

4 October 2019

Facing the Changing Risk Universe – How to identify and evaluate existing and new Emerging Risks

Nigel Riley
Head of Risk Modelling
SCOR Global P&C

Daniel Theben
Chief Risk Officer
SCOR Global P&C

Disclaimer

Any views and opinions expressed in this presentation or any material distributed in conjunction with it solely reflect the views of the author and nothing herein is intended to, or should be deemed, to reflect the views or opinions of the employer of the presenter.

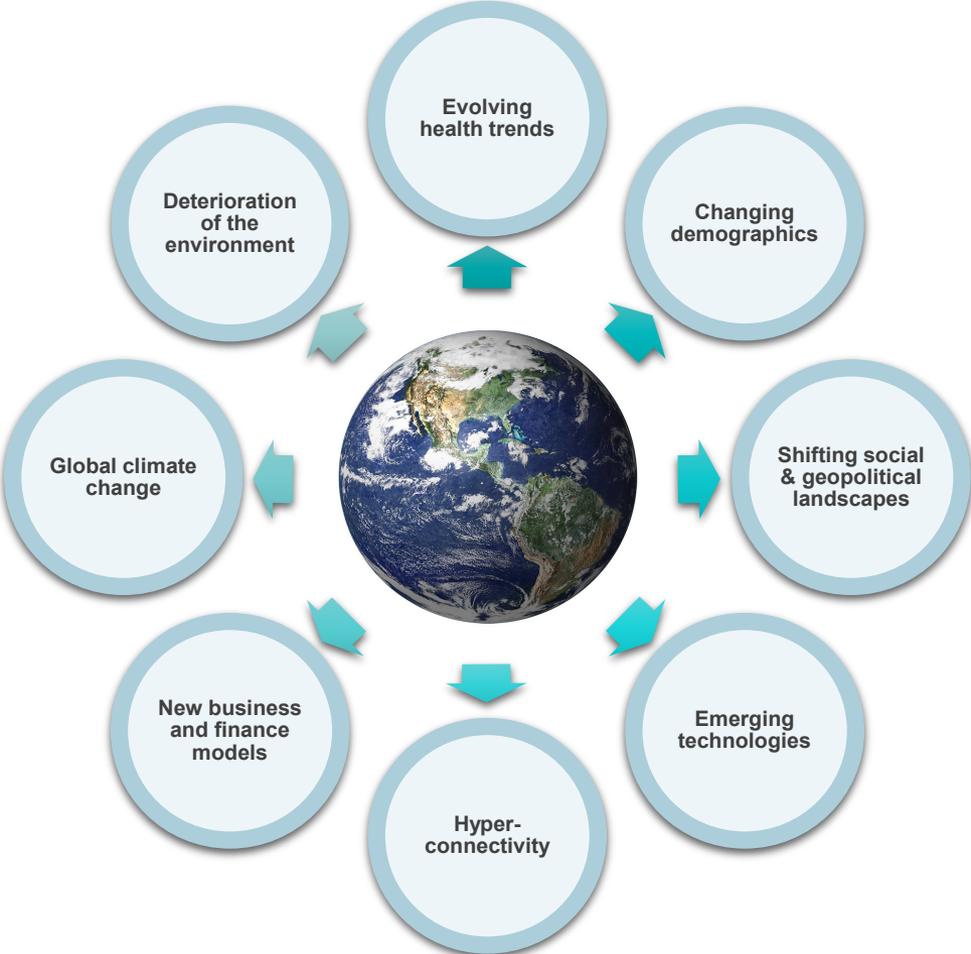
The information, statements, opinions, documents or any other material which is made available to you during this presentation are without any warranty, express or implied, including, but not limited to, warranties of correctness, of completeness, of fitness for any particular purpose.

Emerging Risks and Trends

- 1 **Emerging Risks – what are they and why do we care?**
- 2 Identification and assessment of Emerging Risks at SCOR
- 3 Modelling issues around Emerging Risks at SCOR
- 4 Emerging Risk – SCOR Radar 2019

The World is becoming more uncertain....

The Risk Universe is Expanding



Emerging Risks

Concept and Characteristics

Several Definitions - e.g. Lloyds Definition

"an issue that is perceived to be potentially significant but which may not be fully understood or allowed for in insurance terms and conditions, pricing, reserving or capital setting"

SCOR Definition - Qualities of Emerging Risks

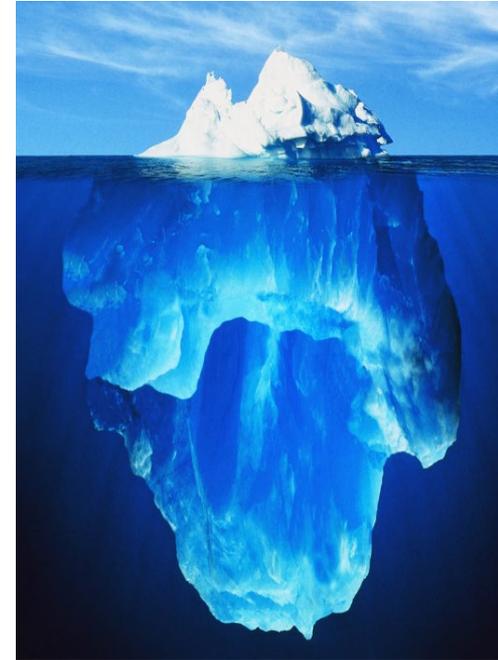
Emerging Risks (ER) present a **very high degree of uncertainty**

ER characteristics:

- Difficult to **quantify**
- Difficult to **assess** (frequency and severity)
- Difficult to **anticipate** potential future related claims and other consequences

Emerging risks include **new threats** but also **evolving risks**:

- Previously unknown risks
- Risks that are known but rapidly developing



So what? Why should re/insurers care?

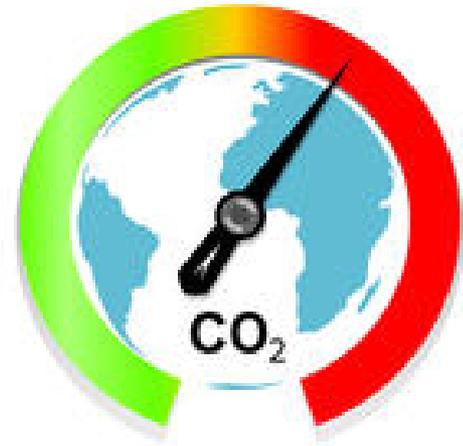
a. Emerging Risks have potential negative impacts on in-force business

E.g. Climate Change Impacts

- **Property Re/insurance**
More frequent claims from natural catastrophes – challenging future business profitability
- **Casualty Re/insurance**
Litigation of non-renewable energy companies for contribution to C emissions and consequences on society; impacts on health and healthcare costs – workers compensation lines
- **Life Re/insurance**
Impacts of heat waves on mortality/ chronic conditions; changing patterns of disease occurrence due to vector migration (e.g. mosquitos)

E.g. Human Exposure to Harmful Chemicals

- **Casualty Re/insurance**
Increasing instances of litigations against companies due to use of potentially harmful chemicals in their products:
 - Glyphosate (e.g. Bayer - Monsanto)
 - Talc (Johnson & Johnson)
- **Life Re/insurance**
Impacts of long term mortality trends – increasing occurrence of chronic conditions such as cancer



shutterstock · 185053544



So what? Why should re/insurers care?

b. Emerging Risks provide raw material for new re/insurance solutions

Cyber

Presents one of the biggest opportunities for the re/insurance industry;

- **+ve:** increasing demand for insurance solutions as the frequency and severity of cyber threats is set to increase
- **??** gaps in understanding of risk – limited modelling solutions and therefore difficulties around loss estimation and risk pricing



New Technologies – e.g. Autonomous Vehicles

Re/insurance of autonomous cars will require new thinking around how the risk is underwritten;

- **+ve:** potential for decreasing claims frequency and therefore increased profitability (fewer accidents)
- **??** possibility for larger claims due to systemic system faults
- **??** assigning fault in the case of an accident



So what? Why should re/insurers care?

c. Consideration of emerging risks is important for supervisors and rating agencies

Re/insurance Regulatory Requirements

E.g. Solvency II

- Under SII, the risk management function is required to include the identification and assessment of emerging risks.
- SII encourages a forward-looking approach to risk management – considering future developments that could impact the business;
 - a company's Own Risk and Solvency Assessment (ORSA) should consider emerging risk management.

Rating Agencies

- Rating agencies consider treatment of emerging risks when rating the ERM framework of a re/insurer:
 - E.g. AM Best
 - “...The ERM program should also ensure that emerging risks identified within the organisation are properly fed back to the top.....”*
 - E.g. S&P
 - “The re/insurer has well-established processes for identifying and monitoring emerging risks, analyzing their significance and preparing for and/or potentially mitigating them.”*

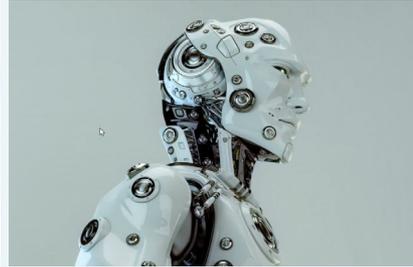
Emerging Risks and Trends

- 1 Emerging Risks – what are they and why do we care?
- 2 Identification and assessment of Emerging Risks at SCOR**
- 3 Modelling issues around Emerging Risks at SCOR
- 4 Emerging Risk – SCOR Radar 2019

Emerging Risk Management at SCOR

Emerging Risk Assessment Process – Part of SCOR's ERM Framework

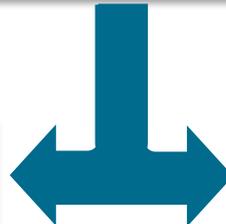
- The Emerging Risks process is open to **everybody at SCOR** via a collaborative internal website.



Emerging Risk Universe: 213 risks identified



Assessment in transversal panels
(Risk Management & Business Divisions)



Mitigation strategies to manage negative impacts

Identification of loss potential

Analysis of business opportunities

Implementation of new U/W products/process efficiencies

Risk Identification

SCORWatch Monthly Newsletter

- SCORWatch is a news database that can be searched using key words
- Topical subjects connected to emerging risks can be “tagged” (e.g. Opioids, Drones), used to produce a newsletter with articles linked to the identified risks
- This information is communicated to Emerging Risk “Observers” at SCOR

SCORWatchnews@scor.com | BERAUD Philippe
Emerging Risks monthly newsletter

SUMMARY

BI / CBI (ER n° 124)

BI & insurers/reinsurers
06/18 - GenRe / Property Business Interruption Insurance – a German Perspective: Quo vadis?
06/18 - Supply chain saviours (Inside Fac)

CBI & supply chain claims
28/06/18 - Panasonic évoque des pénuries de batteries pour la Model 3 de Tesla
17/06/18 - Brazil trucker strike hits suppliers of consumer staples

CBI global report & survey
25/06/18 - Gartner Releases Supply Chain Top 25, Including These with Perfect 10 CSR Score
08/06/18 - Focus: Working to understand supply chain risk (Insurance Day)
05/06/18 - White House Releases Report on Electricity Sector State of Preparedness to Cyber Attacks

Climatic risk and Co²

Climate change & risks (ER n° 54)
02/07/18 - Developing countries face rising payments due to climate change, says report
03/07/18 - Almost Half of South Asia Vulnerable to Climate 'Hotspots': World Bank
25/06/18 - 75% des sols de la planète sont dégradés selon le nouvel Atlas de la désertification
11/06/18 - Predicted environmental changes could significantly reduce global production of vegetables

Health & climate change
05/06/18 - BEH n°16-17/2018 : Comprendre et prévenir les impacts sanitaires de la chaleur dans un contexte de changement climatique

Sea level & coastal flood
04/07/18 - Flood damage costs under the sea level rise with warming of 1.5 °C and 2 °C (Environmental research)
13/06/18 - Antarctica ramps up sea level rise
13/06/18 - Climate change accelerating rise in sea levels

Climate change litigation
02/07/18 - Rhode Island Sues Oil Companies Over Climate Change, First State to Do So
25/06/18 - Droit du climat - réchauffement climatique
18/06/18 - Climate Change Lawsuits a Growing Threat: Opinion (Bloomberg)

Climate Finance
04/07/18 - Lane Financial - One Cost of Global Warming, the view from the ILS Market
01/07/18 - Gestion d'actifs; Les assureurs misent sur le vert (Tribune de l'Assurance)
18/06/18 - Meeting Paris climate targets will require a substantial reallocation of global investment
19/06/18 - Swiss Re, SCOR, AIG elected to EU Expert Group for Sustainable Finance (Reinsurance News)

Risk Assessment

Each Emerging Risk has a One-page Template

- The “spider” allows a quick visual assessment of:
 - Lack of understanding of risk
 - Legal uncertainty
 - Time horizon
 - Geographic scope
 - Market economic loss potential
 - Public awareness
 - Impact on SCOR main risk drivers
- General description of the topic
- Two scenarios are assessed for their impact on SCOR’s divisions and assets
- Outcome of the more severe scenario on SGP&C, SGL, and investments is shown as coloured bars
- Potential impact on SCOR’s operations and reputation is assessed
- Conclusions and recommendations, e.g. further analysis, mitigation actions, early warning systems

Radiofrequency Fields (previously EMF)

ER Number
172

External Macro view		SCOR potential impact assessment			
		Negligible	Low critical	Critical	Highly critical
		SGP&C scenario 1		SGP&C scenario 2	
		SGL scenario 1			
		SGL Scenario 1			
Average Macro assessment:		6,3		Potential impact for SCOR worst scenario:	
				Critical	
				Unlikely	
ER Class: Technology (inc. Cyber-risk)					
SCOR Class: Underwriting and Reserving risks					
Related Risks: ER 43		Business Continuity impact:		No	
		Reputation Risk:		No	
<p>Risk description: Radiofrequency fields (sometimes referred as the broader and more generic term “EMF”) can be emitted from sources such as (i) wireless (mobile and cordless) telephones ; (ii) environmental (e.g. television and radio broadcast antennas, cellular phone base stations or towers, wireless data networking equipment) sources and (iii) near-field occupational (e.g., high-frequency dielectric and induction heaters, radar).</p> <p>This multitude of sources, coupled with an increased public awareness in the absence of conclusive scientific evidence created a lot of background noise around the potential harm(s) that could occur.</p> <p>Mobile phone and Wi-Fi are classified as “possibly carcinogenic to humans”, like other radiofrequency electromagnetic fields, as per the World Health Organization. As of today, the consensus has not reached a threshold significant enough to be successfully brought into court as conclusive piece of evidence. Cases of brain cancers have not increased despite increase usage of cell phones, and the dynamic of science evidences do not suggest that radiofrequency-fields are causing cardiovascular diseases, cancer, and cognitive disorders.</p> <p>ERAG’s view of Radiofrequency Fields risks is informed by recent analysis from Praedicat, a RAND Corporation and RMS spin-off that data-mines 22 Million of peer-reviewed scientific literature on emerging risks.</p>					
<p>Assessment of the potential impact on SCOR: From a science perspective, within the present knowledge, there are not enough conclusive scientific evidences between the exposure to Radiofrequency Fields and cancers/injuries and it is difficult to estimate claims caused by Radiofrequency Fields.</p> <p>However, from a liability insurance perspective, four factors needs to be taken into consideration: 1. New scientific findings proving a causal relationship between Radiofrequency Fields and cancers/diseases 2. Changes in the social environment with implications on legislation and jurisprudence 3. There is an actual risk that pressure of interest groups including media promote a gradual transition from liability based on fault to liability based on presumption or suspicion 4. First judgements at court (France, Italy) creating a legal precedent</p> <p>On the P&C product liability side, potential plaintiffs and defendants could be part of the Wireless telecommunication industry, or be involved in the production chain of mobile phone manufacturing (eg in the Fortune 500: Apple, Google, Panasonic, Toshiba, Texas Instruments, Crown Castle, etc). Consumers could also represent a vast pool of plaintiffs. The last in-depth Radiofrequency Fields study was conducted in 2009 by SGP&C (D. Fort and R. Roesch). Here, the Scenario 1 refers to the 2009 realistic scenario, with an estimated SCOR loss of 22M at this time. The scenario 2 refers to the 2009 worst case scenario, with estimated SCOR losses of 178Mio (worst case scenario at 1/250), and 690M (worst case scenario at 1/1000) at this time.</p> <p>For SGL, in principle, increased incidence rates of certain medical conditions related to radio-frequency field exposure would lead to higher claims ratios, such as on death, disability or critical illness covers. Changes in the legal landscape only would not affect SGL.</p>					
<p>Conclusions & Recommendations: SCOR follows with attention the legal, social and scientific changes in respect of Radiofrequency Fields. Since the above study, actions have been taken to address the issue in SGP&C’s WW underwriting guidelines. Nevertheless the impact is still uncertain since: first law suits are being filed against cell phone manufacturers for alleged injury, potential “class actions” are becoming possible in Europe (France) and new scientific studies keep being issued. If deemed necessary, it could be proposed to refresh the 2 scenarios from the 2009 study, in order to re-assess the risk, taking into account the change in SCOR portfolio over the last years.</p>					
<p>Actions taken: Ongoing monitoring, with the support of Praedicat analysis.</p>					

Outcomes

Reporting to Management Aiding Strategic Decision-making

- Quarterly reporting to the **Group Risk Committee**
- Quarterly reporting to the **Board Risk Committee**
- Annual reporting – **Emerging Risk Report**
 - Developing business case initiatives
 - Developing mitigation strategies for negative risk exposures (introducing sub-limits, exclusions, purchasing retrocession)



SCOR participates in the CRO Forum Emerging Risks Initiative (ERI)

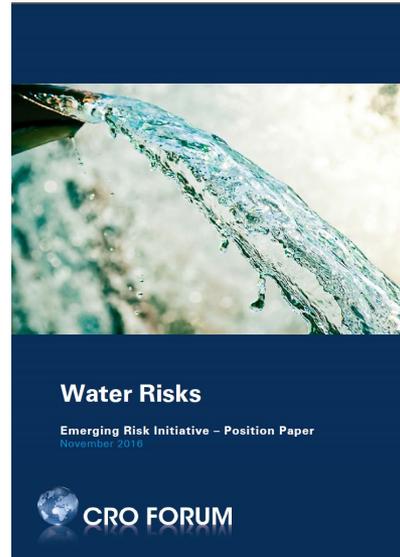
- SCOR is member of the ERI since 2014 and has been chairing it in 2016 and 2017.
- The ERI group includes major insurers and reinsurers:
Allianz, AXA, Generali, Hannover Re, Lloyd's, Nationale Nederlanden, Munich Re, Old Mutual, Prudential, RSA, Uniqua, SCOR, Swiss Re, Zurich Insurance.

Annual position papers going back

The 2018 **ERI position paper** will be focusing on 'Climate Change – Tipping Points and Extreme Weather Patterns' (expected November 2018)



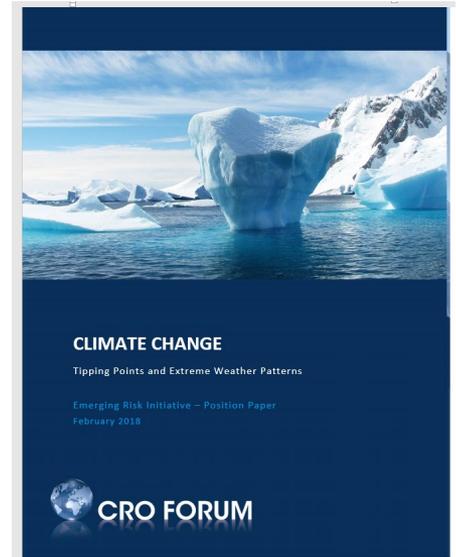
2015 – The Smart Factory



2016 – Water Risks



2017 – Autonomous Machines



2018 – Climate Change
To be released end of 2018

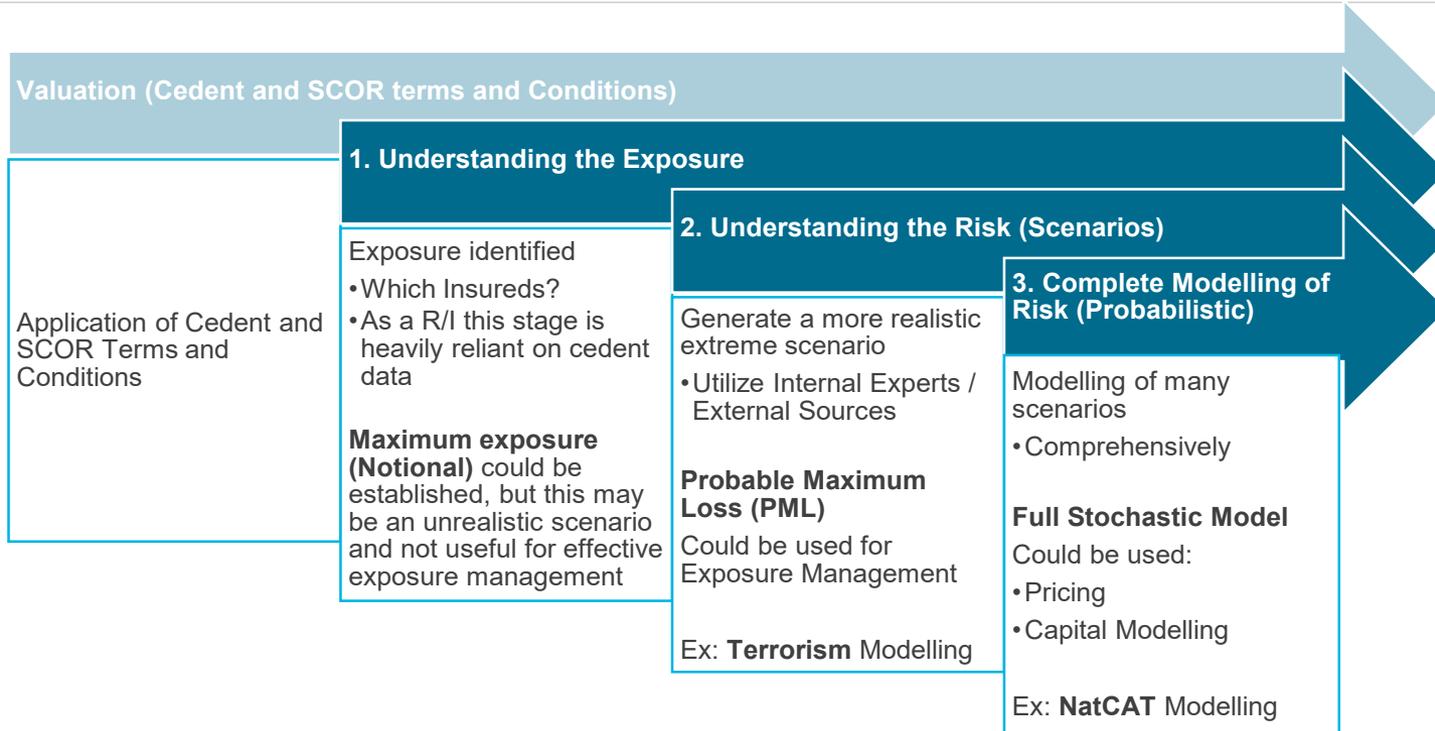
Emerging Risks and Trends

- 1 Emerging Risks – what are they and why do we care?
- 2 Identification and assessment of Emerging Risks at SCOR
- 3 Modelling issues around Emerging Risks at SCOR**
- 4 Emerging Risk – SCOR Radar 2019

Risk Map Process

Context	<ul style="list-style-type: none">❑ The SCOR risk map captures the risks SCOR is exposed to and confirms whether the material quantifiable risks* are included in the internal model and, together with results of the validation, supports the demonstration of the completeness of the internal model.❑ It covers SCOR Group and the legal entities using the internal model under SII).
Risk Map Process	<ul style="list-style-type: none">❑ Targeted quarterly reviews are performed which focussed on the identification of material changes in :<ul style="list-style-type: none">▪ the risks SCOR is exposed to,▪ the coverage of the internal model, and/ or▪ the expected materiality of non-modelled risks❑ A annual comprehensive review
Main Outcomes	<ul style="list-style-type: none">❑ Based on targeted reviews completed and the work performed for the comprehensive review, SCOR has not identified any material changes in the risks to which it is exposed, internal model coverage or expected materiality of non-modelled risks which would lead to a change in the assessment of the completeness of the internal model.

Expected Evolution of the modelling of Emerging Risks



1. Understanding the Exposure

- Even with this limited information, the urgency in refining policy / contract wording would be made more clear.

2. Understanding the Risk

- More informed decisions could be made. Extreme scenarios that are indicative of a PML could enable comfort on underwriting risk in a limited capacity

3. Complete Modelling of Risk (Probabilistic)

- Risk could be more credibly priced and exposure fully controlled

Most material modelling Issues

Unsurprisingly it is DATA related

Techniques for handling large volumes of data have revisited given that technology has caught up.
Big Data Solutions avail, but access to the data is needed.

Issue	Further Detail
Exposure Data	<p>Can we access the required insured risk information from our cedents / brokers? As a Reinsurer, we rely on access to the individual insured risks</p> <ul style="list-style-type: none"> • Requires some effort – key is standardisation and automation • Data Privacy concerns need to be adhered <p>Does the cedent have the required information?</p> <ul style="list-style-type: none"> • For emerging risks it may not have been the practice to request the relevant information from the insured. (e.g. Silent Cyber)
Risk Data	<p>Do we have access to the data to model the risk? Modelling of the Risk could either evolve from</p> <ul style="list-style-type: none"> • Specialized Vendor Tools. Examples: <ul style="list-style-type: none"> • RMS for Terrorism • Praedicat for exposure to large potential US Tort cases • Bespoke Internal Models. Example: <ul style="list-style-type: none"> • Nat CAT Peril Regions not modelled in Vendor Tools (Flood in China) <p>Choice is largely a function of who has better access to data, but accessing this data can be a challenge</p>
Managing Expectations	<p>Data quality and Data Access challenges means that It takes time.....</p> <ul style="list-style-type: none"> • This is largely a constraint related to how quickly credible data could be accessed and understood • Data quality challenges will always exist and the bigger the data, the bigger the challenge

Emerging Risks and Trends

- 1 Emerging Risks – what are they and why do we care?
- 2 Identification and assessment of Emerging Risks at SCOR
- 3 Modelling issues around Emerging Risks at SCOR
- 4 Emerging Risk – SCOR Radar 2019**

Conclusion



Emerging risks are a key component of strategic decision making.



Emerging risk identification and assessment requires involvement of staff across a broad range of company disciplines.



The challenge for insurers is to manage the downsides of emerging risk while seizing opportunities to provide new solutions and support for their clients.

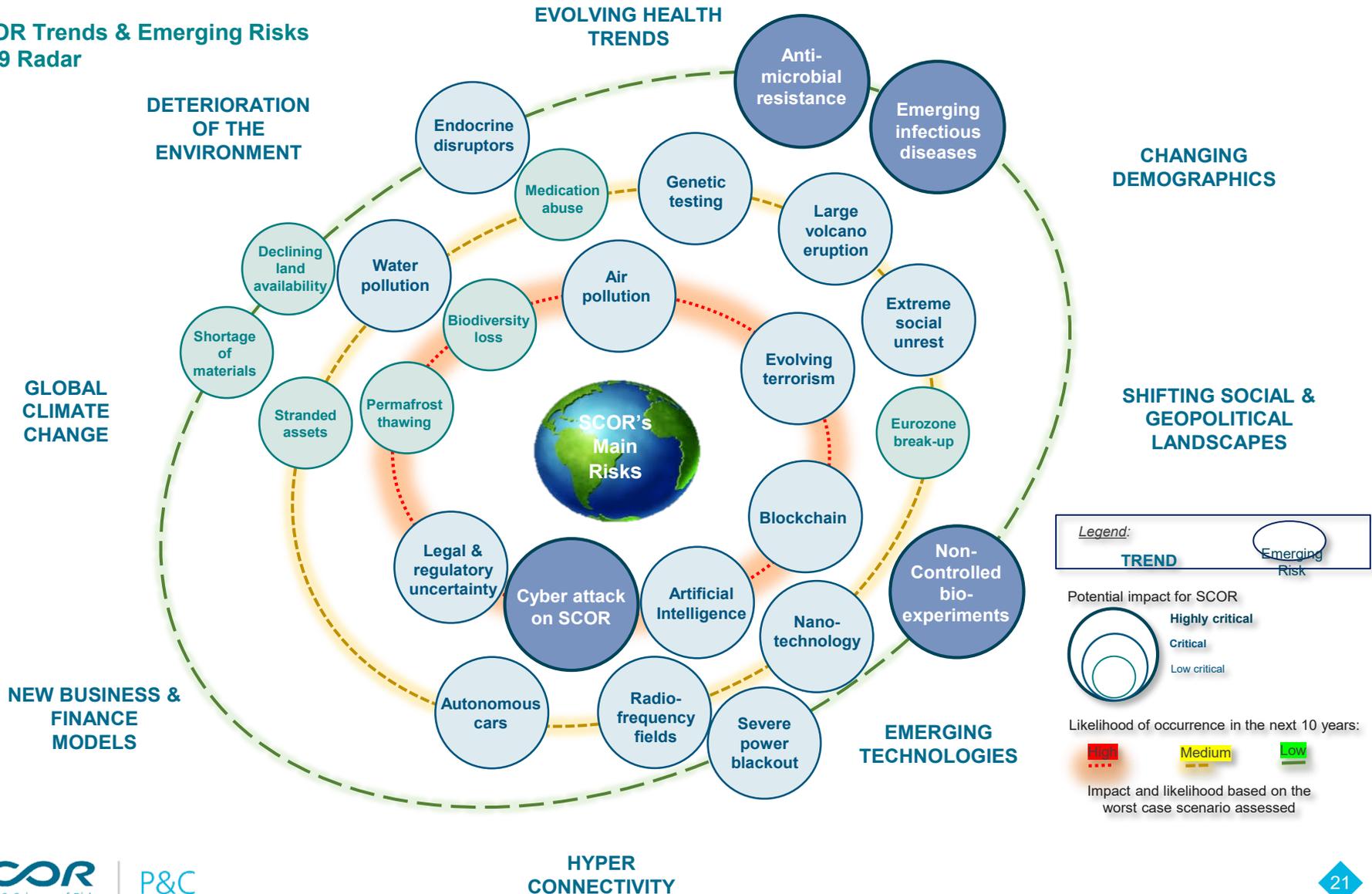


Data, both for Exposure and Risk remain the largest modelling challenges

Outcomes

SCOR's Emerging Risks Radar

SCOR Trends & Emerging Risks 2019 Radar



Questions & Answers



APPENDIX / BACKUP

Selected Emerging Risks with relevance for non-life insurance companies

Risks	Description and potential on non-life (re)insurance industry
-------	--

TRENDS: Emerging Technologies; Hyperconnectivity; New Business & Finance Models

Nano-technologies	<p>Specific attention on 3 types of Nanos with possible impact on human health or environmental hazards: Carbon nanotubes and fibres (CNT & CNF), nanosilver and nano-TiO₂.</p> <p>→ Most Exposed LoBs would be Workers Comp. / Employers Liability, followed by Environmental, Product Liability.</p>
Autonomous Vehicles	<p>Real full self-driving not expected to be significant before 2025. Expected new risks, public fear and scepticism.</p> <p>Motor Third Party Liability Insurance (MTPL) is the main LoBs impacted: it could trigger a drop in frequency from improved safety devices and an increase in liability claims against manufacturers (product liability)</p> <p>→ Major threat: potential deterioration of MTPL long term reserves and/or the occurrence of an annual aggregation of a serial loss.</p>
Blockchain	<p>Decentralized, open database which users can access directly without a bank as intermediary. This technology can affect all economic sectors where relationships (i) generate contracts, (ii) need a trusted third-party –“le tiers de confiance”, – and (iii) can be easily dematerialized. These features are particularly relevant for financial services, banking, insurance, legal, compliance and administration.</p> <p>→ Short term, no particular risk. Medium/long term opportunity for the insurance industry to reduce frictional costs and speed up transactions, and so also impacting reinsurer's business processes and potentially also their business models.</p>
Cyber Risks	<p>Cyber exposures are twofold:</p> <ul style="list-style-type: none"> - from a malicious attack on IT systems. On the regulatory side, a new EU regulation, the General Data Protection Regulation (GDPR), will start on 25 May 2018: companies that fail to efficiently protect personal data could face fines up to 4% of the revenue, which could represent a substantial risk for (re)insurers. - from the in-force book of business through silent cover on insurance policies or through specific cyber covers given by (re)insurers. From an insurance perspective, there are distinct challenges in assessing and attempting to quantify potential cyber exposures both affirmative (specific cyber cover) and silent (no specific exclusions).
3D Printing	<p>→ Potential for a severe liability loss, with intellectual property loss implications. Impacts can be widespread.</p>

TRENDS: Changing Demographics; Shifting Social & Geopolitical Landscapes

Extreme Social Unrest	<p>Expected decrease in government stability in the next three years, with investors in developing markets most susceptible to negative shifts. Businesses and investors used to the traditionally stable markets of Europe will need to adapt the most.</p> <p>→ Exposure to war and social unrest may vary on a case by case basis</p>
Eurozone Break-up	<p>2016 marked by major political and geopolitical events: Brexit in June and Election of Donald Trump in November. With upcoming elections in various countries in Europe, growing risk of pressure on the European Union (EU) and the likelihood of its collapse cannot be ignored (France, Germany, Italy).</p> <p>→ Potential impacts on (re)insurers may vary on a case by case basis</p>

TRENDS: Global Climate Change; Deterioration of the Environment

Permafrost Thawing	<p>As an effect of global warming, Arctic region warmed at more than double the world average rate of increase, and so permafrost in the Arctic region starts to thaw.</p> <p>Need to further evaluate the potential risks for which insurance coverages would respond, e.g. engineering works, property losses, and exposures to pollution such as pipeline rupture, clean-up costs, or containment structures that are installed on frozen grounds.</p> <p>→ Limited impact expected at this stage.</p>
---------------------------	---

Quantifying Impacts of Emerging Risks

Footprint assessment provides a tool suited to the quantification of impacts from Emerging Risks

- Scenario analysis is a useful method to estimate extreme losses in the absence of a reliable model
- The technique takes an imagine extreme event (or extreme historic event) and estimates losses from the event based on the company's underlying exposure
 - + the technique is conceptually easy to understand
 - - no concept of frequency as no return period attached to the event



SCOR analyses a variety of both historic and hypothetical “worst case” scenarios/stress tests on a frequent basis

- SCOR has analysed **17 past Nat Cat events**, including several major North America quakes, North Atlantic Hurricanes, Japan quakes, Japan Typhoon, Europe Windstorms and Europe Quakes but also non-peak events (earthquakes in China, Turkey and Peru).
- SCOR is regularly assessing the impact of hypothetical scenarios:
 - a coordinated wave of 6 **conventional terrorist attacks** (in New York City, Tokyo, Frankfurt, London, Washington D.C., Paris)
 - a **chemical attack**, using Sarin gas or VX, in the Madison Square Stadium (New York City)
 - the emergence over 10 to 20 years of a **resistance to antibiotics**
 - scenarios of **cyber accumulation** (leading to losses for the P&C division and SCOR's own operations)
 - hypothetical combinations of Nat Cat events occurring in a given year, that are used to test the resilience of SCOR's retro program
 - sensitivity tests of SCOR's Solvency Ratio to various market and credit risk stresses.

Examples of Some Recent Footprint Scenarios

Chemical Terrorism Event - Nerve Agent Release in Madison Square Garden

- Scenario assessed was that of a terrorist attack, releasing a nerve agent (100 kg Sarin gas) via the heating ventilation & air conditioning system of a concert hall (capacity c. 20,000) during an '80s rock concert.
- Analysis of toxic effects of the gas (median lethal dose), factors influencing outcomes and likelihood of event to occur.

➤ Impacts analysed on following

1. Impact on SCOR's business (P&C treaties, Specialty reinsurance (SBS), SCOR Channel syndicate and Life business)
2. Economic loss estimate
3. Impact on Group's solvency & financial flexibility
4. Impact on Group's rating
5. Liquidity strain
6. Impact on Group's operations

➤ Overall conclusions

Scenario overall severity: **Low**
Scenario likelihood: **Very unlikely**



Scenario class: Terrorism (non-historical)
Teams involved: Life Retro team, P&C risk management, P&C U/W management, Rating team, Senior Economist, Group Risk management

Examples of Some Recent Footprint Scenarios

Affirmative Cyber Scenario: SCOR Cloud Service Provider Outage

- Scenario assessed a cyber attack on Amazon Web Services, a major Cloud Service Provider (CSP) with data centres worldwide.
- The cyber attack consists of a malware released into Amazon's network, rapidly self-replicating and causing extensive system damage.
- **Two scenarios** assessed:
 - Extreme (duration of outage between 3 and 6 days)
 - Very extreme (duration of outage between 5.5 – 11 days)

➤ Impacts assessed on

1. Business:
 - Data loss and exposure to treaties with cyber covers
 - Business interruption costs
2. Impact on Group's operations
3. Economic loss estimate
4. Impact on Group's solvency & financial flexibility
5. Impact on Group's rating
6. Liquidity strain

➤ Overall conclusions

Overall severity: **Low**

Overall assessment: **Main impact on P&C underwriting (treaties)**

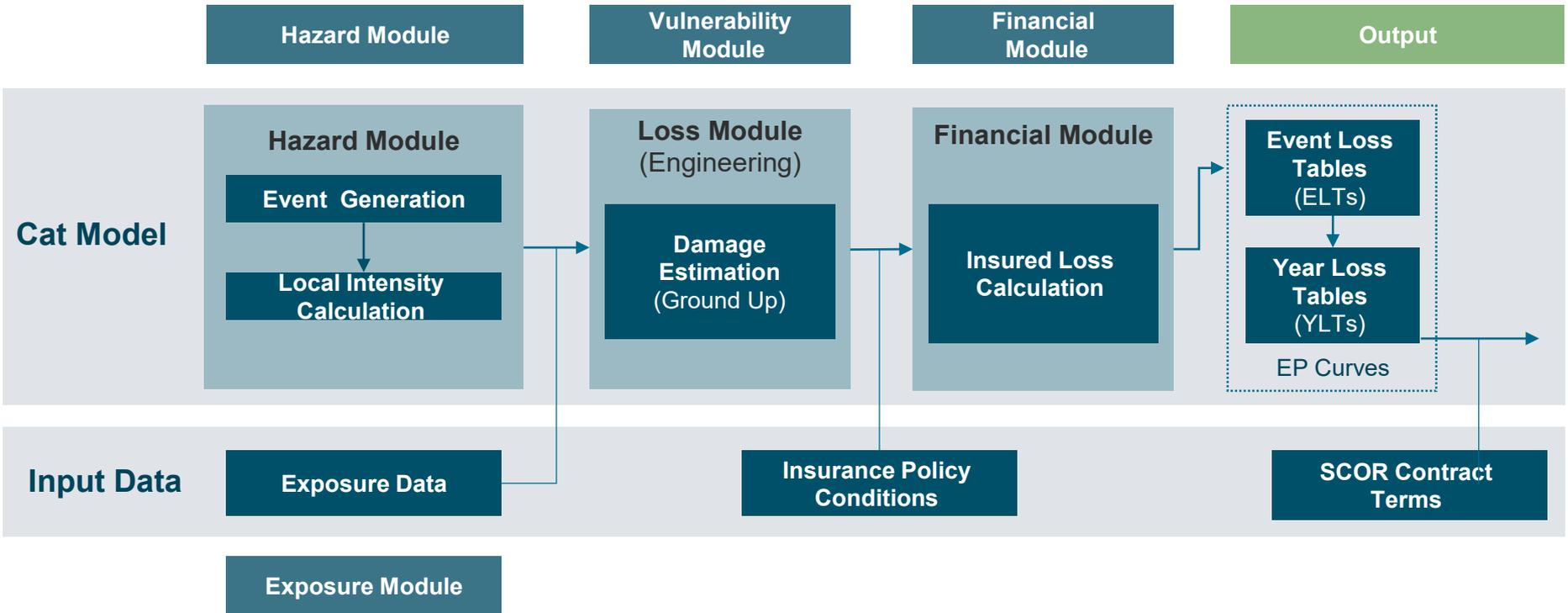


Scenario class: Affirmative Cyber (non-historical)
Teams involved: P&C Cyber Working Group, Group Risk Management, Life Risk Management, Senior Economist

Target Model

NAT CAT is relatively mature in its modelling for many peril regions

Overview – standard vendor model construction



Exposure:

- **Exposure Module:** is well understood for most major peril regions
- **Hazard Module:** Captures additional characteristics of the detailed exposure that could mitigate or exacerbate the exposure
- **Financial Module:** (Re)Insurance Terms and Conditions required to determine the appropriate Financial Impact.

Risk:

- **Hazard Module:** Important for the probabilistic modelling of events