 500 September Future | \$17,250 |
| Long 1 NASDAQ 100 June Future | \$27,000 |
| Maintenance Margin Requirement for Positions Margined Separately | \$44,250 |
| Inter-Commodity Spread Credit | (\$26,993) |
| Maintenance Margin Requirement for Positions Margined as a Portfolio | \$17,257 |

The table shows that an individual position of short 1 S&P 500 September futures contract would require maintenance margin of \$17,250. An individual position of long 1 NASDAQ 100 June futures contract would require maintenance margin of \$27,000. Individually margined, the positions would have a total margin requirement of \$44,250. However, if the positions were margined together as one portfolio, the maintenance margin requirement would be \$17,257. The positions will receive an inter-commodity spread credit savings of \$26,993 (\$44,250 - \$17,257).

Each exchange or clearing organization that uses SPAN determines which of its contracts are related,⁴ and sets the amount of the credit and any applicable ratio between the related contracts (i.e. 1:2, 5:1). The CME and CBT/BOTCC determine the amount of the credit by evaluating the same type of historical price data reviewed in evaluating the margin interval rate and volatility scan range. The credit in SPAN is reflected as a percentage savings of the maintenance margin requirement.

5. Intra-Commodity Spreading (Inter-month) Risk Charge

For most contracts, SPAN assumes that price movements in underlying contract months within the same product will move together. Since this correlation is sometimes less than perfect for price movements of different contract months, SPAN allows an exchange or clearing organization to add an intra-commodity spread charge. If no intra-commodity spread charge is applied, then a spread position in the same product between different contract months will have no margin requirement. The intra-commodity spread charge would be added to the account's minimum maintenance margin requirement. For example:

On April 12, 2001, a speculative S&P 500 position of short 1 June 2001 future and long 1 September 2001 future would have a

⁴ Related contracts have a strong correlation for prices to move by relatively the same values in either the same or the opposite direction.

maintenance margin requirement of \$0 before accounting for the intra-commodity spread risk charge. However, the CME has set a speculative maintenance intra-commodity spread charge on S&P 500 contracts of \$275. Therefore, the maintenance margin requirement for this spread position would be \$275.

The CME and CBT/BOTCC determine the amount of the charge by looking at the same type of historical price data reviewed in evaluating the maintenance margin requirement and the options volatility.

An exchange or clearing organization can also choose to have SPAN not recognize any offsets between underlying contracts of the same product. This would be applicable for products that have a very low correlation between the different contract months.

6. Short Option Minimum Charge

To account for risks associated with short option positions, the CME has set a short option minimum for each of its contracts. The exchange sets the short option minimum charge rate, which is applied to the greater of the short calls or short puts in the product.⁵ The short option minimum charge is not an “add-on” charge to the basic SPAN calculation; rather, the short option minimum is compared to the SPAN combined commodity charge calculation and the greater amount will be the risk maintenance margin requirement. For example:

On April 12, 2001, a short 1 April S&P 500 call 1825 option position has a SPAN-calculated maintenance margin requirement of less than \$1. However, the CME has set an S&P 500 short option minimum charge of \$175. The \$175 short option minimum charge is greater than the SPAN calculation and, therefore, the short option minimum will be the maintenance margin requirement. If the short option minimum had been less than the SPAN-calculated maintenance margin requirement, then the SPAN calculation would be the maintenance margin requirement.

The CBT/BOTCC, by contrast, have set a short option minimum of \$0 for all contracts (that is, no short option minimum). They believe the SPAN-calculated minimum risk maintenance margin requirement is sufficient and should not be overridden. CBT/BOTCC staff believe that the extreme price ranges (see Section B) have been set wide enough to establish margin requirements for deep-out-of-the-money options. Division staff tested this assertion by creating test accounts using PC-SPAN and found that using the extreme price range calculation produced the highest margin requirements for the deep-out-of-the-money options tested.

⁵ The exchange considers it unlikely that both the short calls and short puts would lose in a large one-way movement in the underlying market. SPAN also permits FCM users to instead calculate the short option minimum for customers based on the total of short puts and short calls.

7. Initial/Maintenance Margin Ratio

New portfolios of speculative accounts must meet the exchange set initial margin requirement. The exchanges determine maintenance margin requirements and then set initial margin as a ratio to maintenance margin. The CBT/BOTCC have set the initial to maintenance margin ratio to 1.35 for all contracts. This means that the initial margin requirement is 35% greater than the maintenance margin requirement. For example, a contract with a maintenance margin requirement of \$2,000 will have an initial margin requirement of \$2,700. The initial to maintenance margin ratios for the CME vary by type of product, and range from 1.25 to 1.50. After the initial margin requirement has been met, the account only needs to keep the net liquidating value at or above the risk maintenance requirement. If an account's net liquidating value falls below its maintenance margin requirement, the owner must deposit additional collateral (or reduce the risk of its aggregate positions) to bring the net liquidating value back up to the initial margin requirement.

8. Spot Month Add-On Charge

The spot month add-on charge is used by exchanges and clearing organizations to recognize the additional risk of portfolios with positions in the spot month. This add-on is usually for physically deliverable products and only applies to open positions held in the spot month. The charge is added to the SPAN-calculated risk maintenance margin requirement.

B. SPAN Risk Arrays

The risk array is used to determine the account's largest expected loss and therefore, its margin requirement. The exchange creates a risk array each trading day for each futures and options contract. CME's SPAN Internet web site defines a risk array as a representation of how a specific instrument will gain or lose value, from the current point in time to a specific point in the future (usually, one trading day), over a set of 16 specified changes in market conditions (scenarios). The first two scenarios test the effect on the position if option volatility moves up or down the exchange-set volatility scan range. (This change would only affect options). The next 12 scenarios test the effect on the positions of changes in movements up and down of both the volatility scan range and the price scan range (the price scan range is the exchange or clearing organization defined maintenance margin requirement). In each of the scenarios the gain or loss is computed by moving the price of the underlying future up or down in 1/3 increments (1/3, 2/3 or 3/3) of the maintenance margin, and by moving option volatility either up or down for each scenario.

The changes in scenarios 15 and 16 are designed to account for low-probability events, and involve moving the underlying contract up (scenario 15) and down (scenario 16) by some multiple of the price scan range (usually two or three times the scan range) and capturing a percentage of the resulting gain or loss. These scenarios were created to capture the risk in deep-out-of-the-money short option positions.

The risk array for April 12, 2001, for the S&P futures contracts is shown below. Because the maintenance margin requirements for S&P 500 futures contracts do not differ by contract month, the risk arrays for all futures contracts can be shown as one.

Futures Contract Risk Array: All S&P 500 Futures Contracts

| Line | Value Loss | Scenario |
|------|------------|---|
| 1 | \$0 | Futures Unchanged; Volatility Up |
| 2 | \$0 | Futures Unchanged; Volatility Down |
| 3 | -\$5750 | Futures Up 1/3; Volatility Up |
| 4 | -\$5750 | Futures Up 1/3; Volatility Down |
| 5 | \$5750 | Futures Down 1/3; Volatility Up |
| 6 | \$5750 | Futures Down 1/3; Volatility Down |
| 7 | -\$11500 | Futures Up 2/3; Volatility Up |
| 8 | -\$11500 | Futures Up 2/3; Volatility Down |
| 9 | \$11500 | Futures Down 2/3; Volatility Up |
| 10 | \$11500 | Futures Down 2/3; Volatility Down |
| 11 | -\$17250 | Futures Up 3/3; Volatility Up |
| 12 | -\$17250 | Futures Up 3/3; Volatility Down |
| 13 | \$17250 | Futures Down 3/3; Volatility Up |
| 14 | \$17250 | Futures Down 3/3; Volatility Down |
| 15 | -\$15525 | Futures Up Extreme (3 Times the Maintenance Margin) – Cover 30% of Loss |
| 16 | \$15525 | Futures Down Extreme (3 Times the Maintenance Margin) – Cover 30% of Loss |

The S&P 500 futures maintenance margin requirement at this time was \$17,250. The risk array shows the gain or loss as a result of the underlying market moving in accordance with each scenario. For example, scenario 10 requires the underlying futures contract to be re-priced down 2/3 of \$17,250; the resulting loss is \$11,500. Each risk array is calculated for a single long position with losses shown as positive amounts. The largest positive amount is the largest loss. The largest loss on the above S&P 500 position is \$17,250, which is equal to the maintenance margin requirement. The volatility portion of each scenario only affects calculated gains and losses for option positions in the risk arrays.

Options Contract Risk Array: June 2001 S&P 500 Call Strike Price 1200

| Line | Value Loss | Scenario |
|------|------------|------------------------------------|
| 1 | -\$2050 | Futures Unchanged; Volatility Up |
| 2 | \$2769 | Futures Unchanged; Volatility Down |
| 3 | -\$5118 | Futures Up 1/3; Volatility Up |
| 4 | -\$288 | Futures Up 1/3; Volatility Down |
| 5 | \$625 | Futures Down 1/3; Volatility Up |
| 6 | \$5216 | Futures Down 1/3; Volatility Down |
| 7 | -\$8565 | Futures Up 2/3; Volatility Up |
| 8 | -\$3932 | Futures Up 2/3; Volatility Down |
| 9 | \$2907 | Futures Down 2/3; Volatility Up |
| 10 | \$7073 | Futures Down 2/3; Volatility Down |
| 11 | -\$12370 | Futures Up 3/3; Volatility Up |
| 12 | -\$8102 | Futures Up 3/3; Volatility Down |
| 13 | \$4806 | Futures Down 3/3; Volatility Up |
| 14 | \$8398 | Futures Down 3/3; Volatility Down |

| | | |
|----|----------|--|
| 15 | -\$11996 | Futures Up Extreme (3 Times the Maintenance Margin) – Cover 30% of Loss |
| 16 | \$3086 | Futures Down Extreme (3 Times the Maintenance Margin) – Cover 30% of Loss |

Options have unique characteristics, such as implied volatility, time to expiration, and strike price, that make them behave differently than the underlying future or physical product. Each strike price and each expiration month will have unique risk array values. The option risk array values are calculated using the same scenarios as the futures risk arrays. The volatility scan range for this strike price on this day as shown on CME's Internet web site was .05. Therefore, in scenario 10, the loss of \$7,073 is determined by the underlying futures contract moving down 2/3 of \$17,250 and the option volatility going down .05.

V. Step Two - Margining an Account - Combining Exchange Set Margin Variables, Risk Arrays, and an Account's Portfolio

Every trading day, each exchange or clearing organization packages its risk arrays into a risk parameter file. The exchanges or clearing organizations make the file available on their web sites for FCMs or service bureaus to download. The risk parameter files are also available through direct transmissions. The FCMs or service bureaus load the risk parameter file into their SPAN program software and then calculate each account's maintenance margin requirement as follows:

- 1) For each underlying product in which the account has a position, SPAN selects the scenario with the largest potential for loss. The sum total of the largest losses in each product is called the scanning risk charge.
- 2) If applicable, add to the answer in (1) any intra-commodity spread or spot month charges.
- 3) If applicable, subtract from the answer in (2) any inter-commodity spread credits.
- 4) Multiply the exchange-set short option rate by the short option quantity to calculate the short option minimum.
- 5) Compare the scanning risk total (3) to the short option minimum (4). The larger of the two amounts is the product risk requirement.

The mark-to-market value of the option positions is the equity component of the margin requirement. The account's total maintenance margin requirement equals the risk maintenance margin requirement, minus the long option value, plus the short option value in the account. The account's initial margin requirement will be the exchange-set initial/maintenance ratio times the maintenance margin requirement.

The example below demonstrates how SPAN determines the scanning risk charge based on the entire portfolio of the account. (The table shows losses as positive amounts; the largest positive amount is the largest loss.) The portfolio is

comprised of a long futures position, two long in-the-money call options, and two long out-of-the-money put options.

In determining an account's scanning risk charge (maintenance margin before other charges and credits) SPAN does not simply sum the largest loss from each position in the portfolio. Rather, SPAN looks for the scenario in which the positions in the portfolio would have the highest aggregate loss. Looking for the highest summary total for the entire portfolio versus summing the highest loss for each position is why SPAN is referred to as a portfolio margining system.

In this example, the largest losses for the futures and call option positions occur at scenario 14 (\$17,250, \$13,922, and \$13,682, respectively). The largest loss for the put option positions is at scenario 12 (\$416 and \$552, respectively). The largest aggregate loss for this portfolio is scenario 14. The risk maintenance margin requirement for this portfolio would be the scanning risk charge of \$44,767 (17,250 + 13,922 + 13,682 - 20 - 67).

Scanning Charge Based On Portfolio of Related Futures and Options

| Scenario Number | Scenario | Long 1 June Contract | Long 1 June 1115 Call | Long 1 June 1120 Call | Long 1 June 900 Put | Long 1 June 925 Put | Total |
|-----------------|---|----------------------|-----------------------|-----------------------|---------------------|---------------------|--------|
| 1 | Futures Unch; Volatility up | 0 | -1636 | -1675 | -324 | -408 | -4043 |
| 2 | Futures Unch; Volatility down | 0 | 2123 | 2185 | 316 | 410 | 5034 |
| 3 | Futures up 1/3; Volatility up | -5750 | -5954 | -5933 | -136 | -165 | -17938 |
| 4 | Futures up 1/3; Volatility down | -5750 | -2647 | -2519 | 364 | 478 | -10074 |
| 5 | Futures down 1/3; Volatility up | 5750 | 2384 | 2279 | -566 | -720 | 9127 |
| 6 | Futures down 1/3; Volatility down | 5750 | 6523 | 6501 | 244 | 307 | 19325 |
| 7 | Futures up 2/3 ; Volatility up | -11500 | -10533 | -10461 | 9 | 23 | -32462 |
| 8 | Futures up 2/3; Volatility down | -11500 | -7711 | -7533 | 395 | 523 | -25826 |
| 9 | Futures down 2/3 ; Volatility up | 11500 | 6077 | 5897 | -876 | -1118 | 21480 |
| 10 | Futures down 2/3; Volatility down | 11500 | 10478 | 10354 | 137 | 155 | 32624 |
| 11 | Futures up 3/3 ; Volatility up | -17250 | -15340 | -15225 | 119 | 167 | -47529 |
| 12 | Futures up 3/3 ; Volatility down | -17250 | -12995 | -12783 | 416 | 552 | -42060 |
| 13 | Futures down 3/3 ; Volatility up | 17250 | 9415 | 9155 | -1271 | -1622 | 32927 |
| 14 | Futures down 3/3; Volatility down | 17250 | 13922 | 13682 | -20 | -67 | 44767 |
| 15 | Futures up extreme (3 X the Price Scan Range) – Cover 30% of loss | -15525 | -14065 | -13985 | 131 | 175 | -43269 |
| 16 | Futures down extreme (3 X the Price Scan Range) - Cover 30% of loss | -15525 | 6837 | 6596 | -1518 | 1951 | 25489 |

VI. Determining if an Account has Excess Margin or Margin Deficiency

SPAN only calculates the account's risk margin requirement; it does not determine the account's margin status. The example in the table below illustrates how an account's margin status is determined. In this example the firm is using the total equity method to determine the margin status of the account. The maintenance margin requirement is calculated by summing the SPAN risk margin requirement (risk

component) and the option value (equity component). In computing the equity component, short option value is added to the risk maintenance margin requirement and long option value is subtracted.

The margin requirement for this account is \$2,000, composed of a \$500 risk component plus a \$1,500 short option value equity component. The total equity is \$3,250, composed of the cash ledger balance of \$1,500 and the open trade equity of \$1,750. Therefore, the account has excess margin of \$1,250 (\$3,250 total equity - \$2,000 maintenance margin requirement).

| | |
|---|---------|
| Risk Maintenance Margin Requirement | \$500 |
| Short Option Value | \$1,500 |
| Maintenance Margin Requirement (Sum of short option value and risk maintenance margin requirement) | \$2,000 |
| | |
| Cash Ledger Balance | \$1,500 |
| Open Trade Equity | \$1,750 |
| Total Equity (Sum of cash ledger balance and open trade equity) | \$3,250 |
| | |
| Excess Margin (Total equity minus the maintenance margin requirement) | \$1,250 |

VII. Sample Portfolios and SPAN's Calculation of Margin

The examples below are designed to show the effect exchange inputs have on the SPAN-calculated maintenance margin requirement.

The table below shows the effect of the extreme moves in scenarios 15 and 16 and the short option minimum. The portfolio in the example has S&P 500 April option positions in eight different deep-out-of-the-money strike prices. The account is short a total of 4,000 option contracts, 500 in each of the four furthest out-of-the-money call and put strike prices. The only scenario in which the value of the options changes is the extreme up scenario (#15), which results in a scanning risk charge of \$222,000. In the example, however, CME has assigned a short option minimum of \$175 a contract. The CME's short option method is to multiply the short option minimum times the greater of the short option call or put position. In this example, the number of short call and put positions is each 2000 contracts, therefore the short option minimum is \$350,000 (2,000 contracts * \$175/contract). The short option minimum (\$350,000) is greater than the scanning charge (\$222,000) and is, therefore, the SPAN-calculated risk maintenance margin requirement.

| Scenario Number | Short 500 April 1700, 1725, 1775 & 1850 calls and 925, 950, 975 & 1000 puts (S&P 500 Options) | Scenario Total |
|-----------------|--|----------------|
| | Scenario | |
| 1 | Futures Price Unchanged; Volatility up | 0 |
| 2 | Futures Price Unchanged; Volatility down | 0 |
| 3 | Futures Price up 1/3 the Price Scan range; Volatility up | 0 |
| 4 | Futures Price up 1/3 the Price Scan range; Volatility down | 0 |
| 5 | Futures Price down 1/3 the Price Scan range; Volatility up | 0 |
| 6 | Futures Price down 1/3 the Price Scan range; Volatility down | 0 |
| 7 | Futures Price up 2/3 the Price Scan range; Volatility up | 0 |
| 8 | Futures Price up 2/3 the Price Scan range; Volatility down | 0 |
| 9 | Futures Price down 2/3 the Price Scan range; Volatility up | 0 |
| 10 | Futures Price down 2/3 range the Price Scan; Volatility down | 0 |
| 11 | Futures Price up 3/3 range the Price Scan; Volatility up | 0 |
| 12 | Futures Price up 3/3 range the Price Scan; Volatility down | 0 |
| 13 | Futures Price down 3/3 range the Price Scan; Volatility up | 0 |
| 14 | Futures Price down 3/3 range the Price Scan; volatility down | 0 |
| 15 | Futures Price up extreme (3 X the Price Scan Range) – Cover 30% of loss | \$222,000 |
| 16 | Futures Price down extreme (3 X the Price Scan Range) - Cover 30% of loss | 0 |
| | Greatest Scan Risk (per above scenarios) | \$222,000 |
| | Short option minimum (2,000 contracts * \$175/contract) - overrides computed scenario - becomes the SPAN-calculated risk maintenance margin requirement) | \$350,000 |

The following example shows the effect of the spot charge and the intra-commodity spread charge. The account is short 50 April and long 50 June live cattle futures. The date the position was margined, the April future was the spot month. The scanning charge for this spread position is zero, because the number of long contracts is equal to the number of short contracts. The CME has assigned a live cattle intra-commodity charge of \$175 per spread. Therefore, the intra-commodity charge is \$8,750 (50 * \$175). The CME has designated a live cattle spot charge of \$75 per spot month contract; therefore, the spot charge is \$3,750 (50 * \$75). The SPAN-calculated maintenance margin is \$12,500 which is \$0 (scanning charge) + \$8,750 (intra-commodity charge) + \$3,750 (spot charge).

SPAN Maintenance Margin Requirement:

| | | | |
|------------------------------|----|-----------------|--|
| Scan Risk | \$ | 0 | |
| Intra-commodity Charge | | 8,750 | (50 spreads x \$175/spread) |
| Delivery/Spot Month Charge | | <u>3,750</u> | (50 spot contracts x \$75/spot contract) |
| SPAN Maintenance Margin Req. | | <u>\$12,500</u> | |

VIII. The Effect Exchange-Set Variables Have on Margin on Dually-Listed Contracts

An exchange can reduce portfolio margin requirements by setting a lower maintenance margin requirement and by giving greater inter-commodity spread credits, or by setting low or no inter-month spread charges. The table below shows actual examples of similar contracts listed at two exchanges and their respective minimum maintenance margin requirements. The minimum maintenance margin requirements at the Cantor Financial Futures Exchange, Inc. ("Cantor") are 0%-55% percent lower than CBT:

| Futures Contract | CBT | Cantor | Percentage Difference |
|---------------------------------|---------|---------|-----------------------|
| 30 Year Treasury bond 6% Coupon | \$1,500 | \$1,300 | 13% |
| Treasury note (6 ½-10yr) | \$1,200 | \$ 900 | 25% |
| Treasury note (5Year) | \$ 700 | \$ 700 | 0% |
| Treasury note (2 year) | \$ 600 | \$ 270 | 55% |

Lower margin levels result in lower risk-based capital requirements. A firm with open positions on Cantor would have a lower risk-based capital requirement than if the positions had been established in CBT's similar treasury contract.

IX. Exchange & Clearinghouse Margin Setting Procedures

Division staff discussed with CME and CBT/BOTCC the process they use in setting maintenance margin requirements. CBT/BOTCC staff meet monthly with members of the Risk Management Committee ("CBT Committee") to review the SPAN parameters. Prior to the meeting, CBT and BOTCC staff discuss possible SPAN parameter adjustments and then make a joint recommendation to the CBT Committee. If the CBT Committee determines that maintenance margin requirements need to be changed, it sends notification to members by bulletin. The members are required to deposit any additional margin within two days of the effective date of an increase.

CME's Performance Bond Staff ("CME Staff") meets at least once a month. The CME Staff makes margin recommendations to CME's Board of Directors. However, the CME Staff may implement margin changes immediately with later ratification by the Directors. CME's members are notified of a margin increase by advisory notice and are usually given a five-day notice period before the margin increase takes effect. Any additional margin requirement is collected on the effective date of the change.

The margin setting procedures at the CME and CBT/BOTCC involve reviewing historical price movements. The BOTCC reviews the prior 30, 90 and 125 trading days. Once a year the CBT Committee performs a 10-year historical review of performance bond requirements for all contracts. CME reviews the prior 1, 3 and 6 months and may also look at longer periods of time - up to four years.

The following statistical summary is an example of the information that the CBT/BOTCC used in setting U.S. T-bond maintenance margin requirements. The

number of observations is the number of trading days scanned, either 30, 90, or 125. Maximum and minimum, respectively, refer to the greatest and smallest positive and negative price moves during each time period. The mean is the average of the absolute values of the price moves for the period. The 95% probability and the 99% probability are the amounts needed to capture the largest loss at the 95% and 99% confidence intervals based on the observations over various intervals of time (30 trading days, 90 trading days, or 125 trading days). These amounts are calculated based on a statistical analysis of the mean and standard deviation for each sample; they do not represent the amount that will capture 95% or 99% of the observations in the sample. For example, based on this analysis, the 95% confidence interval for the sample over the last 30 days is greater than the largest amount actually observed in the sample.

U.S. T-Bond – Statistical Summary - Prices

| Number of Observations | Last 30 Trading Days | Last 90 Trading Days | Last 125 Trading Days |
|------------------------|----------------------|----------------------|-----------------------|
| Maximum | \$1,500 | \$1,656 | \$1,656 |
| Minimum | (\$1,438) | (\$2,906) | (\$2,906) |
| Mean (Abs.) | \$ 601 | \$ 565 | \$ 502 |
| 95% Probability | \$1,539 | \$1,554 | \$1,390 |
| 99% Probability | \$2,074 | \$2,058 | \$1,837 |

The U.S. T-Bond table contains the historical price change information the CBT Committee used in determining the appropriate level for minimum maintenance margin requirements. At this time, the maintenance margin for CBT's U.S. T-bond contract was \$2,000 and the daily trading limit price move was \$3,000 per contract.

The table shows that the greatest one-day price increase per contract in the previous 125 days was \$1,656 and the greatest one-day price decrease was \$2,906. Based on the observed one-day price movements for the last 125 days, a margin requirement of \$1,390 would be necessary to cover a future one-day price movement at the 95% confidence level, and a margin requirement of \$1,837 would be necessary to cover a future one-day price movement at the 99% confidence interval.

The CME and CBT/BOTCC each endeavor to set maintenance margin requirements that will capture between 95% and 99% of all price movements over a period of time. Other SPAN users may set different goals. It is important to recall that margin levels are not designed to cover all losses. A margin level that is designed to – and does – cover 95% of one-day losses will be exceeded on twelve days over a year of 250 trading days. Even where the margin level is designed to cover 99% of the one-day losses, the losses will exceed the margin level two to three days over the course of a year. Moreover, because market losses may not be normally distributed – and because negative factors tend to correlate together in sharply down markets – losses in excess of margin levels can be very large. Both CME and CBT/BOTCC address these issues through stress testing. Stress testing is the subject of a report that the Division intends to present to the Commission shortly.

X. PC-SPAN & Joint Audit Committee Margin Testing

CME has developed PC-SPAN, a Windows-based version of SPAN. Among other features, PC-SPAN allows the user to calculate initial and maintenance margin requirements at the account level. The first step in using PC-SPAN is to download the required SPAN risk parameter files. The CBT maintains approximately four months of SPAN risk parameter files for all U.S. exchanges on its Internet web site. To obtain SPAN risk parameter files more than four months old, users would have to contact the specific exchange or clearinghouse and request the file.

The Joint Audit Committee ("JAC") is a committee of representatives from U.S. self-regulatory organizations (commodity exchanges and NFA) that participate in a joint audit and financial surveillance program. In addition to many other audit programs, JAC has developed a nine-step audit program to audit firms' margin compliance. The program requires auditors to select for testing a sample of the firm's margin rates to determine whether they are equal to or greater than the exchange's minimums. Testing is not required on margin rates where a firm or its bookkeeping service is using exchange generated risk arrays.

XI. The Risks of Large Deep Out-of-the-Money Short Option Positions

One of the risks of deep-out-of-the-money options is that, during large market moves, the margin requirements of the positions may increase dramatically. For example, in October 1997, an account holding very large deep-out-of-the-money S&P 500 short option positions suffered large losses when that market fell precipitously. The account holder was not able to cover the losses and the firm clearing the account was forced to obtain additional capital. In other cases, accounts holding very large short deep-out-of-the-money positions have generated margin calls greater than the carrying firm's excess net capital.

To illustrate this point, Division staff created separate test portfolios of short 500 contracts in each of the four furthest out-of-the-money and short 500 contracts in each of the furthest in-the-money S&P 500 June put options (total of 2,000 options for each portfolio). The test portfolios were created on April 13, 2000. On April 14, 2000, the S&P 500 futures dropped significantly, around 88.5 points.

The table below shows the change in margin requirements from April 13th to April 14th, for the out-of-the-money options, in-the-money options, and a futures portfolio. The equity component as mentioned earlier in this report is not a SPAN calculation but rather the marked-to-market value of the option positions. A portfolio with only futures contracts will not have an equity component in its margin requirement.

Percentage Increase in Margin Requirements
After the April 14, 2000 Market Move

| Description | Options | | Futures |
|---------------------------|------------------|--------------|-----------|
| | Out of the Money | In the Money | |
| Equity Margin Requirement | 121% | 31% | N/A |
| Risk Margin Requirement | 267% | <1% | No Change |
| Total Margin Requirement | 151% | 24% | No Change |

The risk of deep out-of-the money short option positions is the greatest when there is an extreme movement in the underlying instrument such as the scenario described above. In setting margin requirements for short option positions, exchanges and clearinghouses must balance this risk with the infrequency of occurrence of extreme market movements and with setting margin requirements at a level which will promote liquid markets.