Good morning Ladies and Gentlemen

I have been very kindly invited to your conference in order to discuss “disaster insurance” and whilst some might believe that insurance is “generally disastrous”, I would like to spend the next 40 minutes discussing the more serious side of our business and that is, natural disasters from an insurance perspective both globally and locally.

Our Group, Munich Re, has for many years been studying natural hazards in its various forms and together with other countries realised the loss potential of natural hazards. As a result of this all parties concerned decided to form a global organisation in order to try and standardise methods of calculating natural hazard exposures from an insurance point of view.

**Slide 2 to 4:** CRESTA Organisation

An organisation was formed, called “CRESTA”, which stands for Catastrophe; Risk; Evaluation and; Standardising; Target; Accumulation. The main task of CRESTA was to standardise accumulation control of natural perils, collating, and publishing general information on loss histories or loss potential assessments on a global basis. As individual rates vary from country to country it was decided to accumulate average rates, deductibles or excesses taking into consideration the legal regulations applicable in the various countries.

**Slide 5:** CRESTA Members

Of the CRESTA member companies, direct insurers constituted approximately 44.6% of the total with reinsurers amounting to 30.8%, the remainder being made up of brokers and others. In terms of individual companies, of a total of 610 member companies, 370 emanated from Europe, 81 from the USA, 60 from Asia, 46 from Latin America, the remainder being other areas such as Canada, Australazia and Africa. It is apparent from the support that CRESTA truly reflects a global effort to try and standardise the methodology of reporting natural hazards and accessing exposure.

In order to reach the goal, some form of definition was required and as a result the CRESTA organisation decided on a few definitions relating to Exposure, Accumulation, Assessment and Loss Accumulation Zones.

**Slide 6 to 8:** Exposure Zones - Accumulation Assessment Zones

In determining exposure zones an entire country is taken as one exposure zone. That country is then divided into various accumulation assessment zones numerically numbered often following natural boarders or postal codes.

**Slide 9:** Loss Accumulation Zone

Once the exposure and accumulation assessment zones had been established, loss accumulation zones were then identified depending on the hazard. For example:- earthquakes - If the epicentre is in Tulbagh the damage can be expected to vary in size depending on the distance from the epicentre, sometime affecting other areas such as Ceres and even Cape Town. Therefore, loss accumulation zones were needed to evaluate the damage from given areas.

Once the standardisation had been completed CRESTA members were able to exchange information freely based on the various accumulation and assessment zones relating individually to different natural hazard perils.

**Slide 10:** General Aspects and Trends of Natural Exposures World-Wide

I have been discussing CRESTA in order to convey a very brief explanation as to how natural hazards are viewed on a global basis. Turning to the research completed by our group, I would like to discuss general aspects and trends of natural exposures on a world wide basis, which will indicate the substantial amount of loss of life, damage to property and economic loss, which natural hazards create. In view of this one needs to have some form of strategy in place in order to cope with natural disasters when they do occur particularly in a country such as ours which is prone to Natural Hazard Perils.

**Slide 11:** Great Natural Disasters 1960 - 1998

If one examines the bar chart it is clear economic losses in terms of value far exceed insurance losses. This might be due to a number of reasons, such as self-insurance, non-insurance and to a large extent under insurance. It is interesting to note that on a global basis the trend for economic losses exceeded the trend of insurance losses, which emphasise the need for insurance being purchased. In 1995 the “Chobe” earthquake resulted in a large economic loss, and only a small insurance loss as earthquake cover in Japan can only be purchased to a limited extent.

**Slide 12:** Great Natural Disasters 1960 - 1998

If one compares the development of the number of great natural disasters from 1960 to 1998, one can see that the decade from 1980 to 1989 increased by a factor of 4,4 compared to the decade 1960 to 1969. Similarly, an increased factor of 3,3 represents the development of the number of great natural disasters in the last 10 years compared with the 1996’s. Note also that in the decade 1980 to 1989 we experienced the greatest number of natural disasters.

When we study the impact of these great natural disasters on both economic and insured losses, we see that the factors for the 80's compared to the 60's are 3,1 and 4,6 which are not out of line with the numerical increases.

However, when we look at the economic losses and the insured losses and compare the last 10 years with the 1960's a most alarming development is evident. The 1980's have increased by factors of 9,1 and 15,3 for economic and insured losses respectively over the 1960 decade. All the monetary amounts in this table have been escalated for inflation and the increases we see before us are therefore real increases in monetary losses in respect of great natural disasters. The corollary that can be drawn from this is that natural disasters continue to have an ever-increasing impact on property damage. This indicates an inevitable increase in breakdown of services, destruction of infrastructure, deaths, injuries and the development of an intolerable strain on disaster management strategies.

**Slide 13:** Natural Perils/Loss Potential (Insured losses only)

On a global basis we analysed the natural hazard perils from the aspects of what kind of events occurred, the cost in billions of Rands to a market and the occurrence probability in number of years commencing with Windstorm in the USA. It cost the insurance market R290 Billion with a return period of 1 in 50 years. Earthquake in the USA cost the insurance market R460 Billion with a recurrence probability of 1 in 1000, however you could expect a R80 Billion market loss occurring 1 in 100 years.

Coming closer to home an earthquake in South Africa could cost the market R14 Billion with the return period of say 1 in 1000 years whereas a hail storm could cost South Africa R6 Billion with a return period of 1 in 100 years.

**Slide 14:** Relation between PML and Return Period

In order to explain the various definitions existing for the abbreviation PML, one would need an entire separate seminar, but for simplicity sake our company regards PML to mean Probable Maximum Loss, in other words, taking the worst scenario likely. The example given in the slide indicates that the higher the percentage (probable maximum loss) for property damage the longer becomes the return period in number of years. (Depending on the exposure in a given country and the portfolio composition.)

**Slide 15:** Average Losses Earthquake

This graph depicts the relationship between the intensity of an earthquake and the loss ratio being the percentage which the damaged property constitutes of full replacement value as new. You will note from the width of the graph that for an intensity of MM6 the loss ratio has a variability of 0,1% to 0,5%. That is we expect to pay between 0,1% and 0,5% of the total value of all property at that location because of the earthquake. The exact loss ratio between 0,1% and 0,5% for MM6 will depend upon the individual circumstances of the area affected by the earthquake taking into account construction of buildings, density of population, etc.

It is interesting to note the bottom end of the impact of an earthquake measured at MM8 being just above 2,5% and that of earthquake measuring 10 being just above 25%.

It might at this stage be pertinent to discuss briefly the difference between the Richter Scale and the modified Mercalli Scale used to measure the forces of an earthquake.

Essentially, Richter measures the force of an earthquake while the modifying Mercalli system measures the impact that an earthquake has in terms of potential damage to property. Thus an earthquake with a force of 4 on the Richter Scale may have a modified Mercalli intensity of 5 at a certain epicenter under certain ground conditions but that same Richter Scale can generate a modified Mercalli earthquake intensity of 10 if the epicenter is closer to the earth's surface and the soil conditions are conducive to the transference of seismic shockwaves.

**Slide 16:** Natural Hazards - Munich Re's Evaluation of the Exposure in South Africa

**Slide 17:** Natural Hazard - Sources

I feel that it is appropriate at this stage to thank some of the sources of our information, which assisted the Munich Re Group in collating such detailed information on our country, namely:-

The University of the Witwatersrand
Council of Gio Science (Geological Survey) Pretoria
The Council of Scientific Industrial Research (CSIR)
The South African Weather Bureau in Pretoria and Durban
The University of Pretoria
Eskom Technological Group, Cleveland
University of Cape Town
University of Stellenbosch
University of Natal and Pietermaritzberg

**Slide 18:** Natural Hazard - CRESTA Zones, Accumulation Assessment Zones

Turning closer to home, analysing our situation in the Republic of South Africa we have approximately 16 Accumulation Assessment Zones.

**Slide 19:** Natural Hazard - Fire Liability Distribution

The total Fire Liability on a countrywide property sum assured distribution basis in 1996 amounted to R1,700 Billion. Of significance is the accumulation of fire property values within the various Cresta Zone areas. More particularly this is interesting if one correlates population with the values at risk. This map indicates that 27,6% of values accumulate within the very congested Cresta Zones of 5, 6 and 7. Another interesting observation is that the entire seaboard and adjoining areas constitute 28,8% of fire values stretching from Durban through to the Western Cape area. The phenomenon of uneven value and therefore population distribution is apparent also in countries like Australia where property and consequently population, instead of spreading themselves out over the available resources. This has obvious and severe implications for disaster management.

**Slide 20:** Earthquake Evaluation of the Exposure in South Africa

**Slide 21:** Earthquake - Historical Events

Looking at the historic data of earthquake occurrences in this country, we analysed the earthquake exposure on an annual basis indicating the magnitude based on the Mercelli scale. From our assessment it is apparent that the Cape, Natal, Transvaal and the Free State are all exposed in one way or another to the earthquake with varying intensities based on the historical data available.

**Slide 22:** Earthquake Exposure Zones

If one examines the major earthquake events since 1966 where the magnitude of the earthquake was greater than 5 on the Richter scale one can see that there are approximately five seismic zones with varying intensities.

**Slide 23:** Earthquake Expected Losses

The graph clearly shows you that the greater the intensity of the earthquake greater becomes the damage. The reason why the graph is as broad as it is is that this is an estimation and not an absolute reading.

**Slide 24:** Earthquake Western Cape Scenario

Historically, there was an earthquake felt in Cape Town in 1809 with a magnitude of approximately 6,1 on the Richter scale. There was also one in the Ceres/Tulbagh areas in 1969 which measured 6,3 on the Richter scale. Using this as the basis of our information we extrapolated a scenario whereby the Ceres/Tulbagh region could expect to have an earthquake of a magnitude of 7 on the Richter scale with a focal depth of 15 km once in 1000 years.

**Slide 25:** Earthquake Western Cape Scenario

If one takes an example of an earthquake occurring with the epicentre in Tulbagh one can see that the expected damage could be widespread and extensive. We estimated the sum insured to be in the region of R310 Billion in this area. Insured losses could be expected in the region of R6.2 Billion (that would be Property and Business Interruption combined) whilst property damage alone would amount to approximately R4.3 Billion. With regards to Probable Maximum Loss, it would be approximately 2% of the total value affecting 8,10,11 and 12 according to the CRESTA zones.

**Slide 26:** Gauteng Scenario

Looking at the historical events Klarksdorp had an earth tremor in 1977, which was approximately 5,2 on the Richter scale. The focal depth was 3 km. Taking a scenario with the location being Johannesburg suburbs and basing it on a Tectonic Earthquake with a magnitude of 5,5 on the Richter scale, one could expect an estimated economic loss of R558 Billion with an insured loss of approximately R14.3 Billion for Property and Business Interruption with approximately R10 Billion being Property damage only. Again looking at the probable maximum loss the expected damage could amount to 2.4% of the total sum insured in the region. The damage would be spread over the CRESTA excess of 5.6.7.

**Slide 27:** Earthquake - KwaZulu Natal Scenario

For the purposes of the scenario description being 6,7 on the Richter Scale with a Mercalli intensity of 9 and the return period of 1 000 years, we allowed the scenario to develop the earthquake 200km south of the previous epicenter and a similar distance off the coast. Otherwise we left the magnitude and intensity per the 1932 earthquake for scenario purposes. This is an entirely probable event given that the 1932 earthquake developed along a branch fault (of a major west-east fault line north of South Africa) which travels south along the continental shelf adjacent to the coast of Natal.

**Slide 28:** Hailstorm - Munich Re's Evaluation of the Exposure in RSA

Having discussed earthquake and its loss potential on a global basis and then having a more focused observation of our local conditions we are now going to do a similar exercise on some of the other natural hazard perils, commencing with hailstorm, which has been known to have caused devastating damage in both Europe, USA and our own country.

**Slide 29:** Hailstorm - Historical Events

On a global basis one can see the devastating damage that hailstorm have caused throughout the world, not to mention our own contribution in 1980, and four years later in 1984, followed again in 1985.

**Slide 30:** Hailstorm - Exposure Zones

Examining the geographical exposure zones calculated for hailstorm events during the period 1947 to 1996 one can clearly see that the frequency of hailstorms is significant and so is the severity of the hailstorm.

**Slide 31 and 32:** Hailstorm - Gauteng Scenario

Any insurers nightmare must be the severe hailstorms which occurred in the Gauteng area at peak hour as was experienced in 1985. The hailstorm had a tracking length in the region of about 100 km with a hailstorm area of about 2 to 3 square kilometres in width. At the time we estimated that the vehicles on the road must have been approximately 2.6 million out of which 1.2 million were insured with the average damage cost about R14 000 per vehicle. One does not expect to have this kind of hailstorm every year but it is not unreasonable to have a similar hailstorm once in every 100 years.

We took an area which we thought was probably the most exposed to hailstorm in our country and based the scenario on the Gauteng area encompassing both Pretoria and Johannesburg. From this scenario we estimated that a total property sum insured would be in the region of about R391 Billion of which about R69 Billion would be motor vehicles. Based on this scenario we would have anticipated an insured loss in the region of about R6.2 Billion material damage and motor. The breakdown being R3.4 Billion in material damage and R2.8 Billion in motor vehicles. The (PML) probable maximum loss scenario anticipated was approximately 0.9% of the damage would be property and the PML basis for motor vehicle would amount to 4%. This calculation is excluding the excess or deductibles. On a combined PML basis we anticipate the material damage and motor exposure to be 1.4% again ignoring the deductibles or excess spread over the CRESTA zones 5,6, and 7.

So far we have examined earthquakes and hailstorms but there are still a host of other perils which are also natural hazards and to name just some of them.

**Slide 33 and 34:** Other Perils - Munich Re's Evaluation of the Exposure in RSA

- Windstorm
- Hail
- Tornado
- Flood
- Drought
- Lightning
- Veld Fire
- Landslide

**Slide 35:** Windstorm - Maximum Wind Speed

The maximum windspeeds have all been measured for the benefit of this presentation on Bft Scale indicating that 8 on the Bft Scale would be the equivalent of a windspeed of between 17.2 - 20.7 m/s. (Approximately between 42 km/h to 50 km/h).

- Bft 9 = 20.8 - 24.4 m/s
- Bft 10 = 24.5 - 28.4 m/s
- Bft 11 = 28.5 - 32.6 m/s
- Bft 12 = anything greater than 32.7 m/s (78.5 km/h)

In viewing this map of South Africa one can see that we are certainly prone to a great number of fairly strong windstorms particularly down in the Cape and the Eastern Cape.

**Slide 36:** Meteorological Events (1947 - 1996)

In this diagram we are identifying a number of storms and a number of floods which have taken place and other events. One can see that we certainly have our fair share of storm and floods with the other perils playing a less prominent role.

**Slide 37:** Windstorm - Western Cape Scenario

In April 1993 the Cape Peninsula was lashed with windstorms of approximately 200 km/h with a precipitation of 150 mm of rain in a 24 hour time frame which was the worst recorded storm in the area in 30 years.

Calculating a scenario placing the location between Cape Town and Mossel Bay with a maximum windspeed in excess of 150 km/h, we would anticipate a loss in today's value of between R0.5 and R0.8 Billion in this area with a return period of 1 in 100 years.

**Slide 38:** Tornado - Historical Events

Examining historical events of tornadoes in our country, it is clear that the path of destruction has varied considerably in that there have been occasions in Hannover/Tropsburg/Petrusburg region where the path of destruction was as much as 175 km. Fortunately, during 1976 this area was predominantly farmland therefore there was very little destruction. On the other hand in 1967 there was tornado which had a path length of approximately 30 km which resulted in 200 injuries and 2 deaths. More recently, in 1999 there was a tornado in Umtata/Mount Ayliff where it resulted in 21 deaths. So it is clear that tornado's do occur in this country and have claimed a number of deaths. The economic loss as a result of the tornado in Umtata on the 15th December 1998 resulted in economic loss of R1 Billion with an insured loss of R100 Million.

**Slide 39:** Tornado - Exposure Zones

Examining the period 1947 to 1996 one noticed that in Pretoria/Johannesburg region and the Free State/Tanskai areas are prone to tornadoes more than in the Cape.

**Slide 40:** Lightning - Exposure Zones

Lightning strikes occur throughout South Africa predominantly in the Pretoria/Johannesburg areas as reflected in this slide. Lightning flashes have caused extensive damage in the past to thatch roofed hotels, conference centres and homes unless adequate precautions are taken for example, lightning conductors or sprinkler systems are installed on the thatched risks, one must expect to have extensive damage even possibly loss of life.

**Slide 41:** Flood - Rainfall and Flood Comparison

This graph clearly shows the escalation in the number of flood events depicted in terms of a 10 year average by the blue bar. Admittedly the 10 year rain average is also increasing but there is a significant increase in the ratio of flood events to rain events beginning in 1960. We can anticipate that flood events will continue to escalate given the extent of increasing urbanization and the impact which this has on the environment in terms of population and interference with natural watercourses drainage and soak away capabilities.

**Slide 42 and 43:** Flood - Historical Events

- In April 1856 Durban was completely flooded with little loss of life.
- In 1904 Bloemfontein had a severe flood which resulted in hundreds of homes being destroyed and 60 deaths.
- In 1968 Port Elizabeth had a severe flood which again affected many houses, communication lines were broken, cars were washed away. The economic loss was R40 Million and 11 deaths.
- In 1981 we had the Laingsburg disaster where 185 homes and 23 offices were destroyed. Insured loss was R48 Million with more than 200 deaths.
- In 1981 again the Port Elizabeth area had a flood which resulted in a R50 Million economic loss with 17 deaths.
- The Natal floods of 1987 caused severe damage as homes and bridges were washed away. Ladysmith had 3000 homes were inundated. The economic loss was R1.5 Billion. The insured loss was US$ 250 Million; 65 000 were left homeless with 487 deaths.

From the above examples it is clear that there are certain parts of South Africa which have a very real flood exposure and some form of disaster plan should be in operation in order to avoid the kind of loss of life and economic loss experienced in the past.

**Slide 44:** Flood - Exposure Zones

From our research it was evident that the coastal areas of the Cape, Eastern Cape and Natal were exposed to flooding whilst the inland areas e.g. Pretoria/Johannesburg were affected to a lesser extent from this peril. It is interesting to note the frequency of floods in our country and that there are a large number of areas which have flood potential in less than a five year frequency. One can expect to have floods in the Cape, Eastern Cape, Natal, etc certainly one in every five years or more frequent than that.

**Slide 45:** Flood - KwaZulu-Natal Scenario

Taking the historic events, basing the scenario on the Natal floods of 1987, we have extrapolated a scenario based on a flood occurring in the KwaZulu Natal surroundings of Durban/Pinetown, Pietermaritzburg and Richards Bay which we feel could result in an insured loss in the region of R2 Billion at toady's values. This scenario would have a return period of 1 in every 100 years.

**Slide 46:** Study Results - Natural Catastrophe Exposure in RSA

From our studies we have come to the conclusion that natural catastrophe exposure in South Africa is very real and one can anticipate that earthquake and floods will occur in certain areas. For example:-

- One can expect an earthquake in the Western Cape which could result in a R6 Billion loss 1 in every 1000 years.
- An earthquake in Gauteng could result in a R14 Billion loss 1 in every 1000 years.
- An earthquake in KwaZulu-Natal could result in a R3 Billion loss 1 in every 1000 years.
- Pertaining to hailstorms in the Gauteng region (Johannesburg/Pretoria) one would anticipate a loss of R6 Billion 1 in every 100 years.
- Windstorms in the Western Cape one would expect less than a R1 Billion damage 1 in 100 years.
- Floods in the south-east coast of KwaZulu-Natal one can anticipate a R2 Billion loss 1 in a 100 years.

**Slide 47:** Munich Re - Control of Natural Hazards Business

In order to try and continuously monitor our natural hazard exposures Munich Re has adopted the attitude of employing seismologists and scientific staff in order to enable us to come to the conclusions which have been portrayed to you during the presentation.

Scenarios are always debatable but necessary nevertheless, as catastrophe reinsurance protection needs to be purchased. In order for us to realistically determine our own catastrophe exposure and that of our clients we employ experts in the field. We constantly update technologies in order to always keep abreast with developments. We communicate frequently on a world-wide basis with scientific institutions, weather bureau, universities in order to avail ourselves of any information that is available for our research. Once having gathered all the information and explored all the avenues we collate our findings and evaluate the exposures by use of the PML calculations as demonstrated earlier in the presentation.

In conclusion we would like to thank you for your attention and for the opportunity of presenting this paper to you.