Annexure 1

Method for calculating the VaR (EWMA) based Margin

The method used to derive the VaR Margin requirements for Futures contracts is based on the Initial Margin methodology suggested in the "*Varma Committee Report for Risk Containment in Derivatives Market*".

Computation:

1. The standard deviation (Volatility estimate) of prices is computed using the Exponentially Weighted Moving Average method ("EWMA").
2. The Standard Deviation (Volatility estimate) at the end of time period t (σt) is estimated using the Standard Deviation (Volatility estimate) at the end of the previous time period. i.e. as at the end of t-1 time period (σt-1), and the return (rt) observed during the time period t (price difference in previous two days).

   Formula for Standard Deviation (Volatility Estimate):

   $$\sigma_t^2 = \lambda\left(\sigma_{t-1}\right)^2 + (1-\lambda)\left(r_t\right)^2$$

   Where,
   - σ (sigma) means the standard deviation
   - λ (Lambda) determines how rapidly volatility estimates changes. The value is taken as 0.99 currently.
   - r (return) is defined as the logarithmic return: $r_t = \ln(S_t/S_{t-1})$ where S_t is the price of the Gold at time t.

   Based on the Standard Deviation, the VaR Margin for a particular day is calculated using the below formula.

   VaR% = 100 * (EXP (3.5 σ)-1)

   Initial Margin = Square Root (MPoR Days) * VaR Margin, where MPoR Days = **3**

   Notes:
   1) *The value of Lambda is taken as 0.99.*
   2) *As per L.C. Gupta committee recommendations, Margins for VaR should be based on 3.5 sigma limits.* **3.5 sigma provides more than 99.7% confidence level.**
   3) *The VaR margin is multiplied by √3 to cover 3 days of Margin Period of Risk (MPOR)*