Emerging Risks and the Role of Insurance

November 20, 2014

Buckeye Actuarial Continuing Education Meeting

Columbus, OH

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Agenda

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- Emerging Risks – Defined
- Importance of Emerging Risks
- Nanotechnology
- Climate Change
- Challenges / Opportunities / Wrap Up

Introduction

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"All is in flux, nothing stands still." - Heraclitus

"No one really knows enough to be a pessimist." - Norman Cousins

"The Times they are a-changin" – Bob Dylan

"Everybody has a plan until they get punched in the nose" – Mike Tyson

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"The future ain't what it used to be"

- L. Berra

Defining Emerging Risk
Life Span of Emerging Risks

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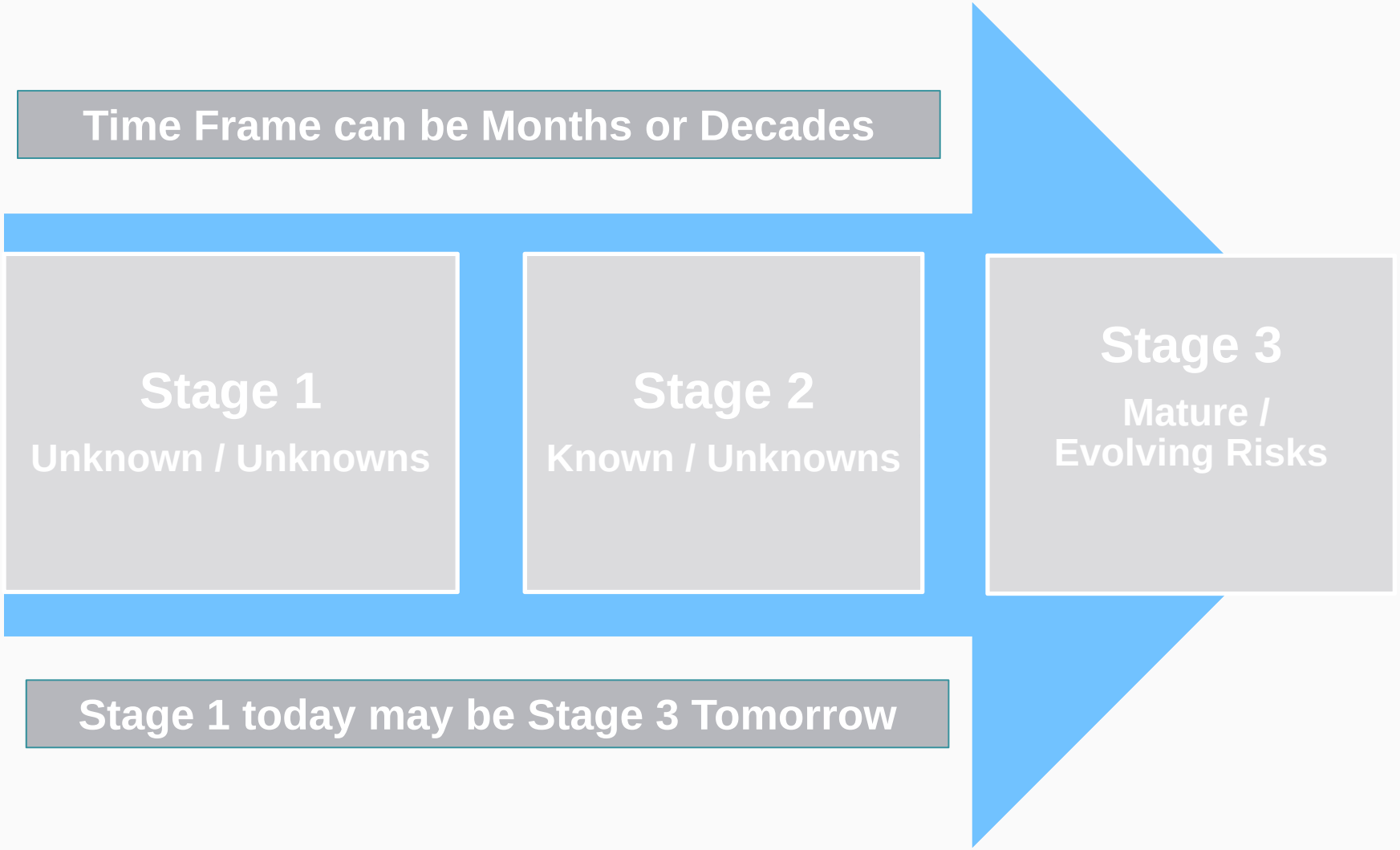

Risk Dimensions
The “Lahnstein Cube”

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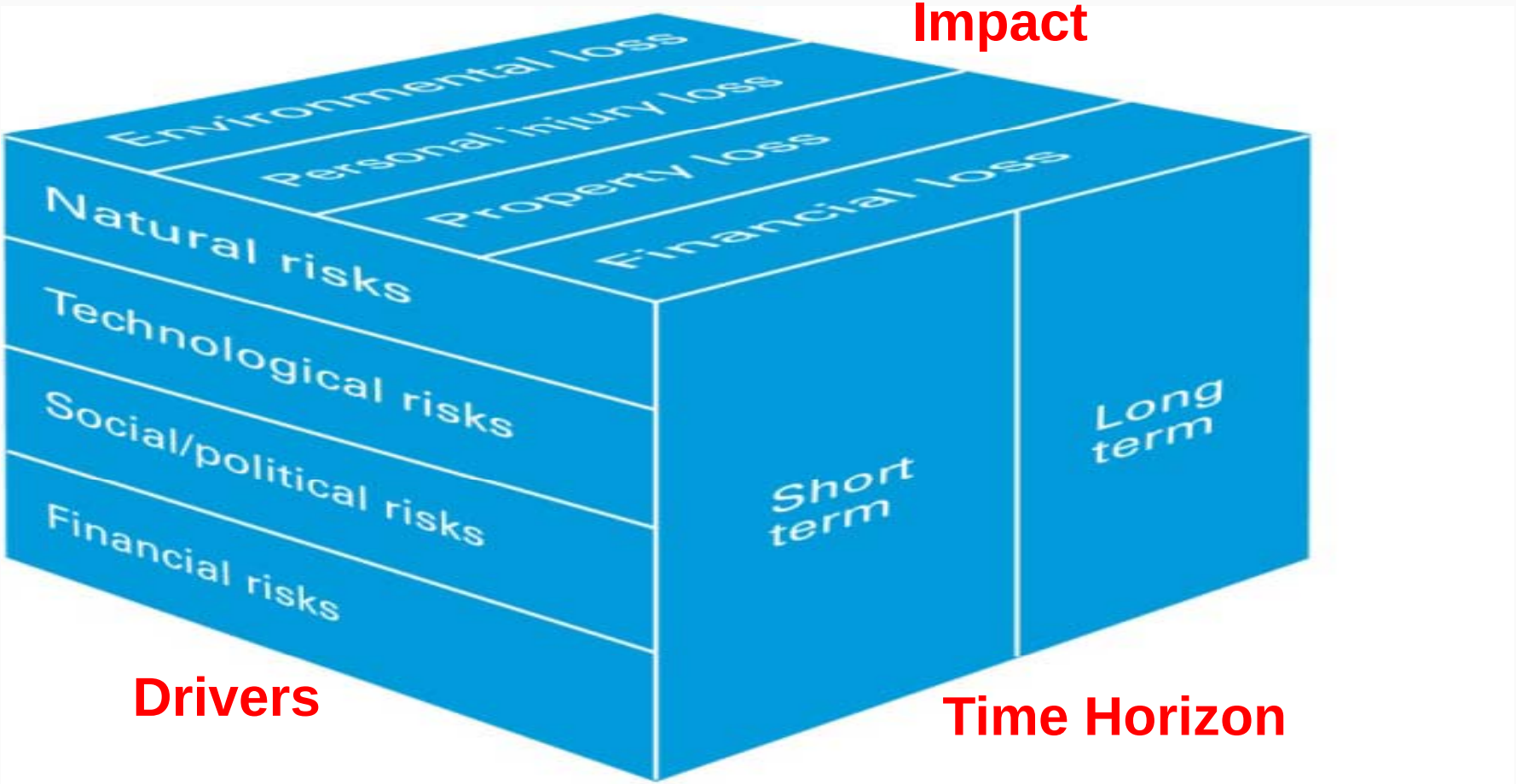

Christian Lahnstein, Department Head, Risk, liability and Insurance, Munich RE

Emerging Risk Drivers

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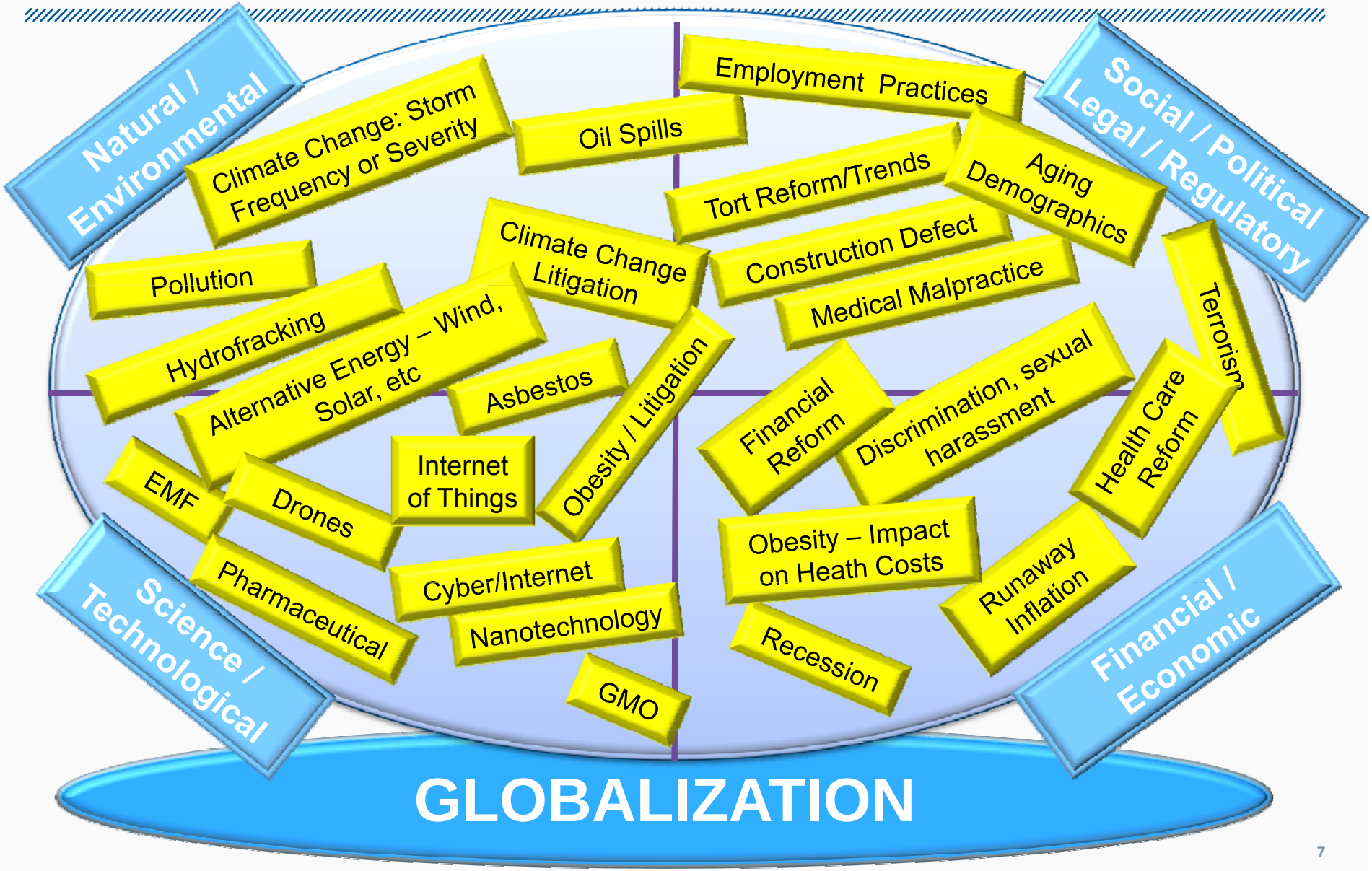

Examples of Global Emerging Risk Trends
Increasing Complexity and Interdependencies

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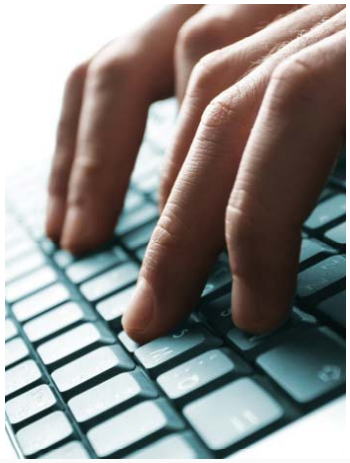
New technologies	Globalization/ Urbanization	Climate change/ Scarcity of resources	Increased regulation/ Market volatility	Changing demographics/ Lifestyles





Speed of transition and future impact hard to forecast…….

……..Insurance Implications are Significant

Defining Emerging Risk
What is an Emerging Risk?

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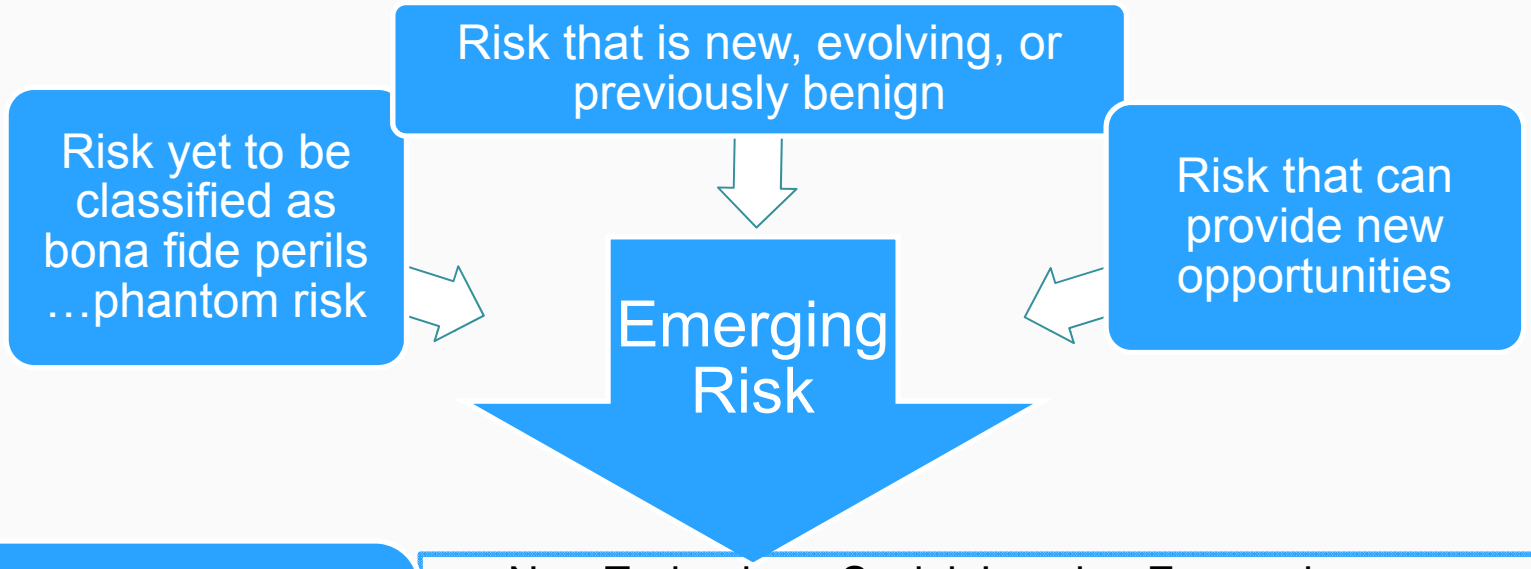

Risk Perspective

- New Technology, Social, Legal or Economic developments
- Established, highly complex industries (e.g. Asbestos), that require a global empirical analysis aimed at developing intelligent strategies.

Insurance Perspective

- A risk that is neither contemplated by the current coverage being offered nor in the premium being charged for the policy
- A risk where coverage is desired but not addressed in existing policy forms

Why is it important to understand Emerging Risks?

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- Insureds Expect Coverage ….. for what's around the corner
- Our business is Assuming and Financing Risk ….Support Economic Growth
- Emerging Risks Impact All Insurers
- We need to be experts in both known & emerging risks.
- Goal: Assume Risks, Manage Impact, Grow Profits

Key: Emerging Exposures = Systemic Reserve Risk

Importance
Emerging Risks = Systemic Risk

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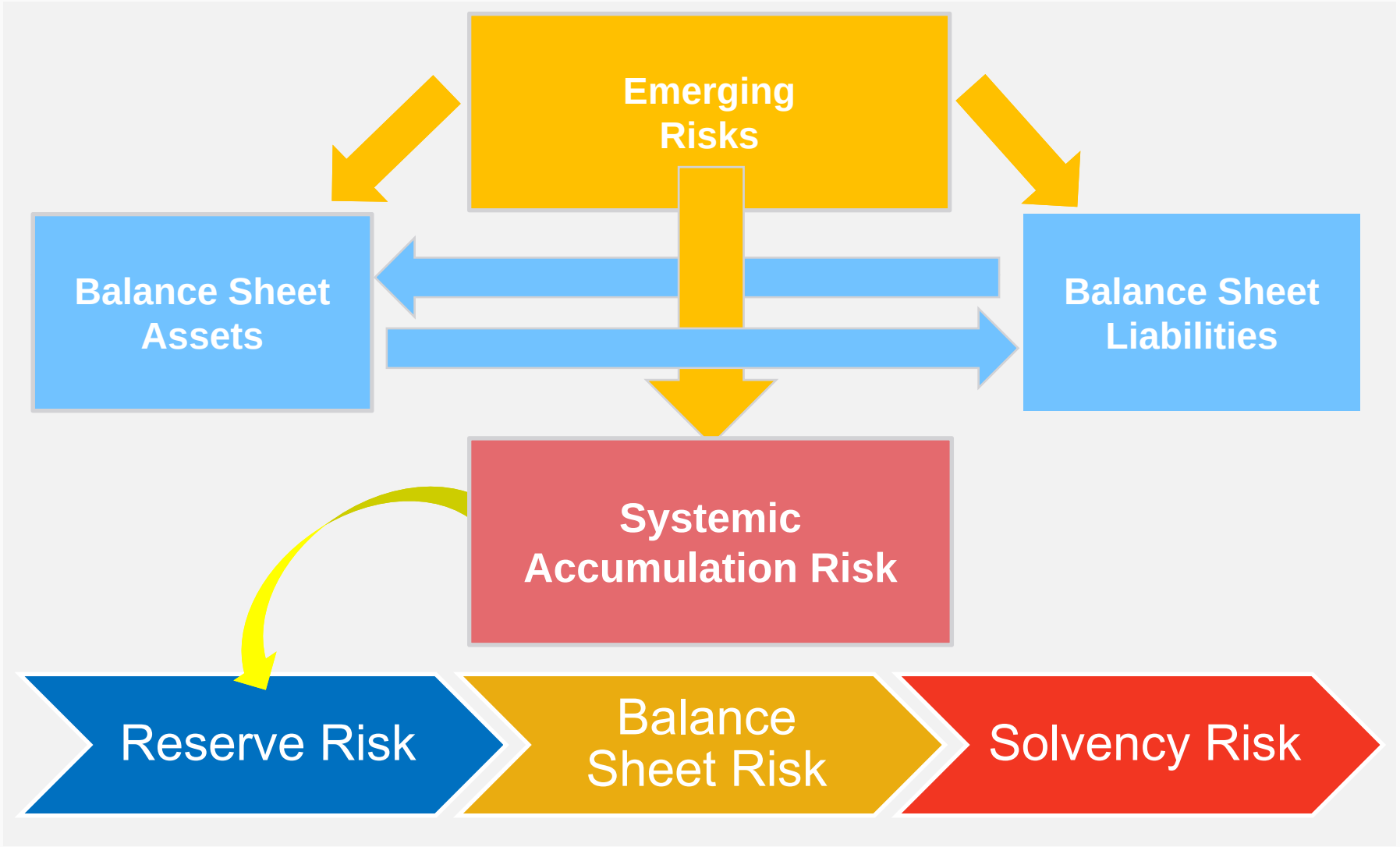

Emerging Risks
A High Level Look at a Sample of Emerging Risks

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Manufacturing / Nanotechnology

Climate Change

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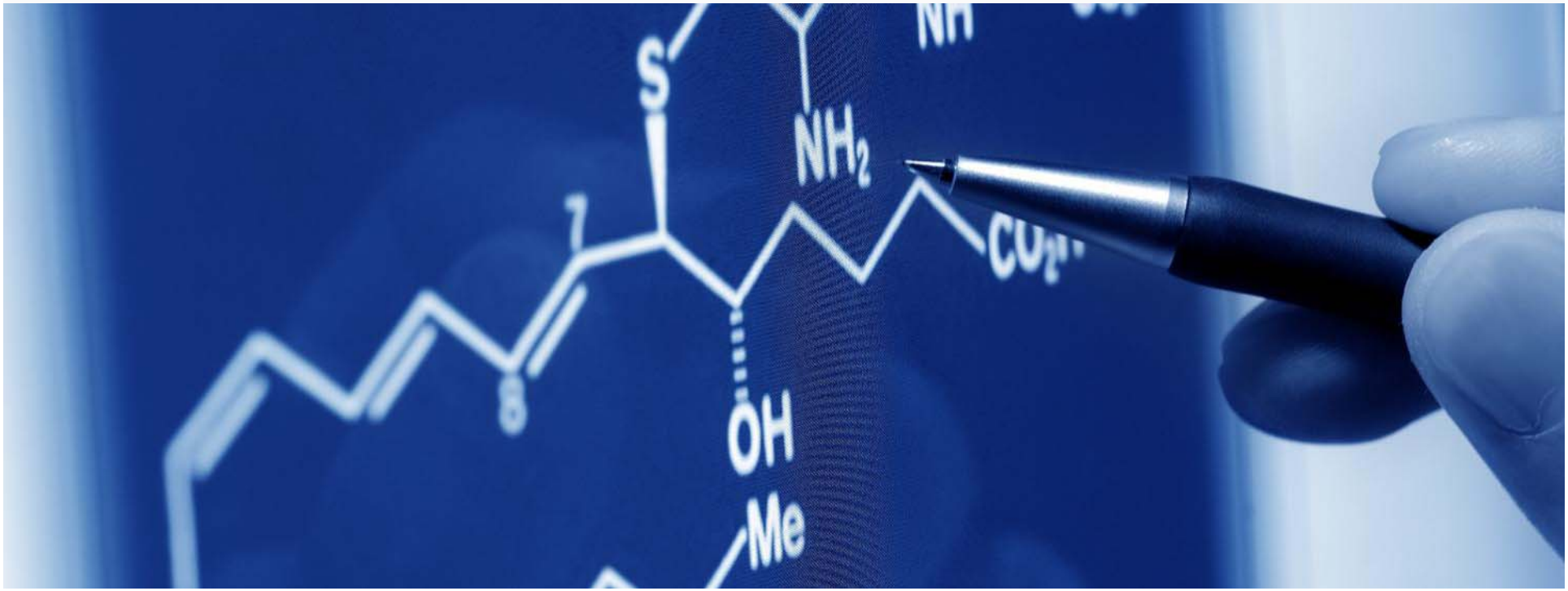
NANOTECHNOLOGY

The Future of Manufacturing



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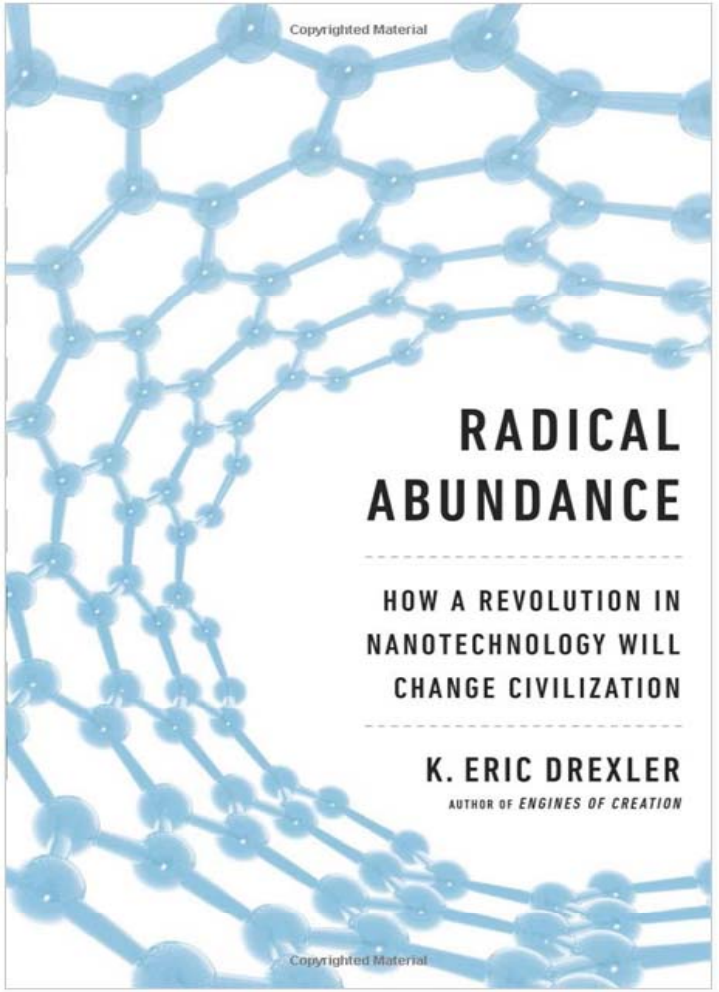
K. Eric Drexler :

- *PHD, Molecular Nanotechnology, MIT*
- Founding Father of Nanotechnology?
- Introduced the concept of Nanotechnology in in 1981 paper in the *Proceedings of the National Academy of Sciences.*

Other Published Works:

- *Engines of Creation* (1986)
- *Unbounding the Future* (1991)
- Nanosystems: Molecular Machinery Manufacturing and Computation (1992 doctoral thesis,)
- *Engines of Creation 2.0: The Coming Era of* (2007)
- *Radical Abundance (*2013)



Nanotechnology
Its Place in History

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Hunters and Gatherers – Nomadic; Unstructured

Agricultural Revolution – Provided the means to grow food; Basis for Societies and Civilizations

Industrial Revolution – Provided the means for producing material objects; mechanical systems; modern economy

Information Revolution – Provided the means to create, store, disseminate information and knowledge at increasing rates

Nanotechnology Revolution – Using all of the above will generate new means for producing material objects with quality and characteristics beyond prior capability

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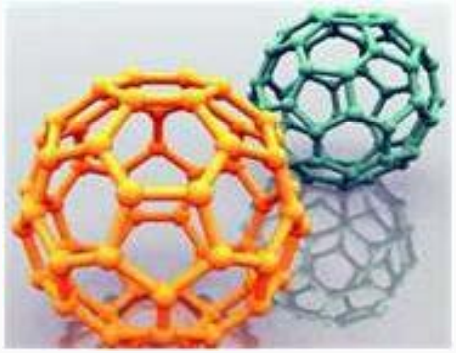
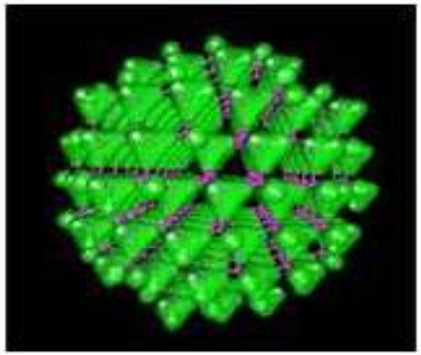
Nanotechnology …
Is the least discussed, most important
Emerging Technology today.





It will redefine manufacturing ……
……and in the process
touch every aspect of society…..
....for the most part making it better……
…...but not without risk

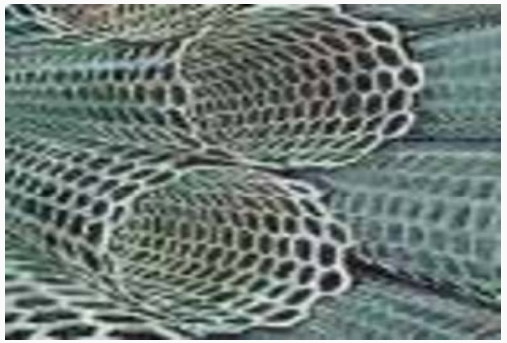


Image source: National Nanotechnology Initiative

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National Nanotechnology Initiative

- Nanotechnology is the understanding and control of matter at the nanoscale, at dimensions between approximately 1 and 100 nanometers (1 Billionth of a Meter), where unique phenomena enable novel applications.

- Encompassing nanoscale science, engineering, and technology, nanotechnology involves imaging, measuring, modeling and manipulating matter.

Image source: National Nanotechnology Initiative

Size of the Nanoscale

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Comparative size chart

Source: NNI

Understanding the Key Terms

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"Nanotechnology" = Totality of techniques used in the investigation, production, processing and use of …

"Nanomaterial" = Specific nano substance used in the manufacturing process leading to…

"Nanoproducts" = Products/Processes that contain knowingly manufactured or utilized functional nano components.

Nanotechnology Value Chain ……a Manufacturing Process

Nanomaterials	Nanotools	Nanoproducts
▪ Minimally processed ▪ Engineered nanostructures – e.g., quantum dots; silver; nanoparticles; nanotubes; polymers	▪ Intermediate products ▪ Incorporate nanomaterials or material constructed at a nanoscale	▪ Finished goods ▪ Incorporate nanomaterials or nanointermediates

Nanotechnology is a new industry that impacts many other industries and has enormous positive potential as well as challenges

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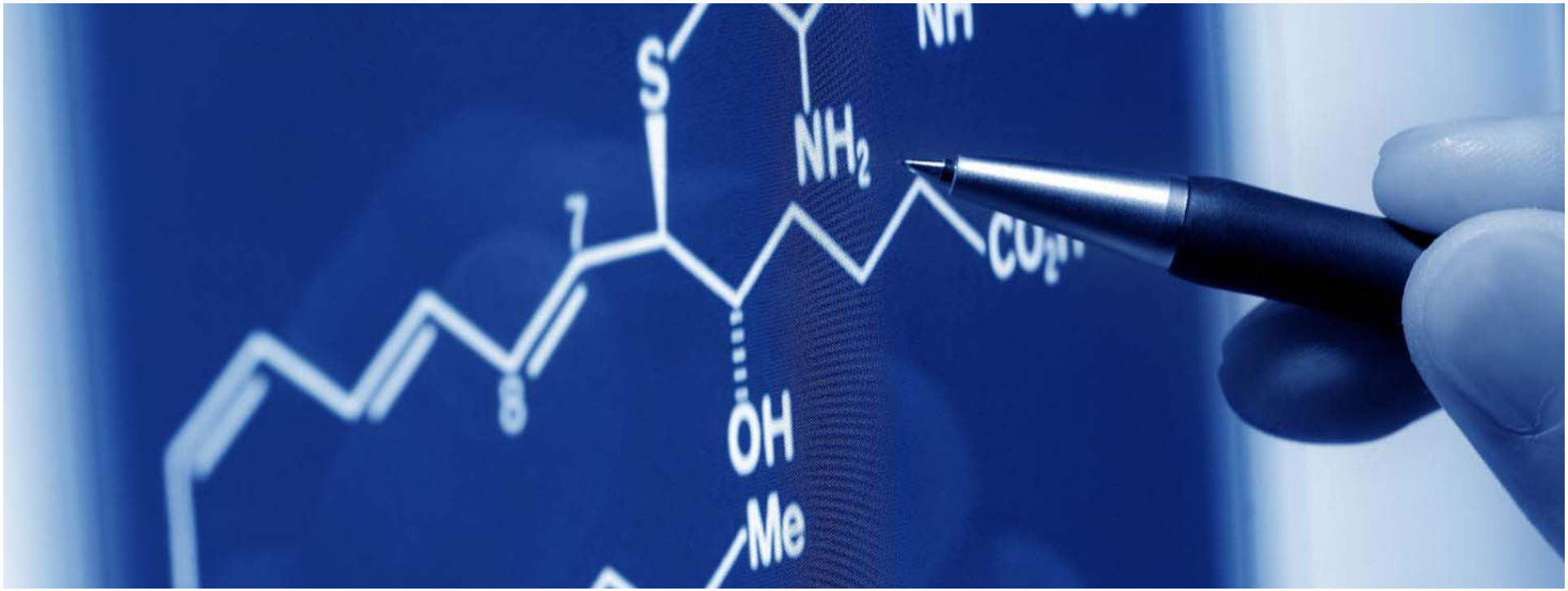
NANOTECHNOLOGY MARKET



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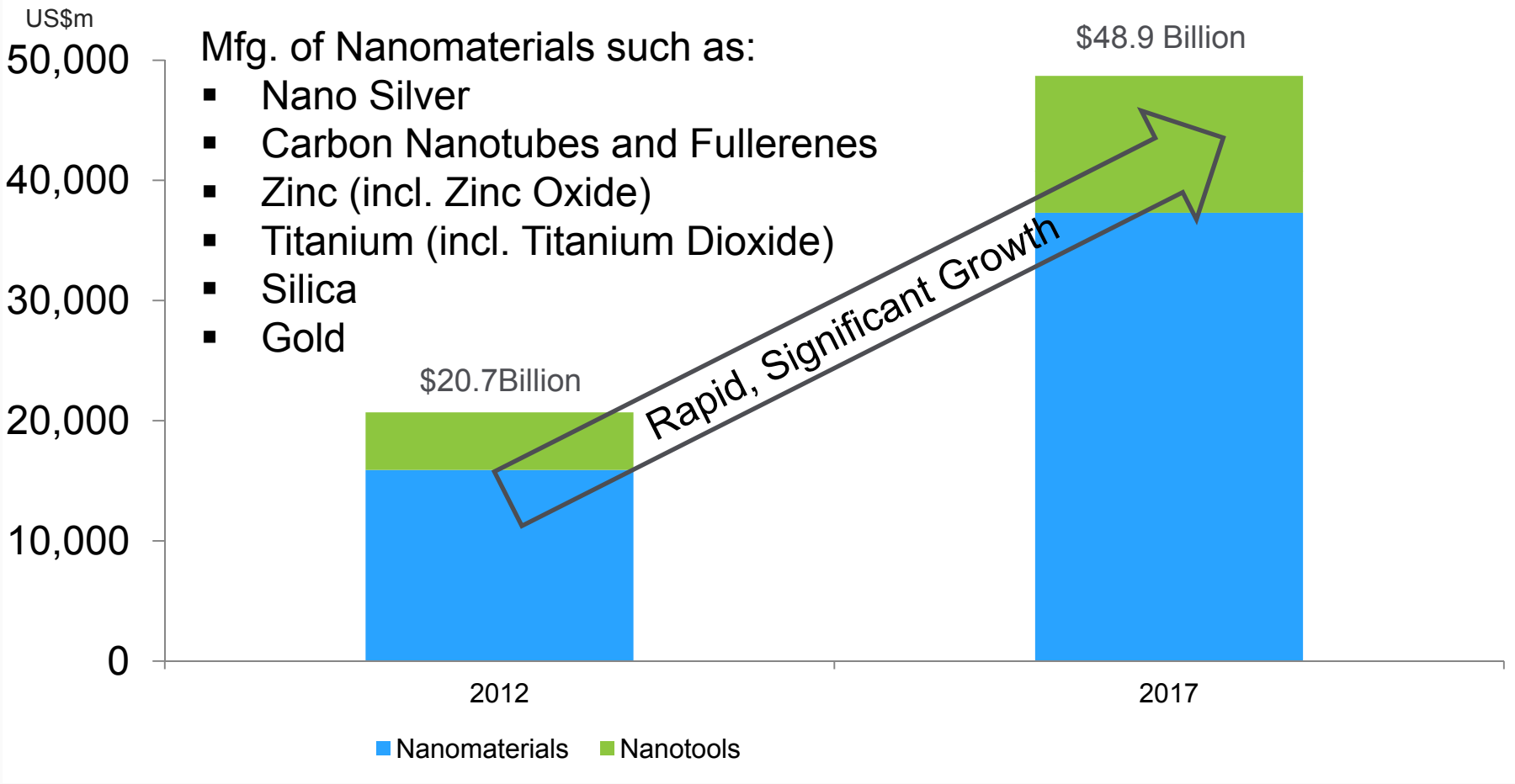
Global Nanotechnology Market, 2012-2017



Source: BCC Research

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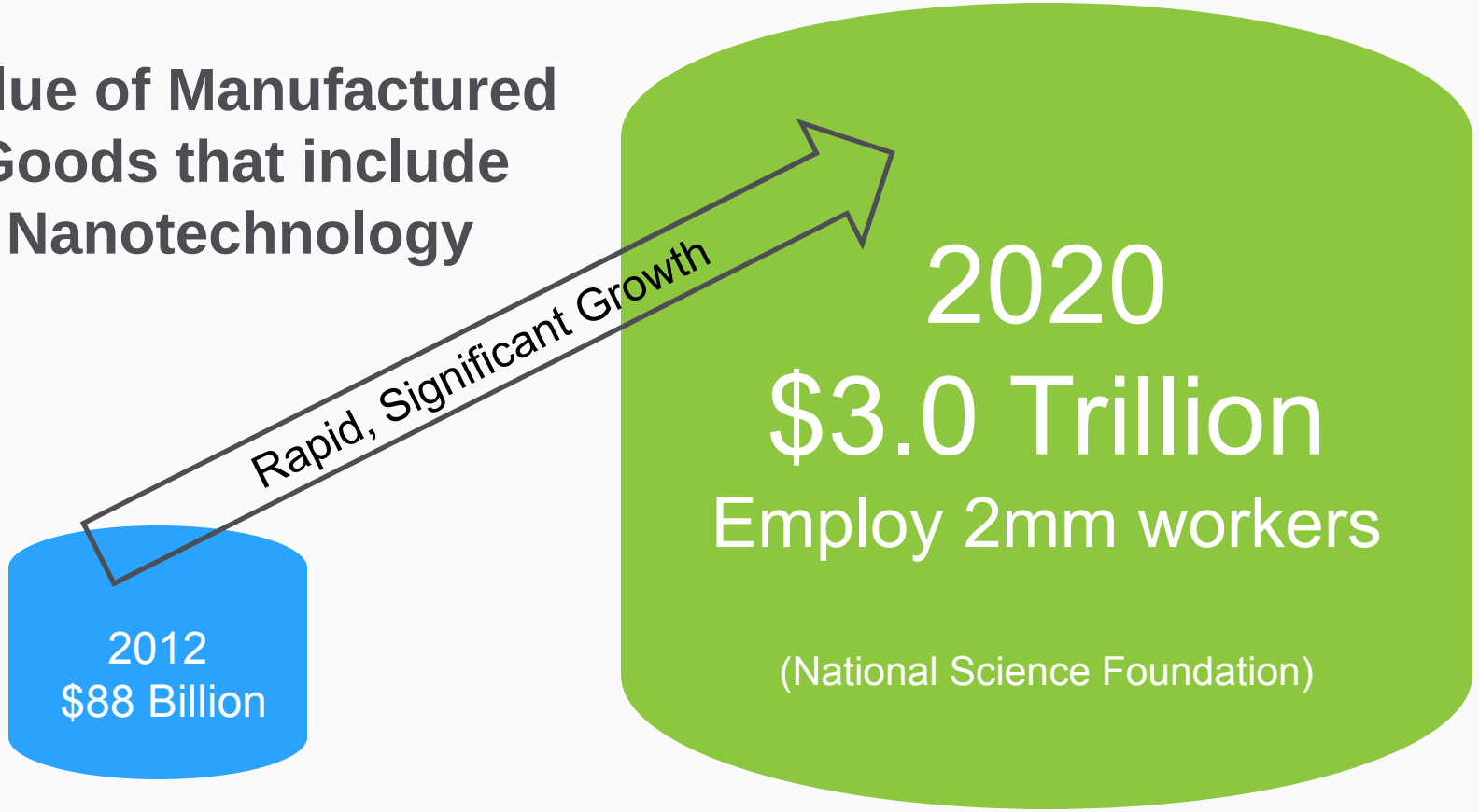
Nano-enhanced Products Market 2012-2015

Value of Manufactured Goods that include Nanotechnology



Source: BCC Research

Origin of Nanotechnology Patents

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Top 10 Countries of Inventor - Nanotechnology Patent Literature*

Country	2012	2002
United States	54.0%	45.1%
South Korea	7.8%	2.3%
Japan	7.1%	7.1%
Germany	6.2%	9.2%
France	4.0%	5.3%
China	4.9%	0.7%
Taiwan	4.1%	1.2%
Canada	2.6%	2.4%
UK	2.4%	3.1%
Switzerland	1.4%	2.0%

Highly Concentrated

- ❑ US Continues to Lead: 54%
- ❑ Asian Countries Tremendous Growth : Combined 24% up 96% driven by So. Korea and China
- ❑ EU Down : 14% down 29%

Individual Assignees – Top 5

- IBM (US)
- Samsung (S. Korea)
- Hon Hai Precision Industry (Taiwan)
- Tsinghua University (China)
- University of CA (US)

The US Accounts for the Bulk of Nanotechnology Intellectual Property

*- Percentages represent the % of total patents having at least one inventor with an address from the designated country
Source: “Intellectual Property in the Next Technology Revolution” (February, 2013) McDermott, Will and Emery

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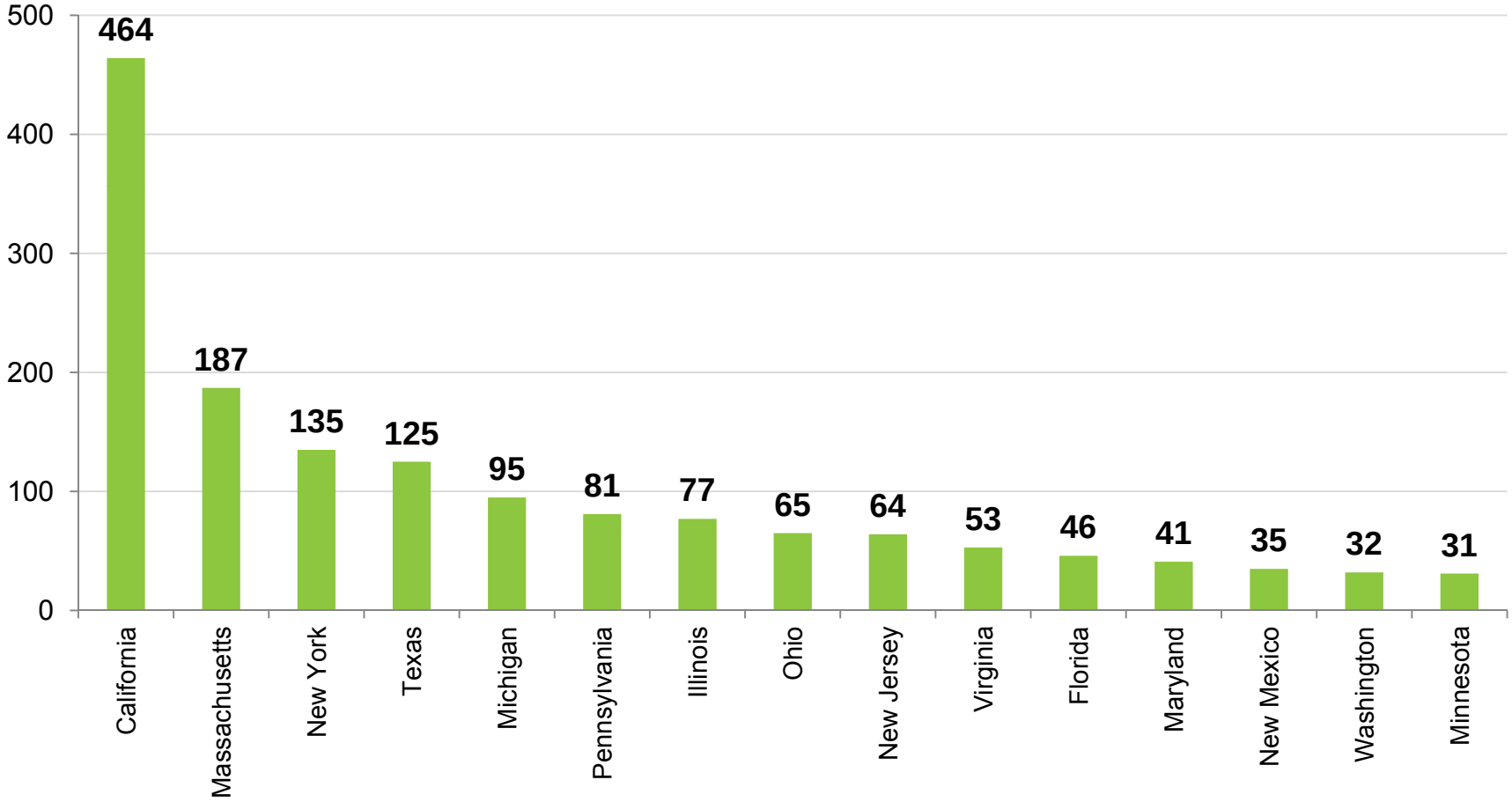
Top 15 states with nanotechnology companies - 2012



Source: Nano Science and Technology Institute - As of May 2012

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Market Scope

- Transforming manufacturing processes
- As of 2013 : Over 1,600 nano-influenced consumer products in the marketplace
- Many more are being developed

Current Major Applications – growing daily

- **Materials:** Enhanced strength with reduced weight
- **Coatings:** Improved properties such as thermal barriers, flame retardant, ultraviolet resistance, friction resistant, etc.
- **Energy Collection and Storage:** Improved surface to volume ratios of nanoparticles use light more efficiently and improve the cost and efficiency of solar panel
- **Lighting:** Quantum dots enabled the manufacture of LED lights
- **Manufacturing Processes:** Self-assembly uses of nanotechnology add precision and are evident in computer chips and biological system constructs.

Source : SME NanoManufacturing Conference, March 2012

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Market Scope : Consumer Products Breakdown (as of October 2013)

- Transforming the marketplace
- @ 2013 > 1,600 nano-influenced products in the marketplace
- Many more are being developed

Project for Emerging Technologies, October, 2013 (nanotechproject.org)

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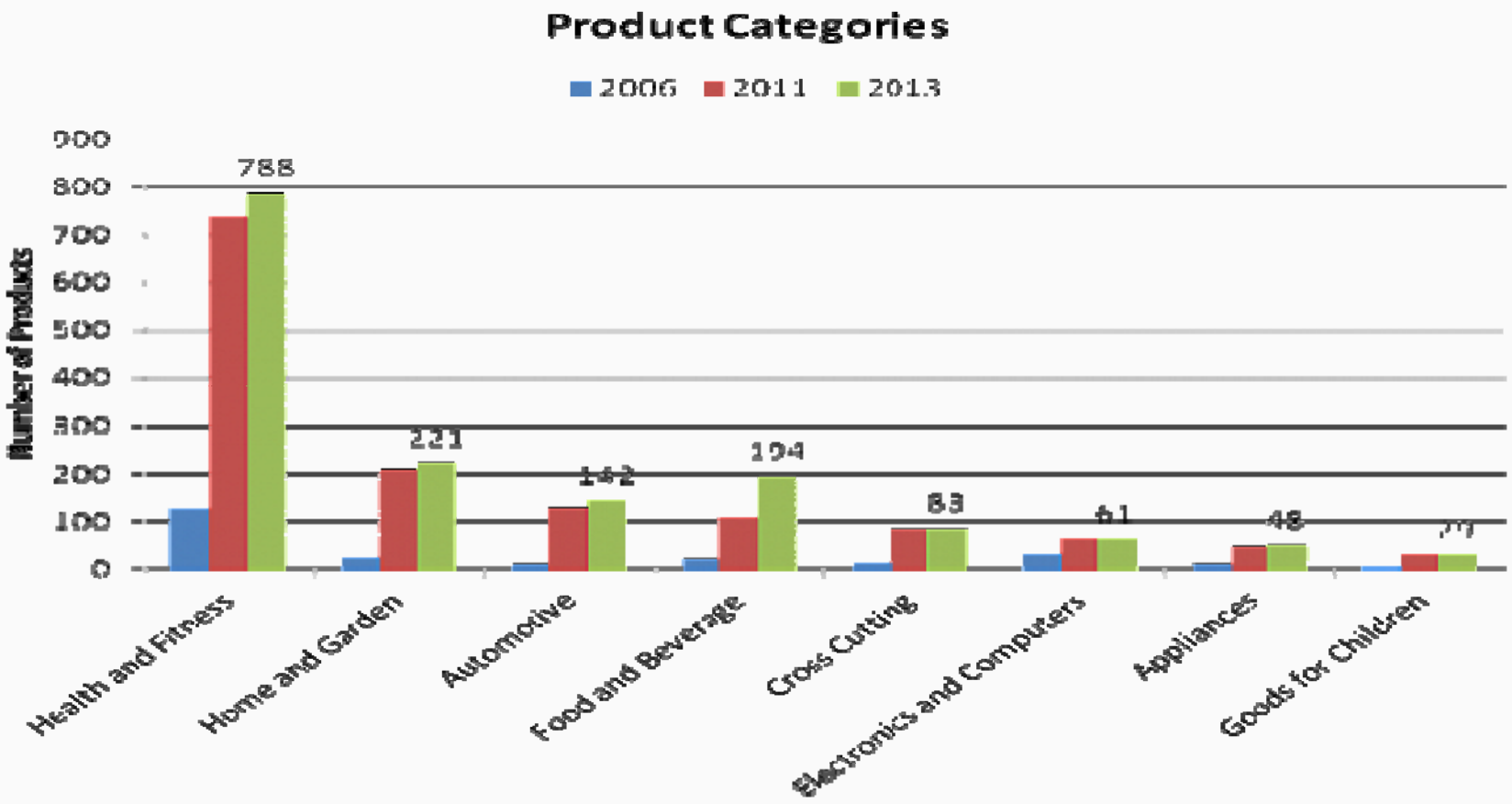
Consumer Product Category (as of October, 2013)



Project for Emerging Technologies, October, 2013 (nanotechproject.org)

Examples of Nanotechnology Use

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Current Specific Nano uses - A sample list (growing daily)	
Composite material	Sports equipment , automobile bumpers, luggage, power tool housings , etc. making them stronger, lighter and scratch resistant
Fabric treatments	resistive to wrinkling, staining, and bacterial growth; personal body armor
Glass treatment	Make eyeglasses, computer & camera displays, windows, etc. more resistant to dirt and damage
Cosmetic products	sunscreens, cleansers, complexion treatments, creams and lotions, shampoos, makeup
Food containers/packaging	Enhance the quality and safety of food
Automotive applications	products involving rechargeable battery systems; temperature control; lower-rolling-resistance tires; sensors and electronics; solar panels; fuel additives/improved catalytic converters.
Household products.	degreasers; stain removers; environmental sensors, air purifiers and filters; antibacterial cleansers; paints and sealing products
Coatings	coatings to extend the lifetime of moving parts in everything from power tools to industrial machinery.
Electronic Components	faster, smaller, more powerful, more durable, with more capacity, etc.…
Chemical Catalysts	boost chemical reactions ; reduces quantity of catalytic materials necessary to produce desired results, saving money reducing pollutants.

Source: NNI (Nano.gov)

The Future
Some Recent Headlines - Medical

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"Researchers Developing New Nanotechnology for Medical Use" (Digital Journal/Technology, October, 13, 2013)

"Delivering Drugs via Skin Moisturizers" (Science Blog 7/3/12)

"Nanotechnology delivers chemotherapy to prostate cancer cells"(Cancer News 1/10/12)

"Researchers use nanotech to make cancer 3mm times more detectable" (Computerworld 7/9/12)

"Nanotechnology Shows Potential in Fighting Mesothelioma" (PRWEB, November 19, 1013 usa.gov/1gJGL8A)

"Nanotechnology Provides a way to Detect Potentially Dangerous Blood Clots…" (ACS Nano November, 30, 2013)

"How Nanotechnology Can Help Detect Disease Earlier" (ScienceDaily 5/22/12)

The Future
Some Recent Headlines …..More "Stuff"

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Nanotechnology T-Shirt to replace batteries? Towards wearable energy storage (NanoWerks 8/29/13)

"New 'Power Felt' could charge your phone with body heat"(techland.time.com 2/23/12)

"Nanotechnology Delivers a Brighter Smile" (Newswise, October 16, 2013)

"How nanotechnology can improve paint and detect structural flaws" (Daily Commercial News 3/9/12)

Nanotechnology Engineers Build First Carbon Tube Computer (Nanowerks, Stanford University, 9/25/13)

"6 Amazing Inventions Made Possible by Nanotechnology" (Inhabitant 3/21/12)

- Water Purifying Teabags
- Artificial Muscles to propel nanobots through the body
- Self Heating Roads
- Improving methane energy output by 20X
- Catalytic Clothing improves air quality
- Solar Panel Clothing

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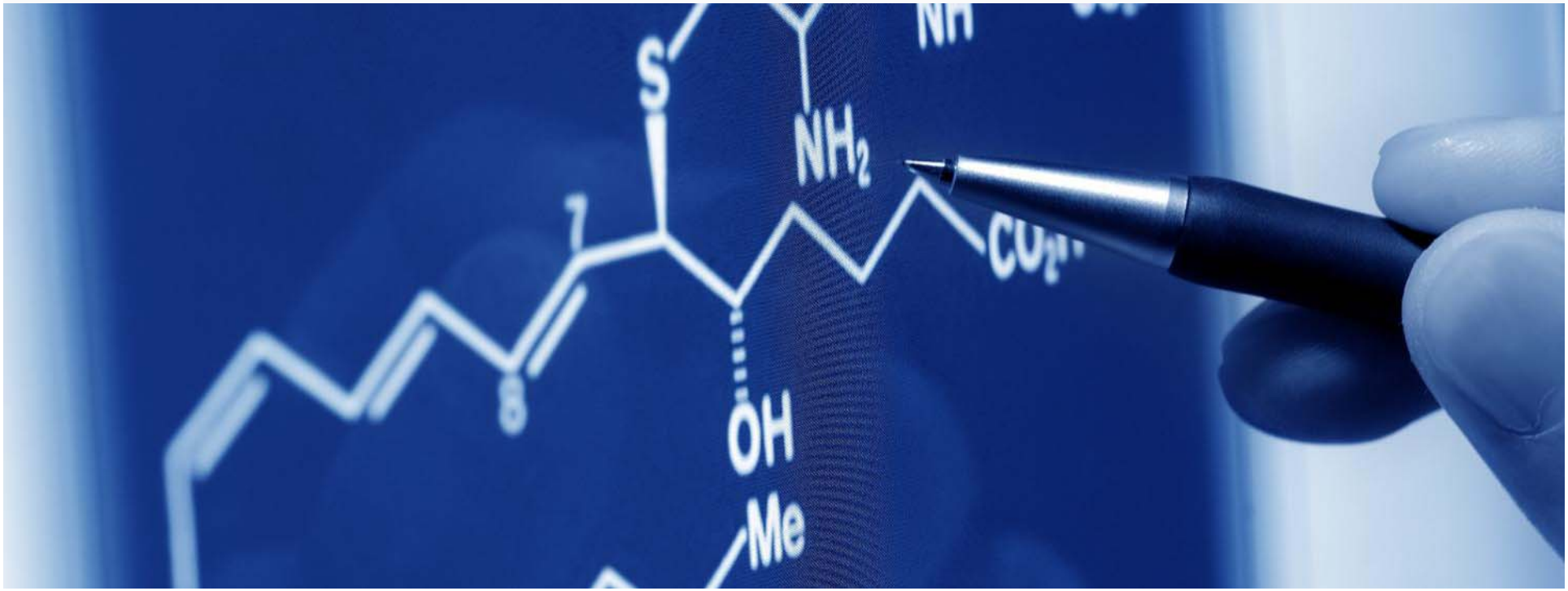
NANOTECHNOLOGY

RISK/ EXPOSURES/LOSS SCENARIOS



Nanotechnology Exposures

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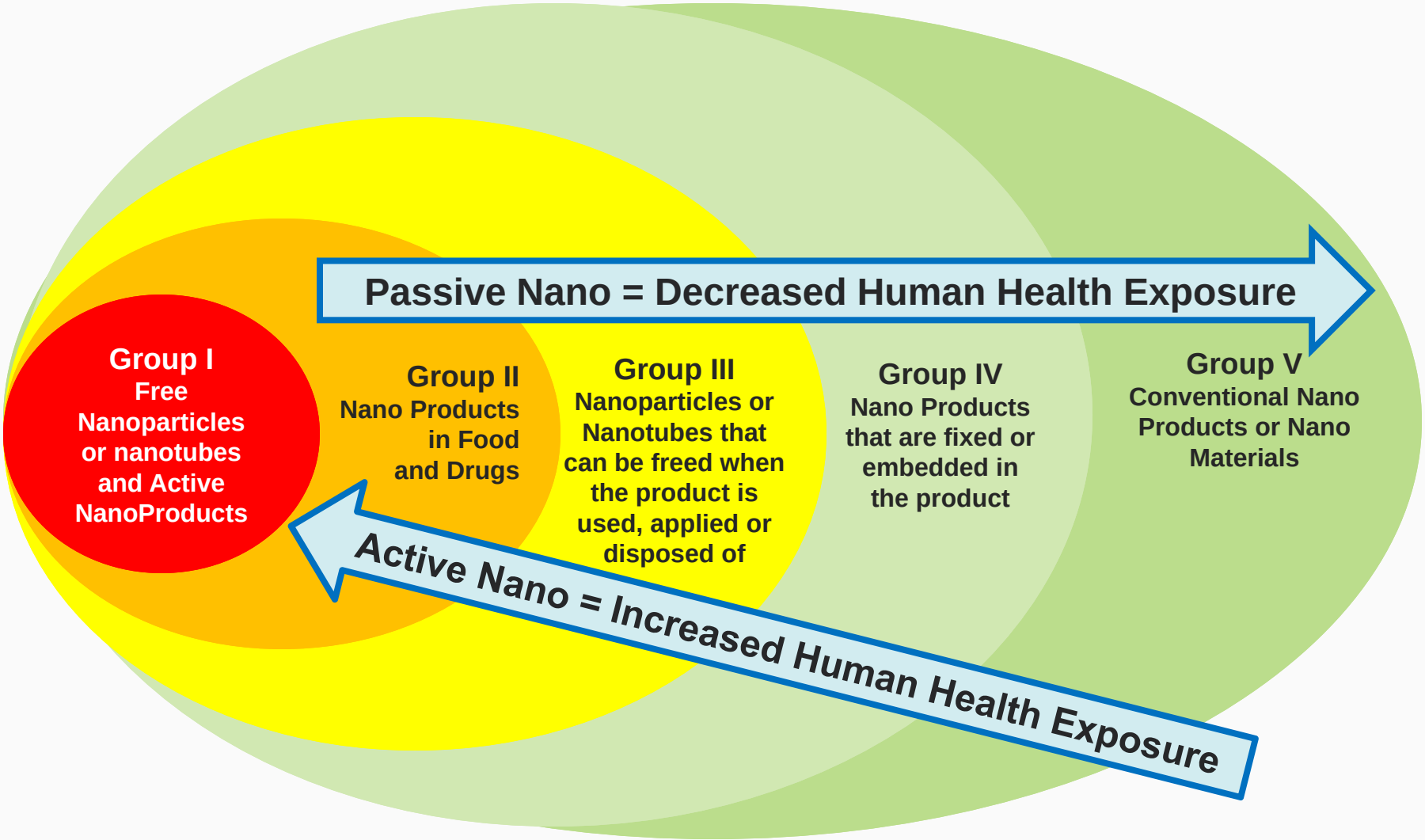

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Active nano particles and health exposure

Group I Free Nanoparticles or NanoTubes; and Active NanoProducts

Small Size allows entry into the body in 3 ways:

1. Crossing the Blood-brain barrier (Ingestion): accumulate in the brain, lungs or other internal organs – ultimate effect is unknown
2. Crossing the Skin-blood barrier Dermatological) : penetrate and accumulate through absorption by contact – ultimate effect not clear
3. Crossing the Blood-air barrier Respiratory) : accumulate directly in the lungs – lungs and all affected organs can be severely damaged.

Extensive global research is ongoing. Initial indications are that nanotubes can penetrate the walls of the lungs, damaging lung tissue.

Major Risk Categories

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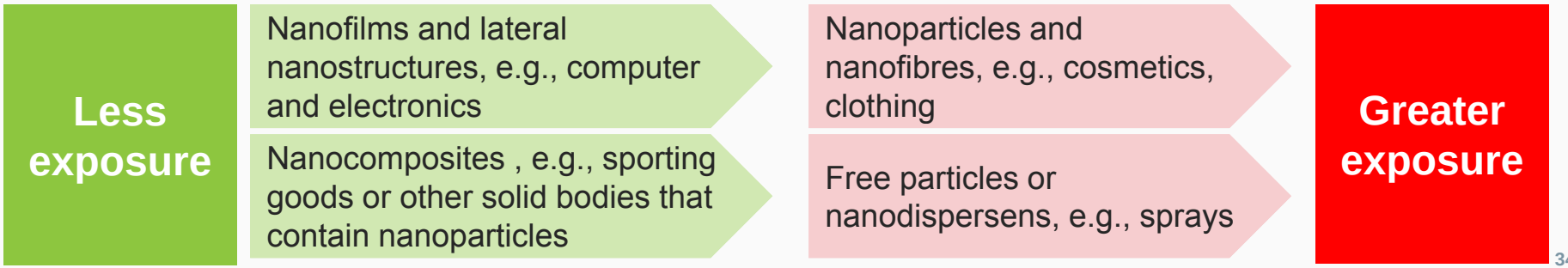
Potential Major Risk Categories - Personal/Bodily injury	
Workers	▪ Most prominent health exposure to date ▪ Manufacturing and processing ▪ Disposal and recycling (including incineration) ▪ Firefighting/first responders
Consumers / Products Liability	▪ Lack of awareness makes choice & “intelligent consumption” difficult ▪ e.g., potential skin absorption – clothing, cosmetics, skin creams, etc.
Healthcare recipients	▪ Most prominent “consumer” exposure ▪ Release/escape of nanoparticles used in medical applications ▪ e.g. – dental fillings,
Mental anguish and emotional distress	▪ Fear of disease (workers and consumers)



Major Risk Categories

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Other Potential Risk Categories

Environmental

- Production process handling by-product release into the air or water
- Waste disposal
- May lead to health effects (drinking water or agriculture contamination)

Financial/D&O

- "Economic Bubble" potential…. >>>
- False/Misleading statements ….>>>
- Unrealistic Investment Expectations….>>>
- Securities Claims and Shareholder Suits

Coverage and Defense expense

- Uncertainty regarding harm
- Multiple Injury Configurations
- Novel Loss Scenarios
- Untested Coverage

Increased Existing Risks

- **Terrorism** – Smaller more powerful bombs
- **Cyber** - Development of quantum computers > current computer data encoding methods less effective & cyber crime easier or more effective.

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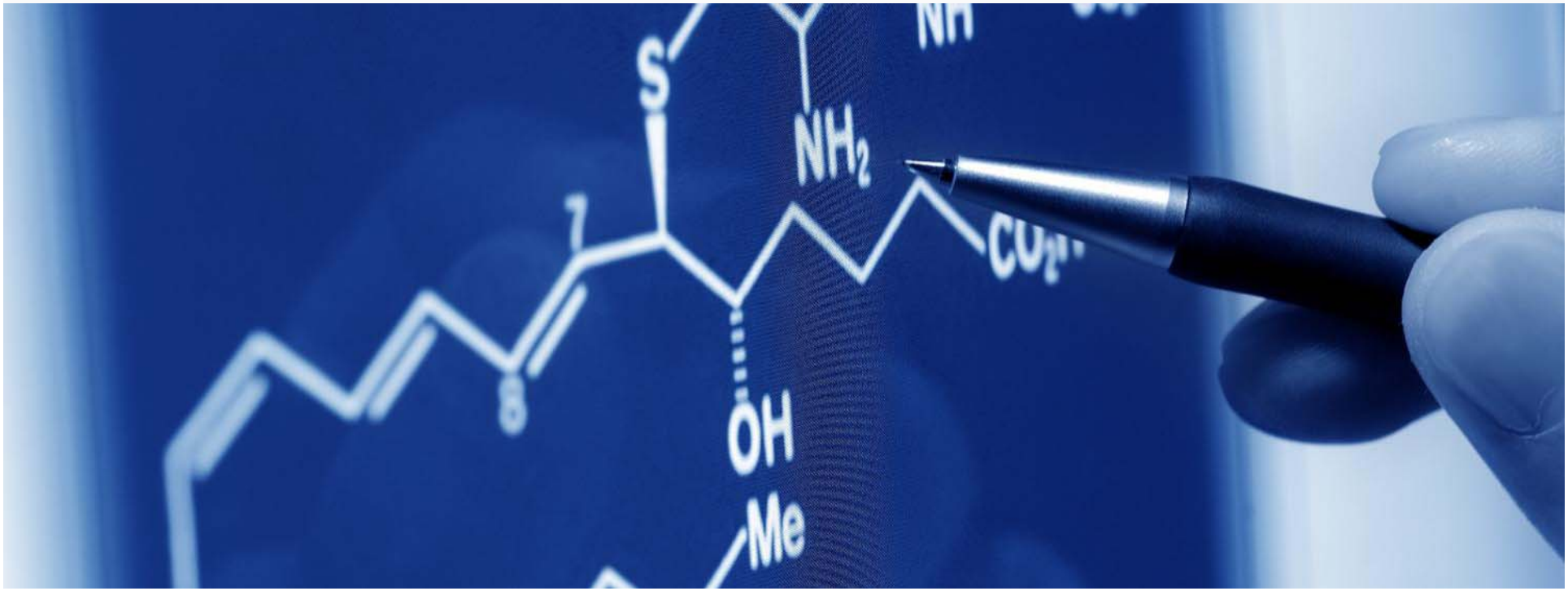
LEGAL AND REGULATORY LANDSCAPE



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Minimal Litigation To Date...

International Center for Technology Assessment, et al v. Margaret A. Hamburg, M.D

- Administrative Procedure Act case seeking declaratory & injunctive relief. Filed 2011
- Demands that the FDA respond to petition that the plaintiffs filed with the FDA (2006) that claimed: 1] there was scientific evidence of nanomaterial risks; and, 2] requested the FDA take regulatory action.
- FDA has formally responded to the Plaintiffs and the Suit has been dropped.

…Significant Future Litigation Potential

Future Mass Tort Potential…
…fueled by:

- Warnings (often speculative) about nanotechnology risks have been publicized by various interest groups & even some governmental agencies …sets the stage…feeds public and political perception
- Even with uncertainties about the actual health/environmental risks…the legal industry (plaintiffs bar) has established an infrastructure geared to extensive litigation of new exposures

At a minimum, defense costs will be high initially

Regulatory Challenges

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1

Too little =
Public harm

How much regulation?

Too much =
Progress stalled

2

Who is best qualified?

How effective will it be?

NNI
Multiple agencies involved: coordination is critical

21 participating Agencies including:
EPA, FDA, OSHA, NIOSH , DOE , CPSC, DOD, NASA, Nat'l. Inst. Of Health, Nat''l Institute of Standards, DOJ, Dept. of Interior, Technology and the National Science Foundation.

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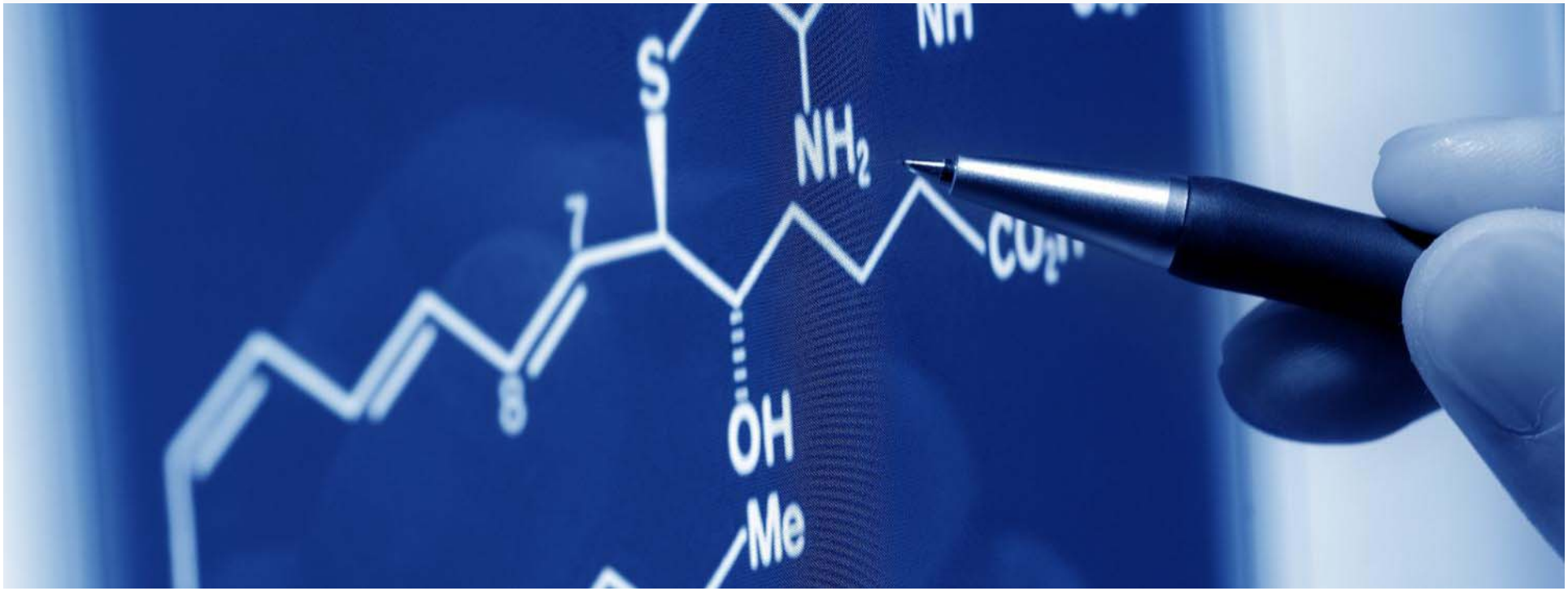
INSURANCE IMPACT…

UNDERWRITING AND RISK MANAGEMENT CONSIDERATIONS



Insurance Challenges
More Qualitative than Quantitative

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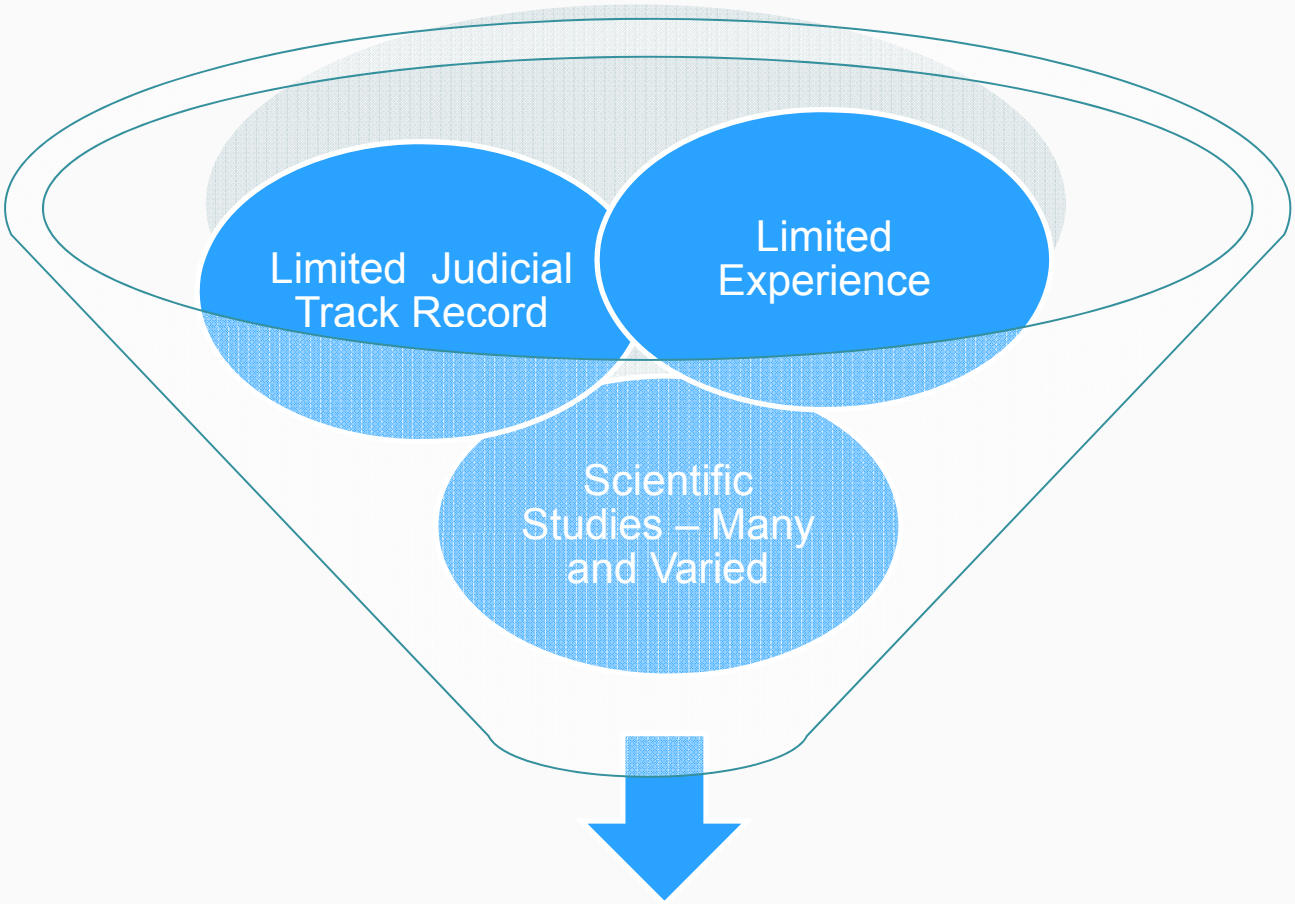

No Established / Credible Way to Identify, Measure, Classify, Price Risks

Numerous Studies….Mixed Conclusions

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Nanotechnology and ISO/NCCI

ISO General Liability Classification	▪ Introduced in 2011 ▪ Code 13208: Nanomaterial distributors – risks that sell nanomaterials to others ▪ Code 53953: Nanomaterial manufacturing – risks that manufacture or engineer nanomaterial for others
ISO Exclusions	▪ ISO does not have a Nanotechnology Exclusion, nor do they have plans to develop one. ▪ They feel the Pollution and Designated Products Exclusions are adequate …*Not Court Tested in a Nano case yet*
WC - NCCI	▪ NCCI does not have separate Class Codes for Nanotechnology ▪ They feel it is absorbed by the Governing Class of the business……*??????*

Fundamental Risk Assessment Steps

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1	**Hazard**	Assess the specific engineered nanomaterial based on the use and the scientific /expert analysis of hazard
2	**Industry**	Determine the specific industries and industry segments that are exposed based on how the nanomaterial is manufactured, processed and used
3	**Exposure**	Assess the exposure throughout the entire life cycle of the product…emphasis on risk management and safety protocols
4	**Insurance Impact**	Determine the specific lines of business that may be impacted, the extent to which they will be impacted, and how best to manage the impact

Source: CRO Briefing on Nanotechnology, November 2011

Underwriting Considerations
In Sum - Multifaceted Approach

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Understand Risks

BE CURIOUS/INQUISITIVE – at the Industry level

- Proactively monitor relevant developments
- Science, Legal Landscape, Market, etc

Risk Selection / Management Criteria

BE CURIOUS/INQUISITIVE – at the Client level

- Understand the specific exposures, understand insured operations
  - What, where, how is nanotechnology used
    - Need specific disclosure of the nature and size of the nano materials used as well as the process that is used.
  - How is exposure managed by the insured
    - WC, products, pollution, etc.

Coverage

- Risk appetite?? How much???
- Where there is significant exposure and/or exposure that is not adequately managed: adapt coverage, e.g.,
  - Sublimit or exclude (definitional challenge)
  - Coverage triggers (e.g., claims made)
  - Defense cost containment
- Manage exposed limits in the portfolio (establish a budget ?)

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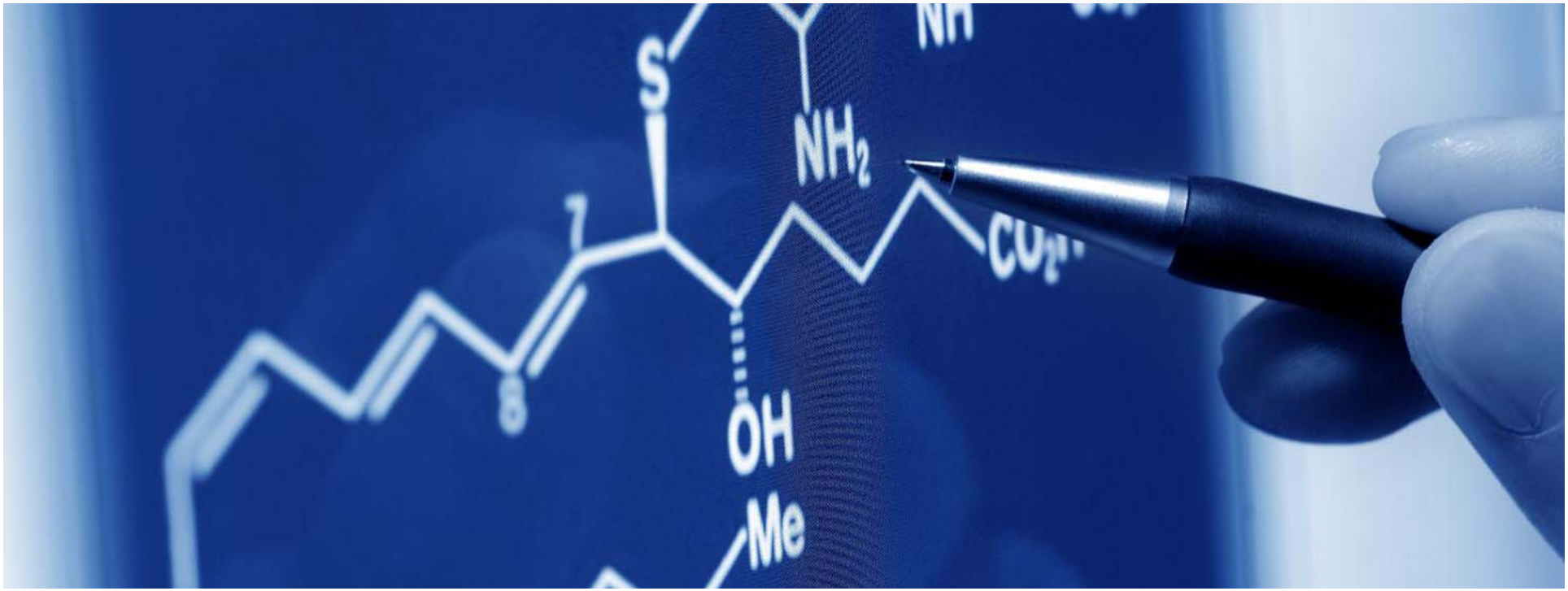
NANOTECHNOLOGY …..
…….SOME CLOSING THOUGHTS



The Future of Nanotechnology: Broad and Significant Growth Projected

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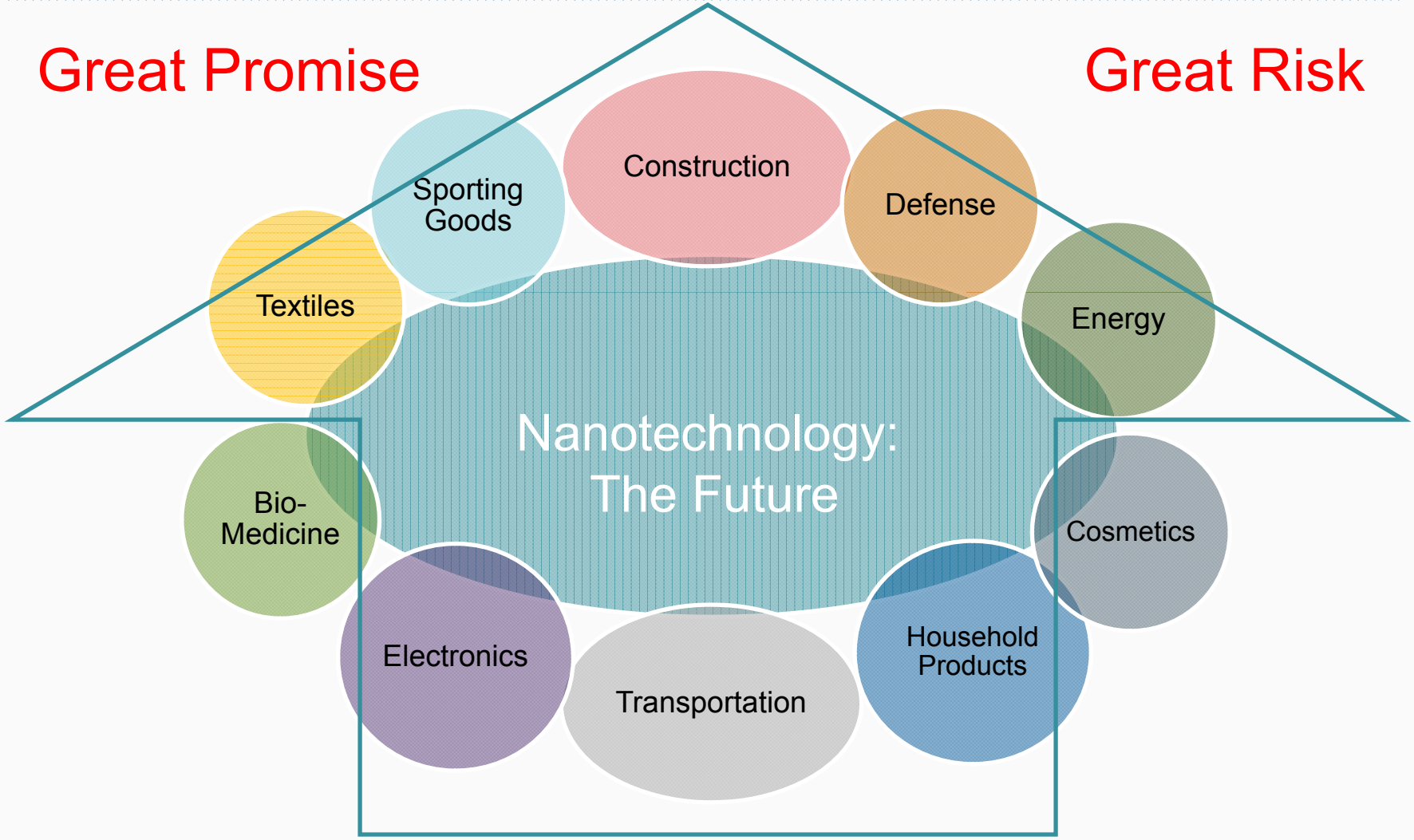

Image credit: Argonne National Laboratory

Nanotechnology/Manufacturing Takeaways
With Progress…there also comes Risk

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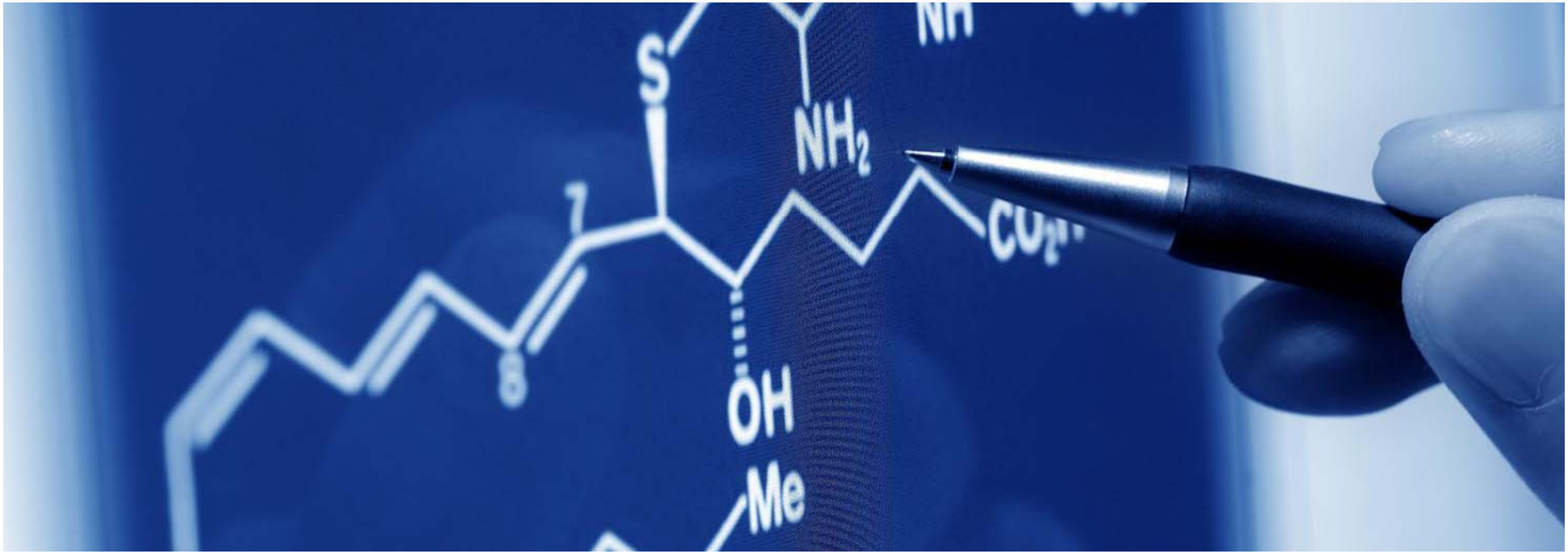
- Rapidly growing as a major component of Manufacturing…Innovation leading to economic growth, jobs, etc.
- Potential benefits are enormous / Risks are uncertain in many respects
- Insurance Industry has a major role to play: Risk Management and Financing…Need to Understand the Risks fully



CLIMATE CHANGE OVERVIEW

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Definitions

Weather- Climate - Climate variability – Climate change

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Weather
Description of the combination of **short-term** meteorological conditions such as temperature, precipitation, pressure, etc. occurring at a particular time and place

Climate
Description of the **average and the variability of weather conditions at a specific location** from a given period of time including its extreme peaks;
Typical physical parameters: wind speed, air temperature, precipitation, air pressure

Climate variability
Deviation of the average conditions or the frequency of extremes of a specific period from conditions as inferred from other periods

Natural climate variability
Climate variability caused by interactions of natural forces (e.g. interaction of the ocean and the atmosphere)

Anthropogenic climate change
Climate variability caused by human intervention (e.g. emissions of CO_2)

Source: Munich Re – Severe weather in North America, 2012

Hurricane Katrina
August 29, 2005

Source: Munich Re

Superstorm Sandy
October 29, 2012

Photo: Munich Re

Joplin EF5 Tornado
May 22, 2011

Photo: FEMA

Notable wildfires in 2013

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- **Colorado:** “High Park” fire near Fort Collins destroyed 257 homes and “Waldo Canyon” fire near Colorado Springs destroyed over 300 homes, becoming the most damaging fire in state history. Insured losses from both fires are estimated at $450 million.
- **California:** “Rim” fire near Yosemite National Park lasted nine weeks over August to October, scorching 257,000 acres and destroying 111 buildings. Due to remote location, insurance impacts were minimal.

Source: USFS

US thunderstorm loss trends
Annual totals 1980 – 2013

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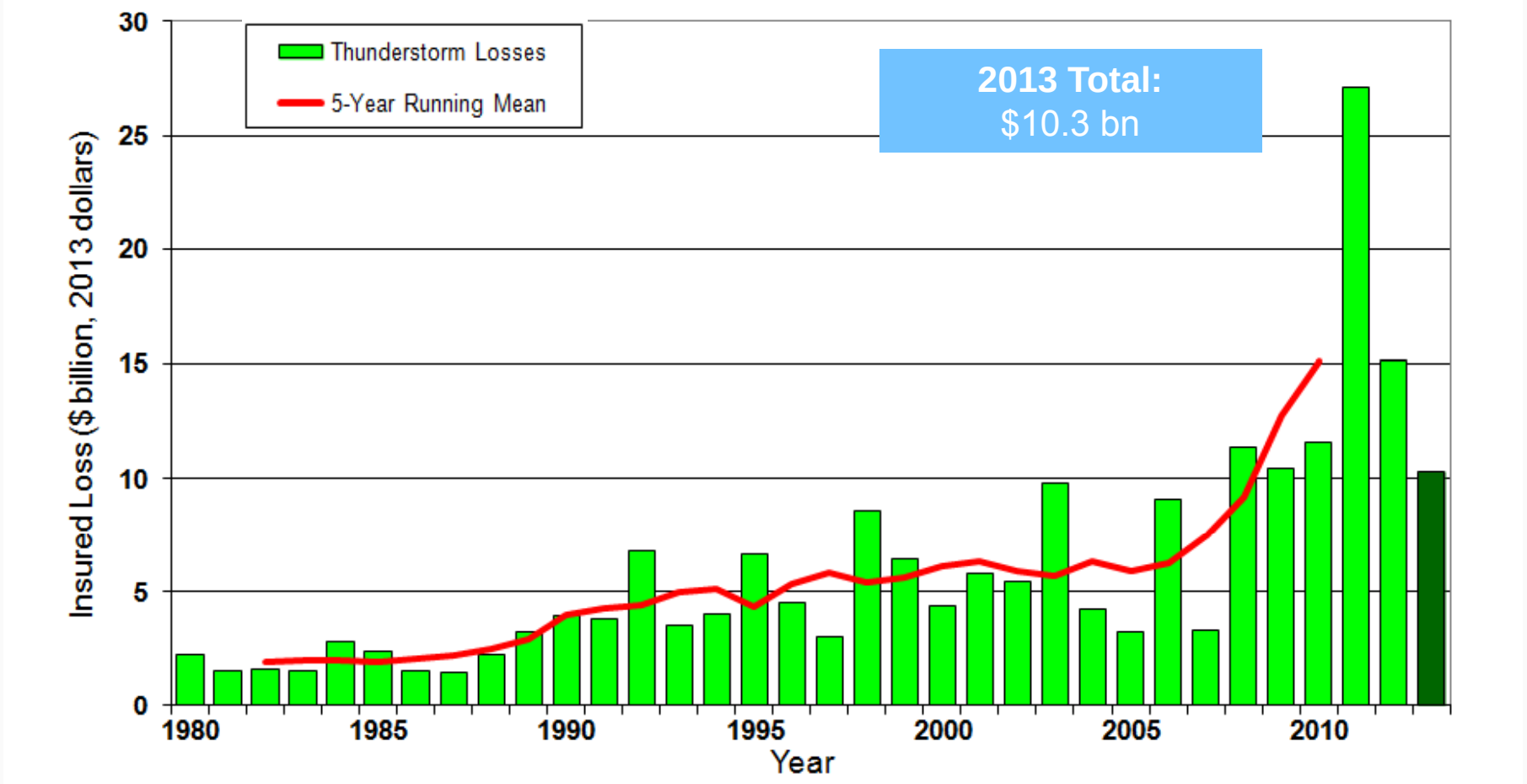
Average insured thunderstorm losses have increased sevenfold since 1980.



Sources: Property Claims Service, MR NatCat*SERVICE*

Loss events in the US 1980 – 2013
Number of events

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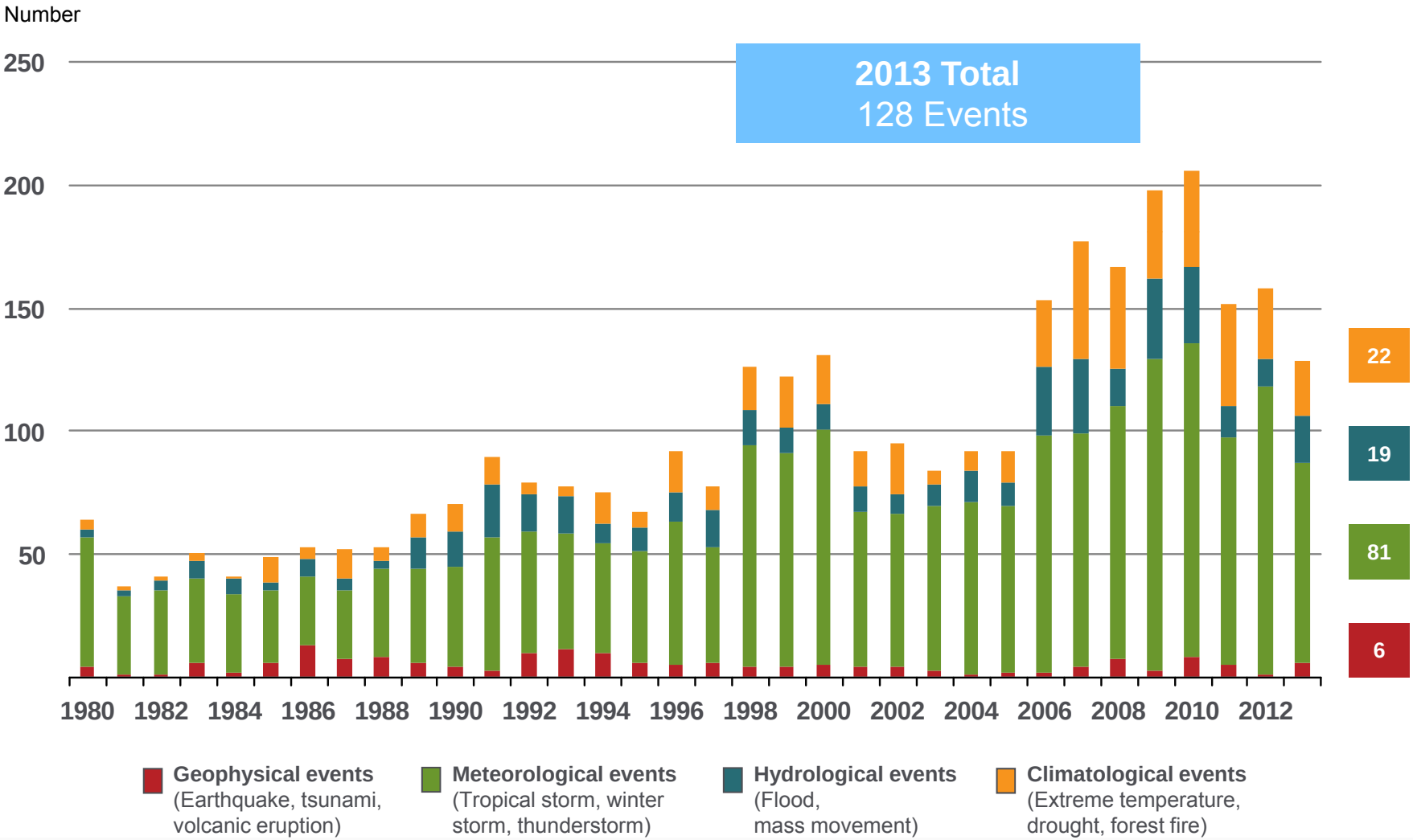

Source: MR NatCat*SERVICE*

Loss events in the US 1980 – 2013
Overall and insured losses

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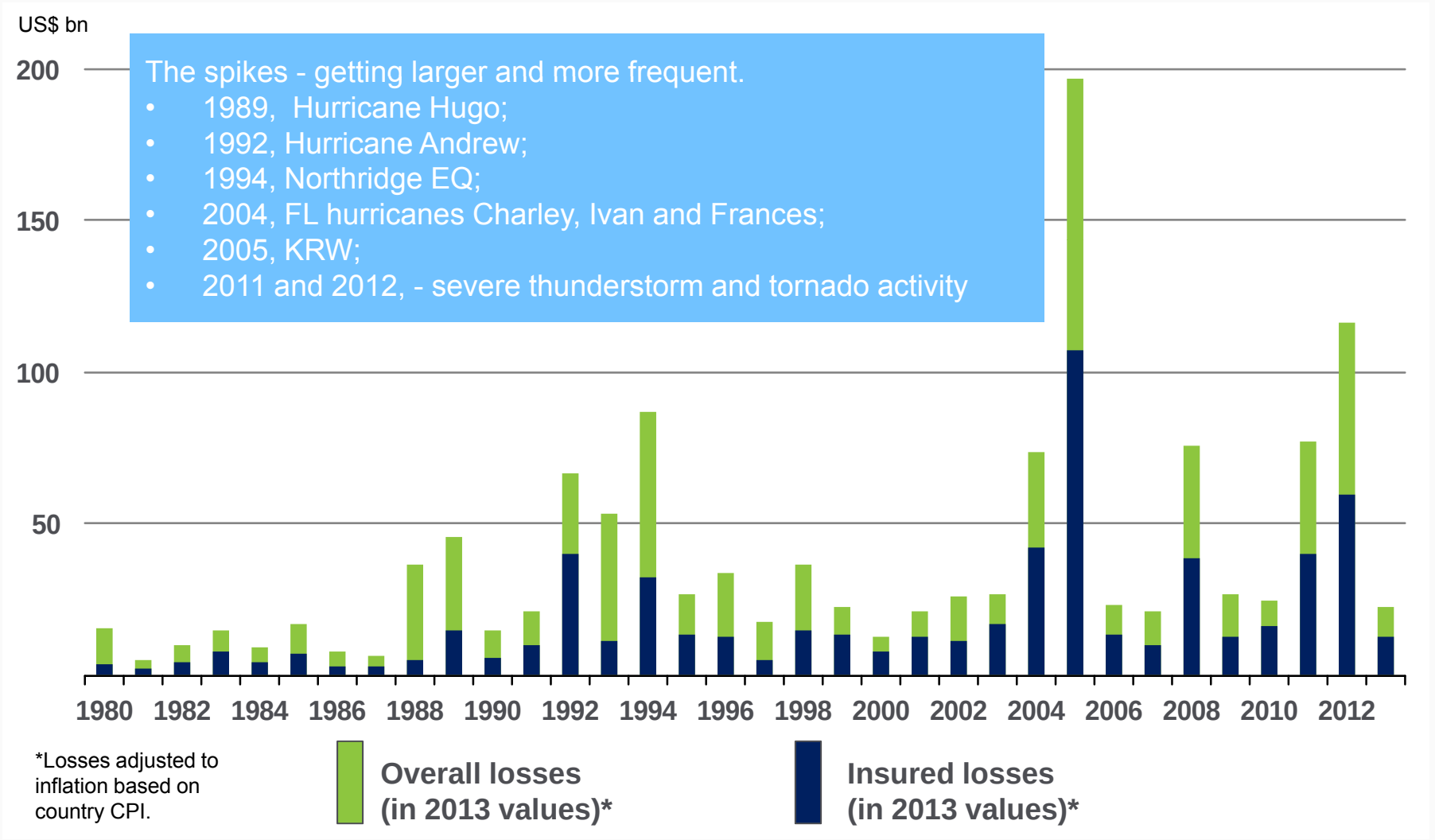

Source: MR NatCat*SERVICE*

Reasons for increases in natural catastrophe losses

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1. Population growth
2. Increasing standard of living (wealth)
3. Settlement and industrialization in highly exposed regions
4. Concentration of population and values in large cities
5. Increasing insurance market (relevant for trend of insured losses)
6. Environmental changes – global warming

Greenhouse gas emissions: CO2

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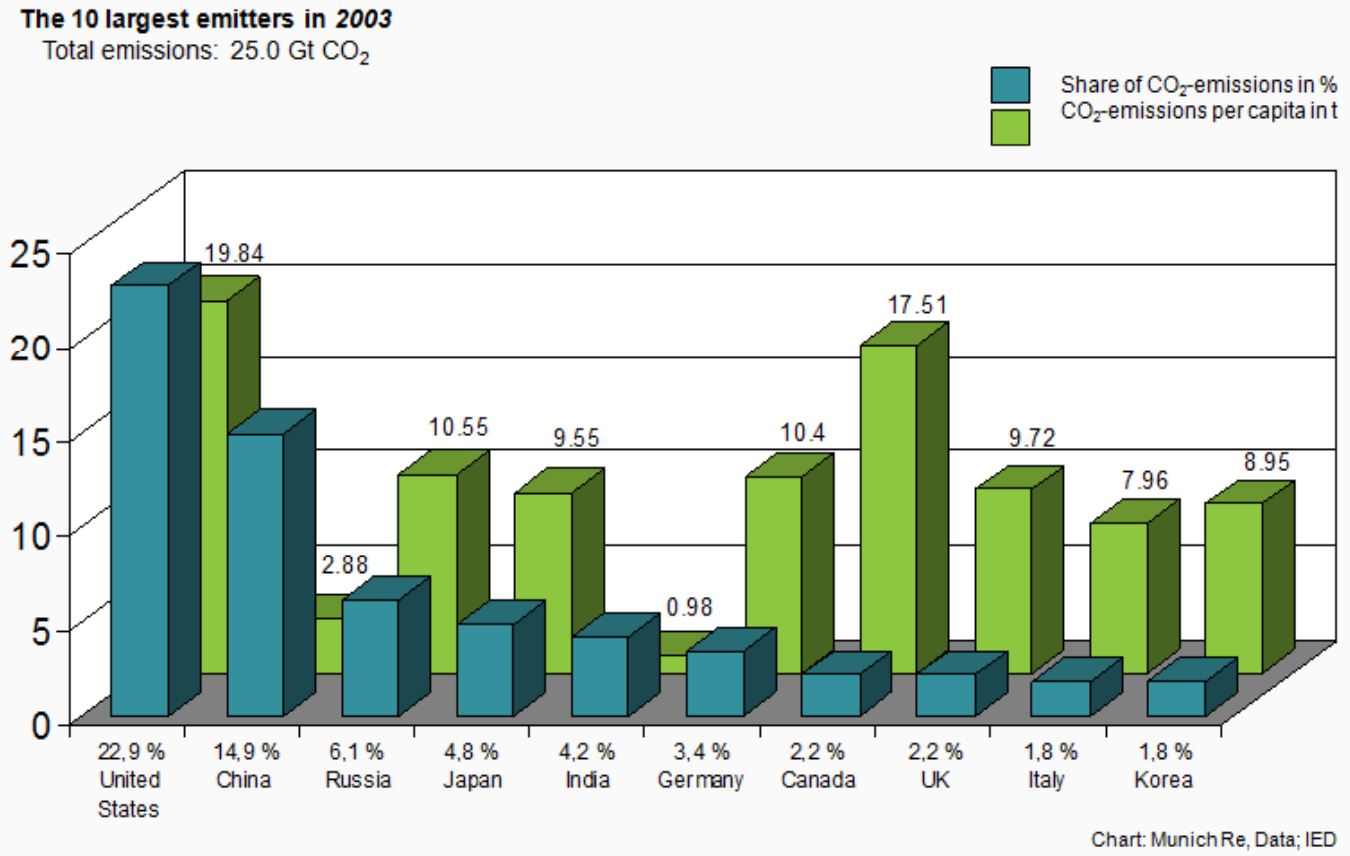
CO2 –Emissions from burning of fossil fuels
80% of world wide emissions



Global average sea temperature and level

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Increase in atmospheric CO2 concentrations over the past 60 and 1000 years

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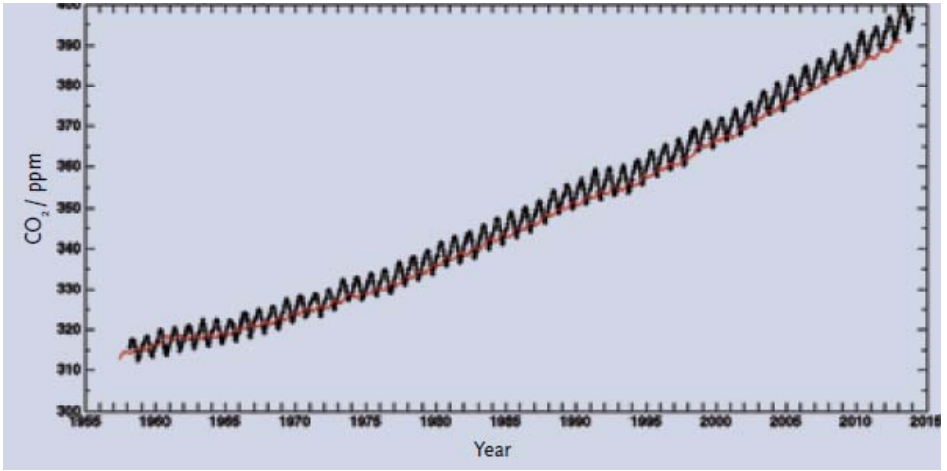
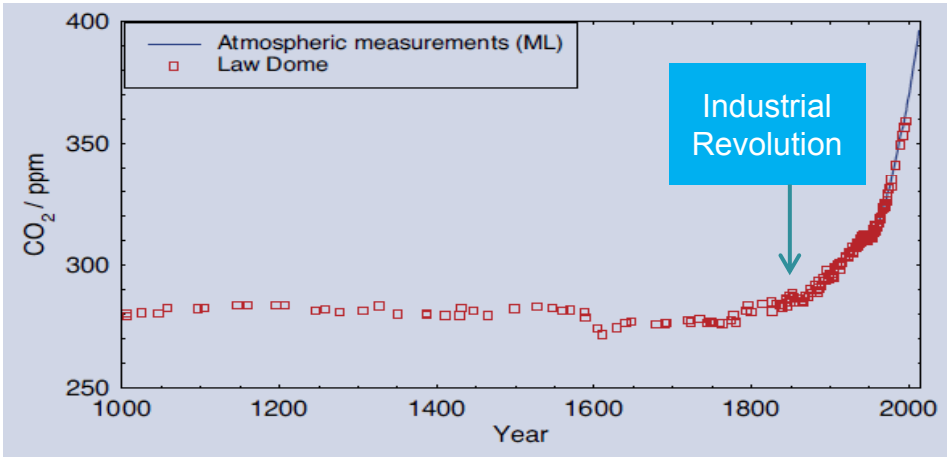
60 Year Trend



1,000 Year Trend



Sea levels will rise

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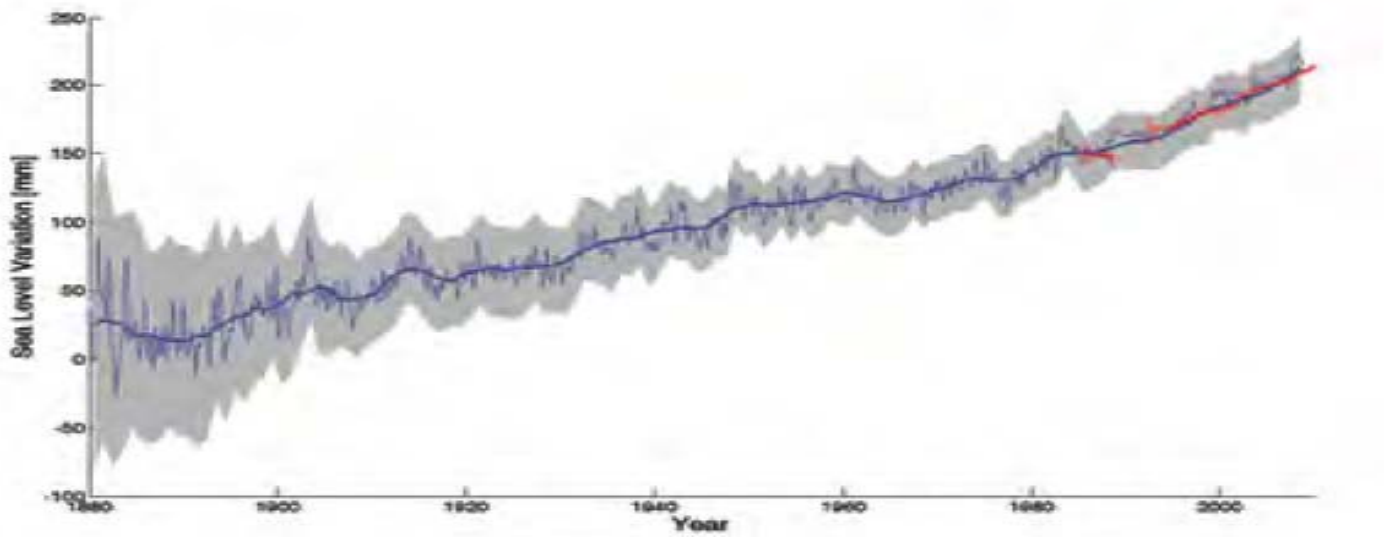
The effects of rising sea level are felt most acutely in the increased frequency and intensity of occasional storm surges. If CO_2 and other greenhouse gases continue to increase on their current trajectories, it is projected that sea level may rise by a further 0.5 to 1 m (1.5 to 3 feet) by 2100. But rising sea levels will not stop in 2100; sea levels will be much higher in the following centuries as the sea continues to take up heat and glaciers continue to retreat. It remains difficult to predict the details of how the Greenland and Antarctic Ice Sheets will respond to continued warming, but it is thought that Greenland and perhaps West Antarctica will continue to lose mass, whereas the colder parts of Antarctica could start to gain mass as they receive more snowfall from warmer air that contains more moisture. Sea level in the last interglacial (warm) period around 125,000 years ago peaked at probably 5 to 10 m above the present level. During this period, the polar regions were warmer than they are today. This suggests that, over millennia, long periods of increased warmth will lead to very significant loss of parts of the Greenland and Antarctic Ice Sheets and to consequent sea level rise.



Temperature anomalies (1900 – 2011)

Annual temperature anomalies at global scale and for the U.S.

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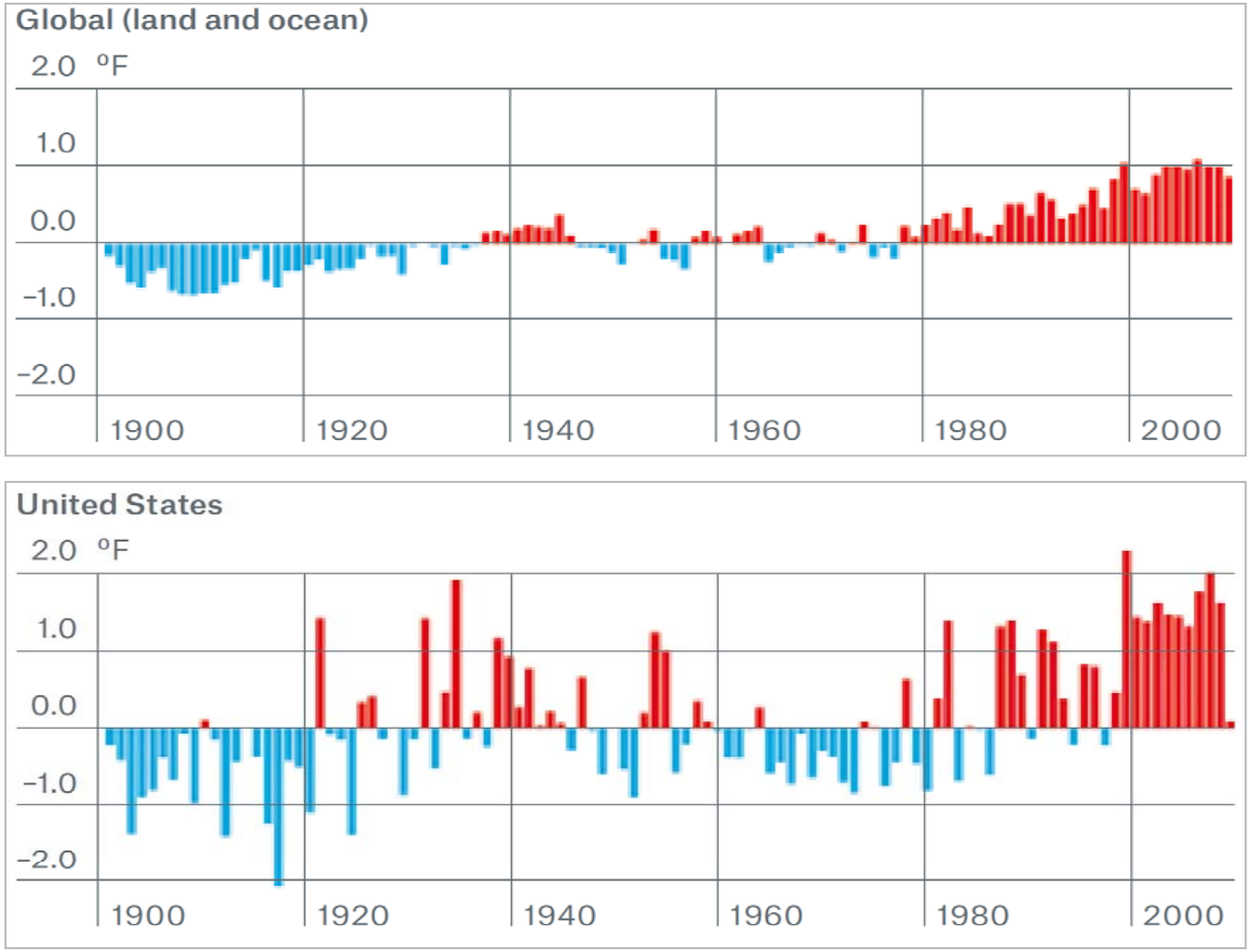

Source: Munich Re – Severe weather in North America, 2012

Climate change – Temperature, 2090-2099
Scenario A1B, with unchanged CO2 emission

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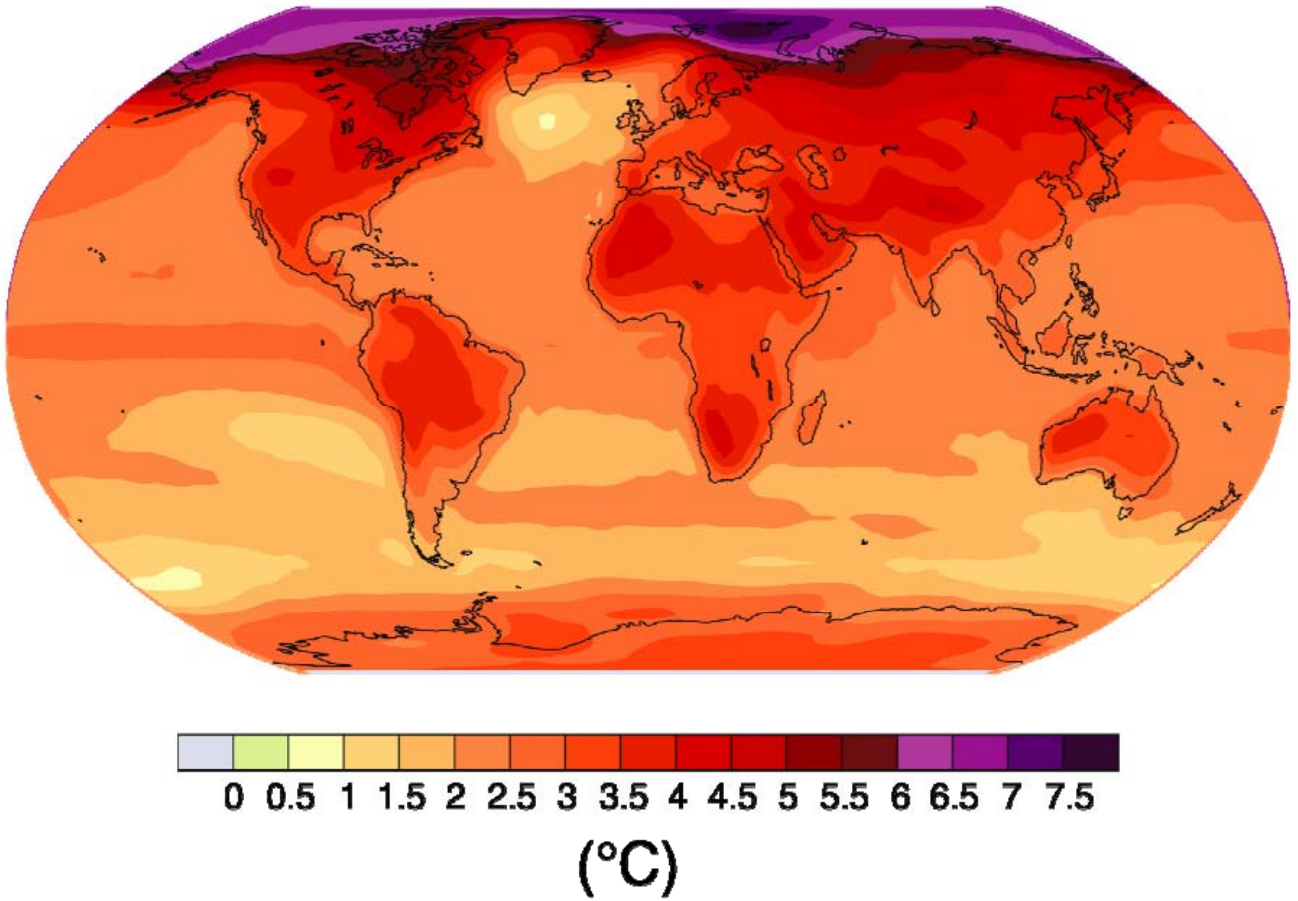

Source: Intergovernmental Panel on Climate Change Fourth Assessment Report
Summary for Policymakers, IPCC, Page 8, Figure SPM 6.

Sea level rise: Key problem regions
A view from Outer Space…2100

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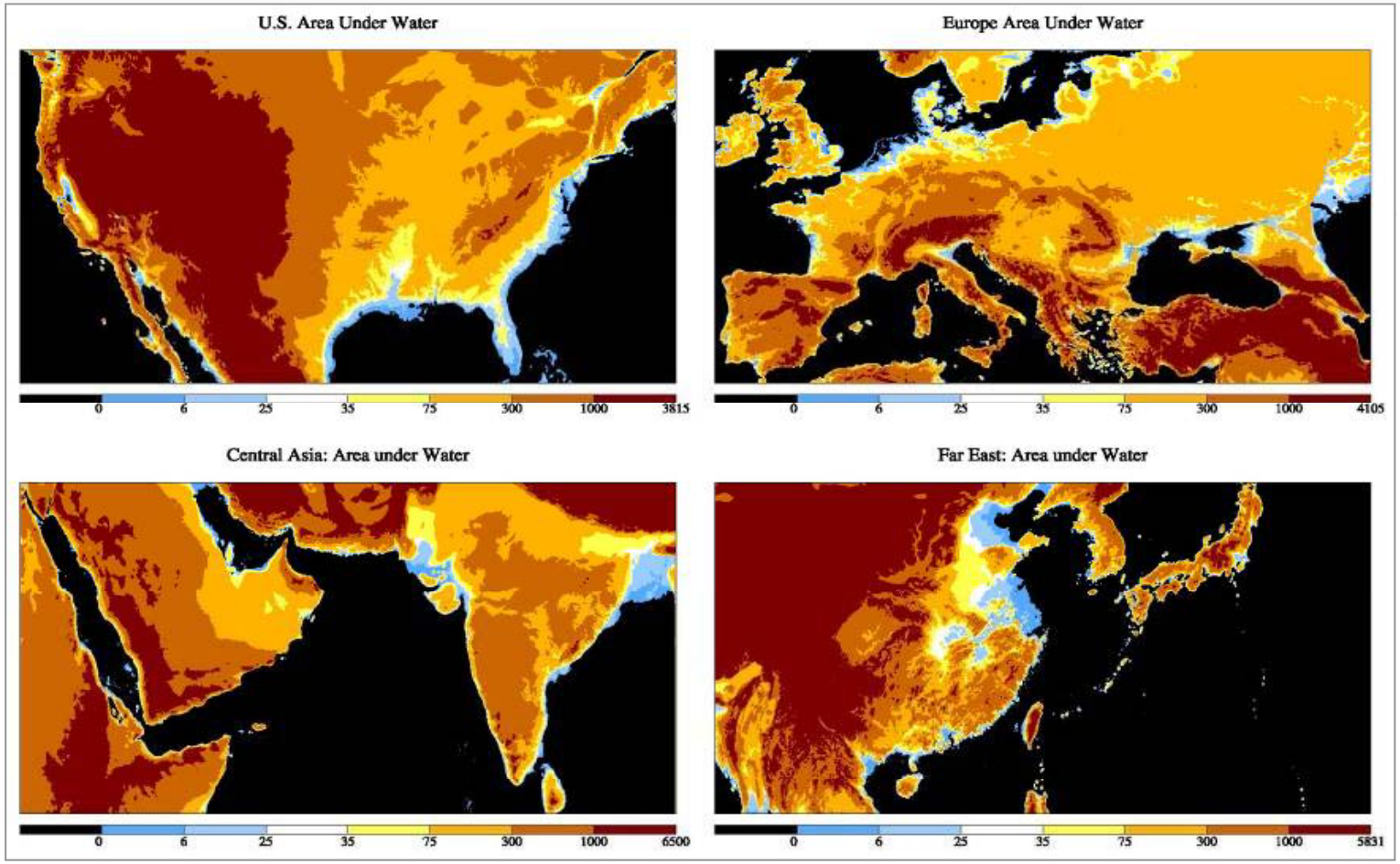
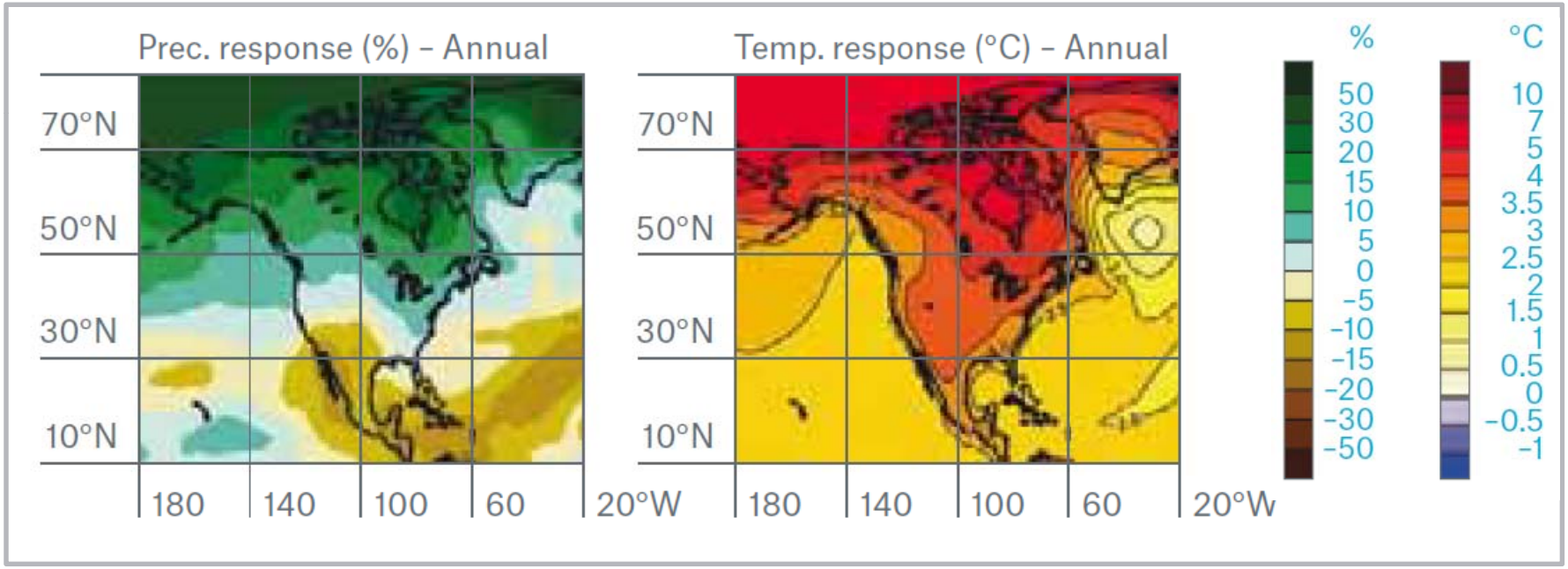
50-100mm People Displaced
South Florida, Coastal Louisiana and Bangladesh hit hardest



Source: NASA

Changes in temperature and precipitation
North America

Changes in temperature and precipitation over the period 2080-2099 relative to 1980-1999, based on the IPCC's A1B scenario:



- North America is projected to become much warmer
- The northern half is projected to get wetter, southern parts to become dryer

Source: IPCC (2007): Climate Change 2007: The Physical Science Basis

Heavy precipitation in North America
Observed and projected changes

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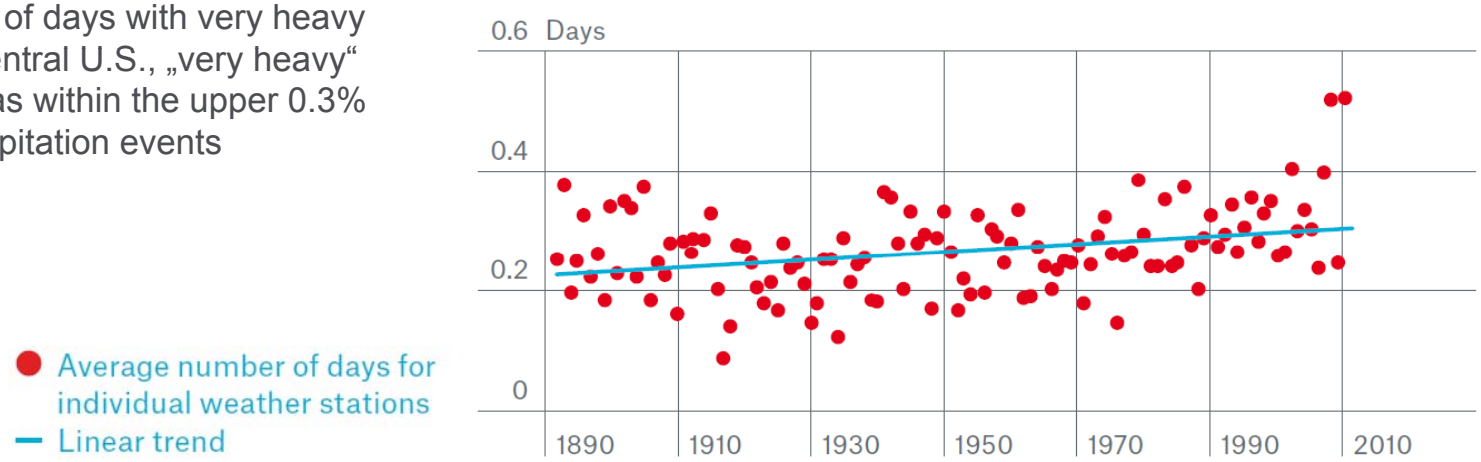
Observed changes

- Increasing frequency and intensity of heavy precipitation events
- Strongest increase in heavy precipitation in the region Midwest and Northeast

Annual number of days with very heavy rainfall in the central U.S., „very heavy“ being defined as within the upper 0.3% of all daily precipitation events



Projected changes

- Precipitation intensity rise over the contiguous North America
- Events with extreme precipitation will become more frequent

Source: Munich Re – Severe weather in North America, 2012

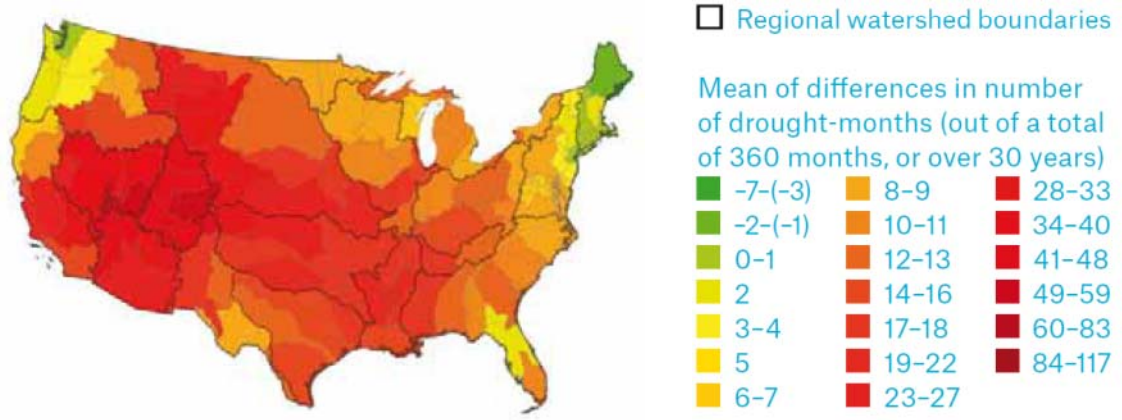
Droughts in North America
Observed and projected changes

Munich RE

Observed changes

- For most parts of the US, droughts have become shorter and less frequent
- Areas with rising drought trends: Western Canada, Alaska, southwestern US

Projected change in the number of months with drier conditions in the time period 2035 to 2065, relative to the 20th century



Projected changes

- Increasing trends in heatwave frequency and duration for North America
- Average temperatures rise throughout the continent
- Precipitation amounts decrease in the southern US

Source: Munich Re – Severe weather in North America, 2012

Climate change

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Water Restrictions Threaten Agriculture Operations and Reduce the Industry's Economic Activity

AT RISK

(based on 2009 water shortage impacts)

$2.8 billion in **foregone statewide income** from jobs lost

6% of CA's **total economic activity** comes from agriculture

$11 billion in **annual state revenue**

$2.2 billion in **gross direct and indirect losses** to the Central Valley

40% of **Central Valley jobs** are tied to ag production and related processing

The Water Crisis Will Cause a Decline in **Trucking**, **Shipping**, **Trade** and **Food Processing** Industries

AT RISK

95%
of California's agriculture is transported by freight

$640 billion
in exported goods are processed by the ports in Los Angeles, San Diego and Bay Area counties

1.4 million
jobs are generated by the movement and exporting of goods through California ports

640,000
people work in trade related jobs in the Southern California Region

Over 50,000
food processing jobs in CA are directly tied to agriculture production

Source: The California Farm Water Coalition

Thunderstorms and Climate Change

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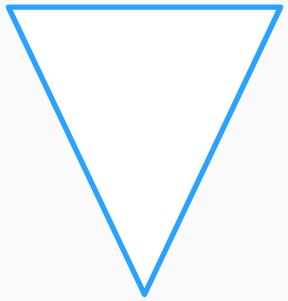
Due to the small-scale, localized nature of severe thunderstorms and their associated hazards, it is hard to tell what impact climate change will have on these storms.



- Increased atmospheric moisture and heat will likely increase the number of days per year that severe thunderstorms are possible in certain areas of the globe.
- Some studies already indicating more large hail events over past 50 years; unclear if naturally driven change or influence by human activity.
- Socioeconomic factors will likely dominate thunderstorm loss potential for the foreseeable future.

Climate Change Conclusions / Takeaways
Impact on the Insurance Industry

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North America at High Risk

- The **intensities of certain weather events** in North America are among the highest in the world, and the risks associated with them are changing faster than anywhere else.
- The underlying reason for this is that **North America is affected by all types of weather extremes,** including hurricanes, tornadoes, wildfires, droughts, floods and winter storms.
- Due to **socio-economic factors** such as ongoing urbanization and increasing values, the **potential for weather-related losses in North America is still rising.**
- **Scientific findings** hint strongly toward the likelihood of a climate change (CC) impact. This is supported by the joint report issued in March 2014 by the US Academy of Sciences and the UK's Royal Society as well as the 2013 report of the Intergovernmental Panel on Climate Change (IPCC).
- In addition, **new technologies may give rise to new risks**. Natural hazard insurance will therefore remain a challenge, with climate change bringing further uncertainty.

Impact on Insurance Industry

Climate Change = Unanticipated Loss levels = Risk of Change

Risk of Change = Pricing and Reserve Risk

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EMERGING RISKS …..Revisited
CHALLENGES / OPPORTUNITIES:

Paradigm-changing events for Risk Management (USA Examples)

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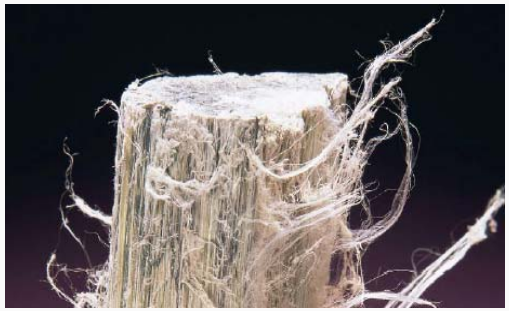
Starting 1970s/80s
Asbestos



11.9.2001
Terror-attack on WTC

29.8.2005
Hurricane Katrina

Starting 2007/2008
Financial Crisis

Basic elements of a risk management process

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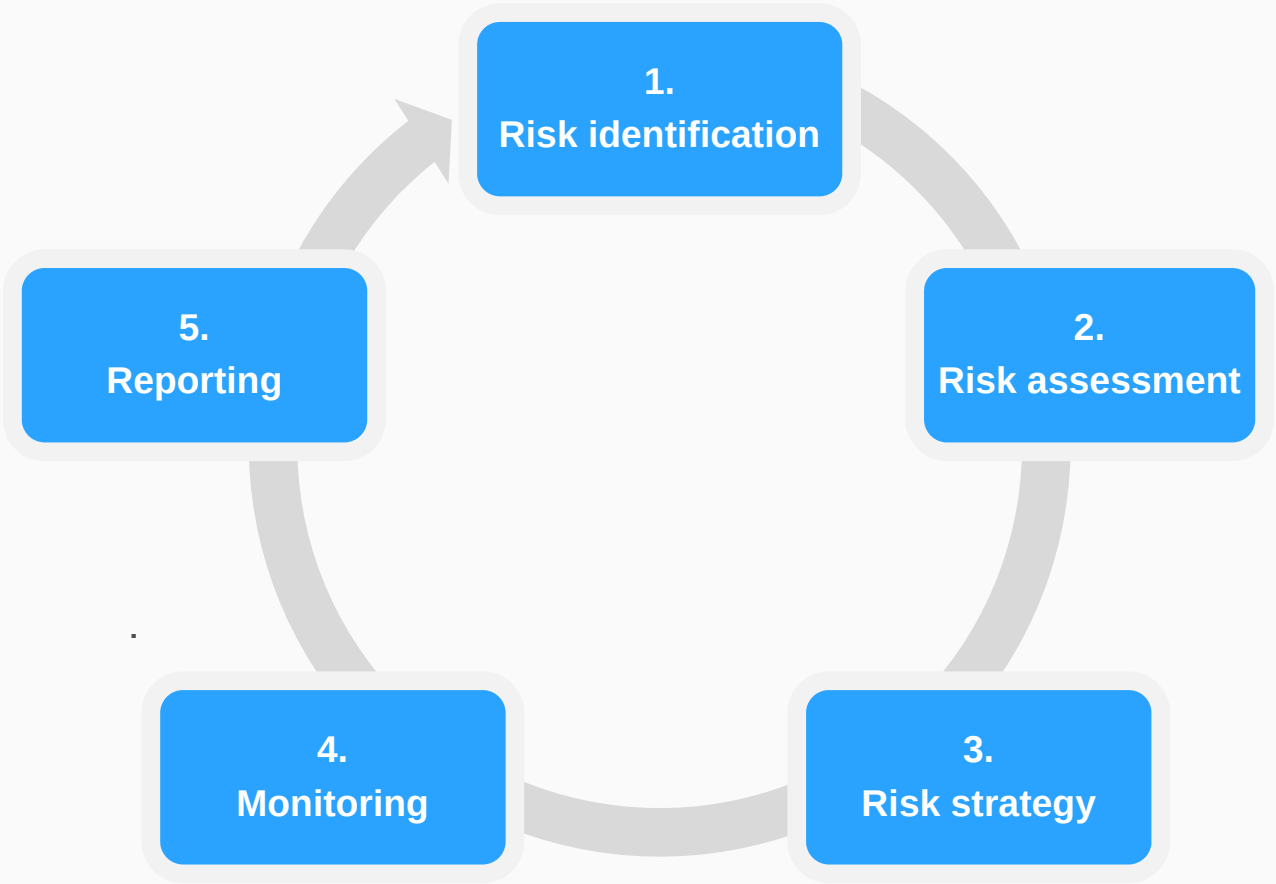

Uncertainty and action – the dynamics of emerging risks

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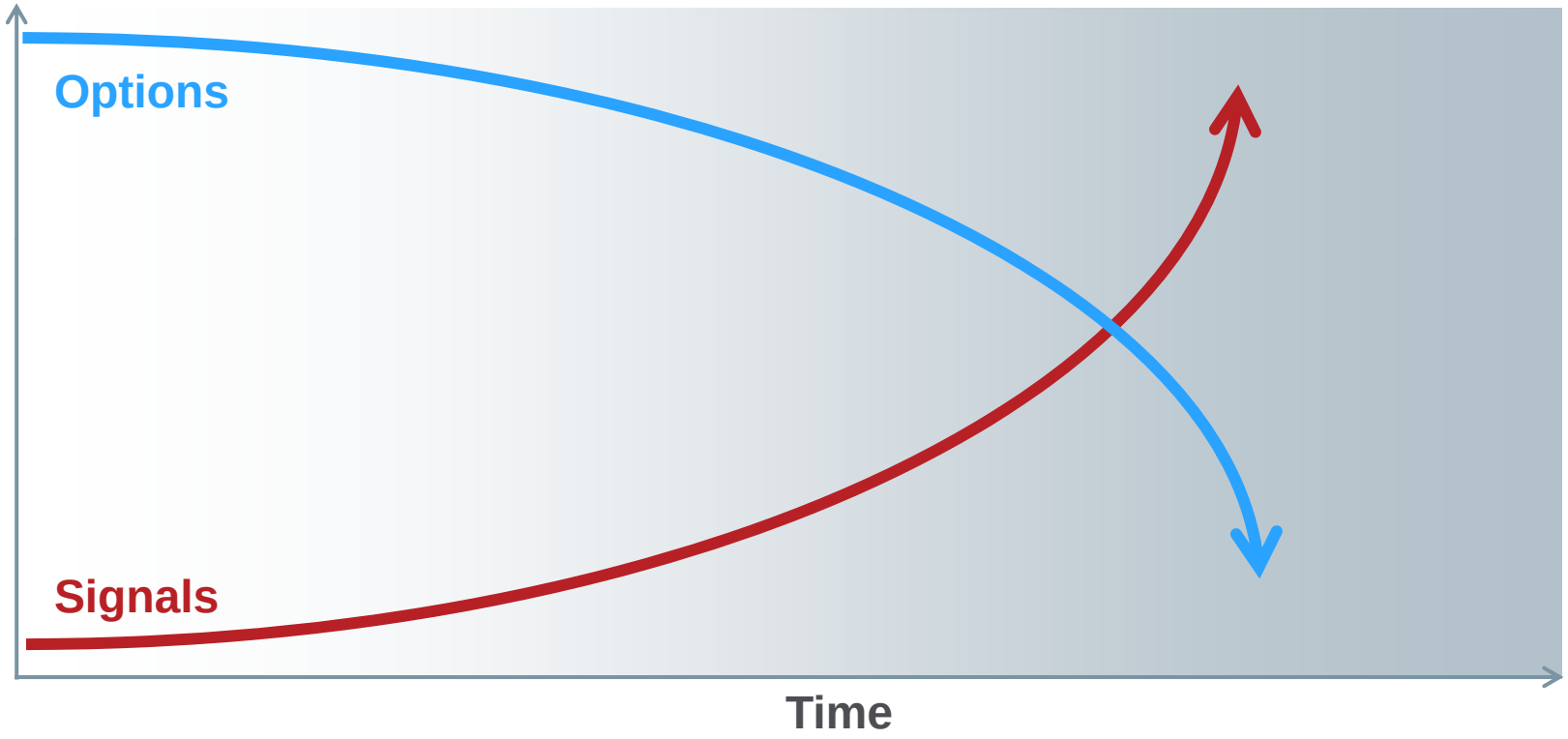
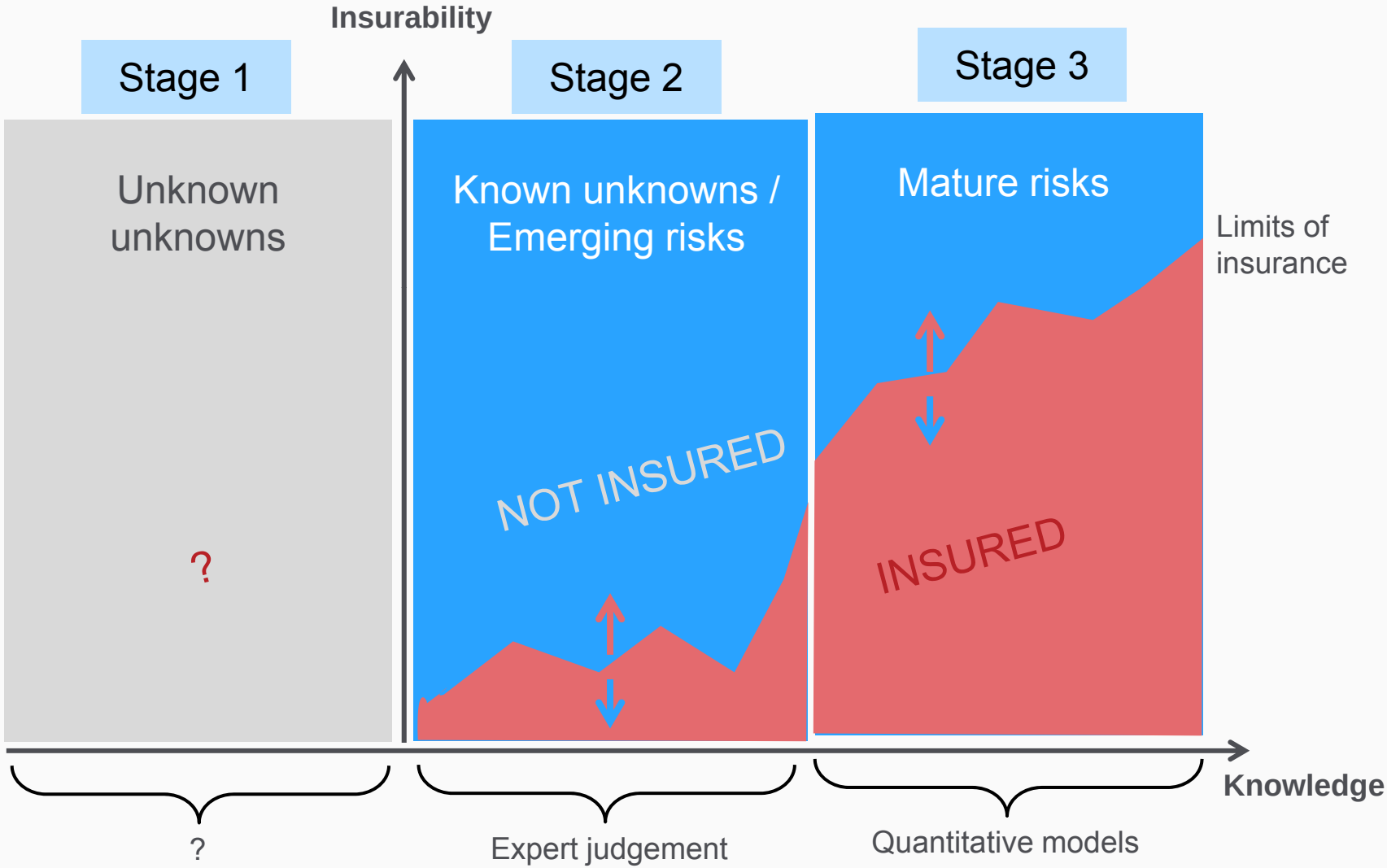


Early detection and evaluation are crucial

Emerging risks and the limits of private insurance



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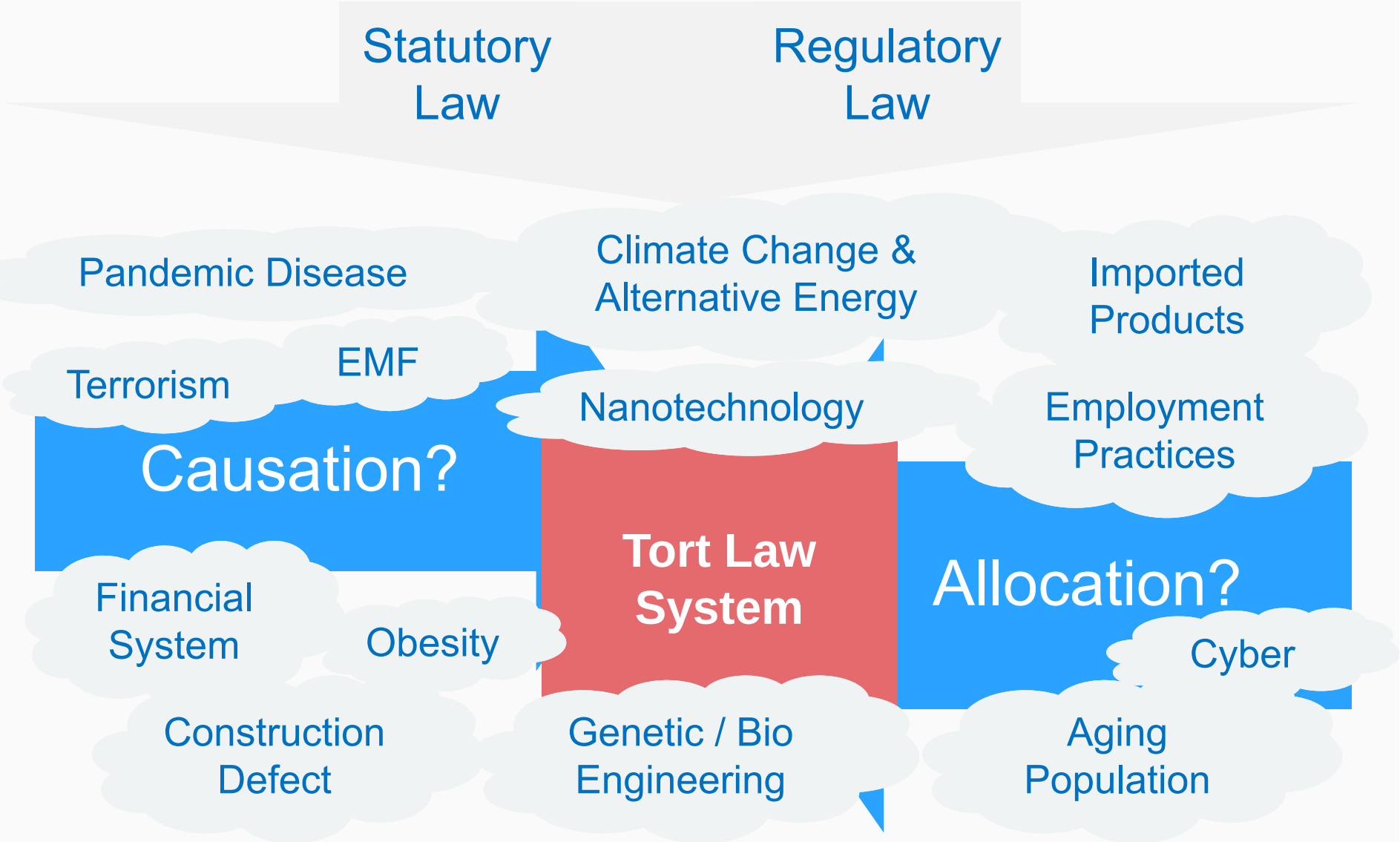
Statutory Law
Regulatory Law
Pandemic Disease
Climate Change & Alternative Energy
Imported Products
Terrorism
EMF
Nanotechnology
Employment Practices
Causation?
Tort Law System
Allocation?
Financial System
Obesity
Cyber
Construction Defect
Genetic / Bio Engineering
Aging Population

Three Stages of Insurance Role As Respects Emerging Exposures

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Insurance as "Enabler" → Supports the development of new technologies by managing and financing risk

Three Stages of Insurance Coverage

1	Early study period	▪ Efforts to understand exposure ▪ Risks may unknowingly be covered
2	Apprehensive phase	▪ Initial risk knowledge leads to concerns ▪ Insurers look to reduce/contain coverage
3	Mature phase	▪ Increased risk knowledge = enhanced understanding, leading to… ▪ Risk management, customized coverage & other approaches, at reasonable prices

Source: R. Blaunstein – Unfamiliar Exposure , Insurance Networking News, 2006

A look Back….The industrialization of the US

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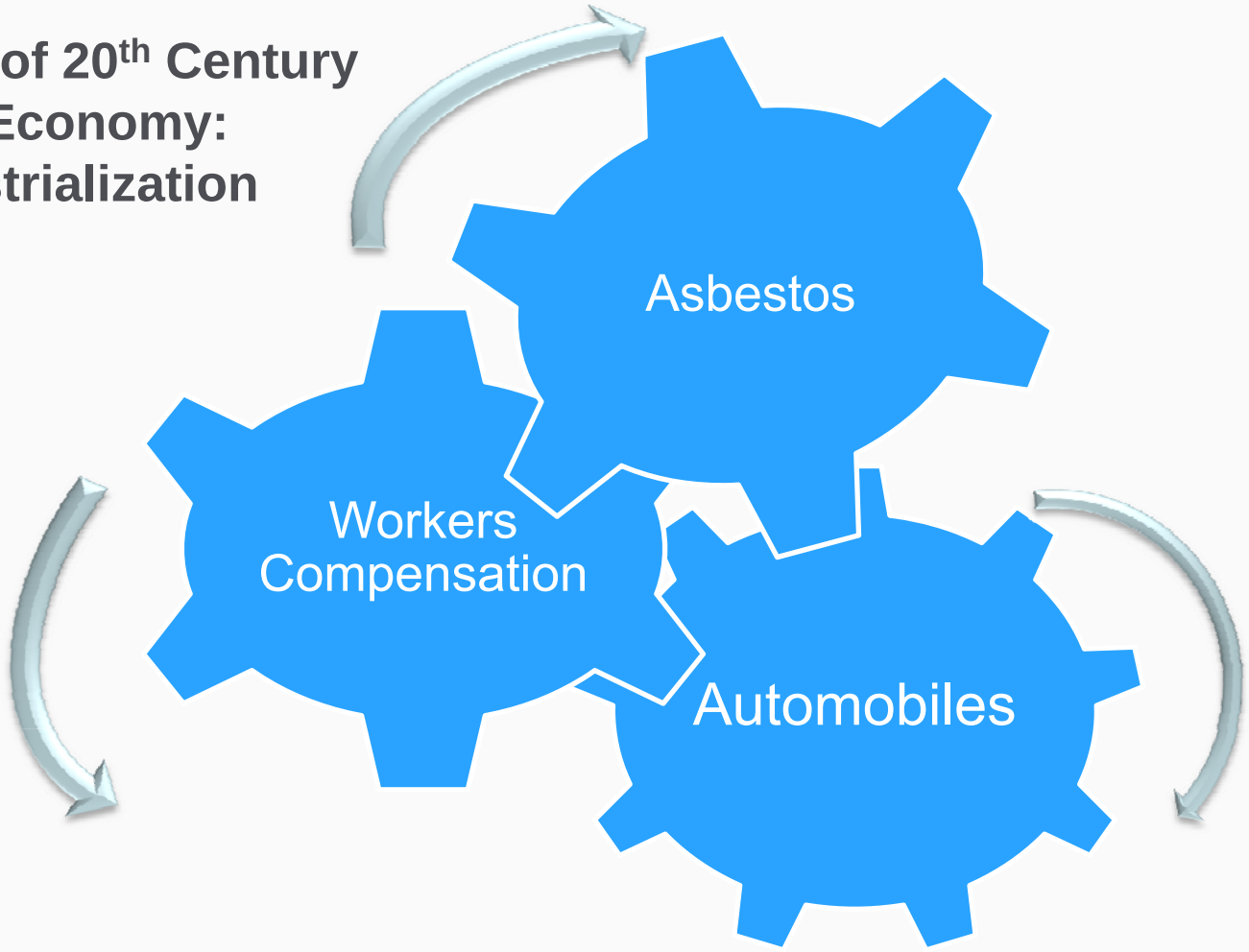
3 Drivers of 20th Century US Economy: Industrialization



What Will Drive the 21st Century Economy?
What Role will the Insurance Industry Play?

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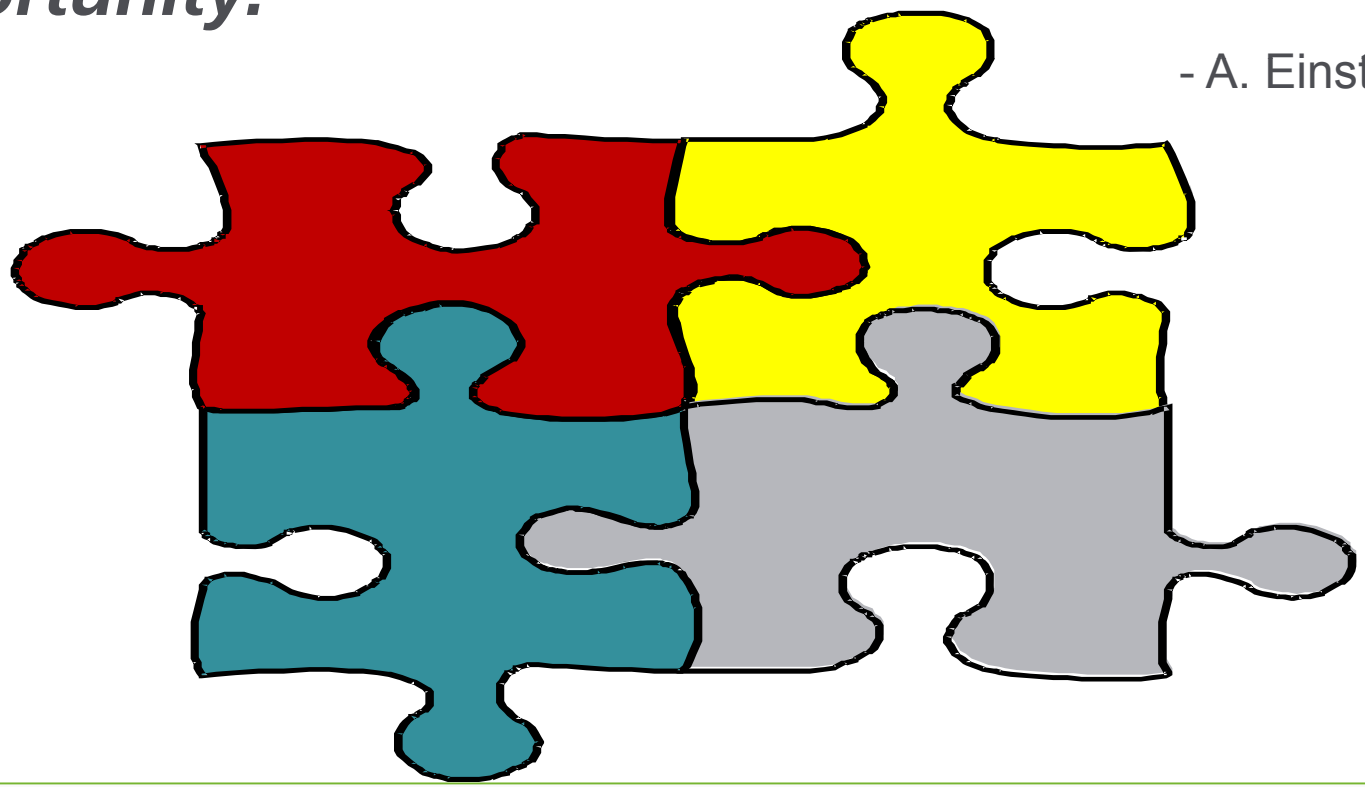
"Out of clutter, find simplicity. From discord, find harmony. In the middle of difficulty, lies opportunity."

- A. Einstein



Challenges / Opportunities
Decisions, Decisions

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When you come to a fork in the road……

Emerging Risks

Central to Society

Central to Our Business

…..take it

(L.Berra)

Threats

Understand the Risks

Opportunities

Proactively Develop Solutions

Monitor and Analyze → Insurance Implications → Strategy or Solution

Risk Evaluation Criteria
Resource Allocation

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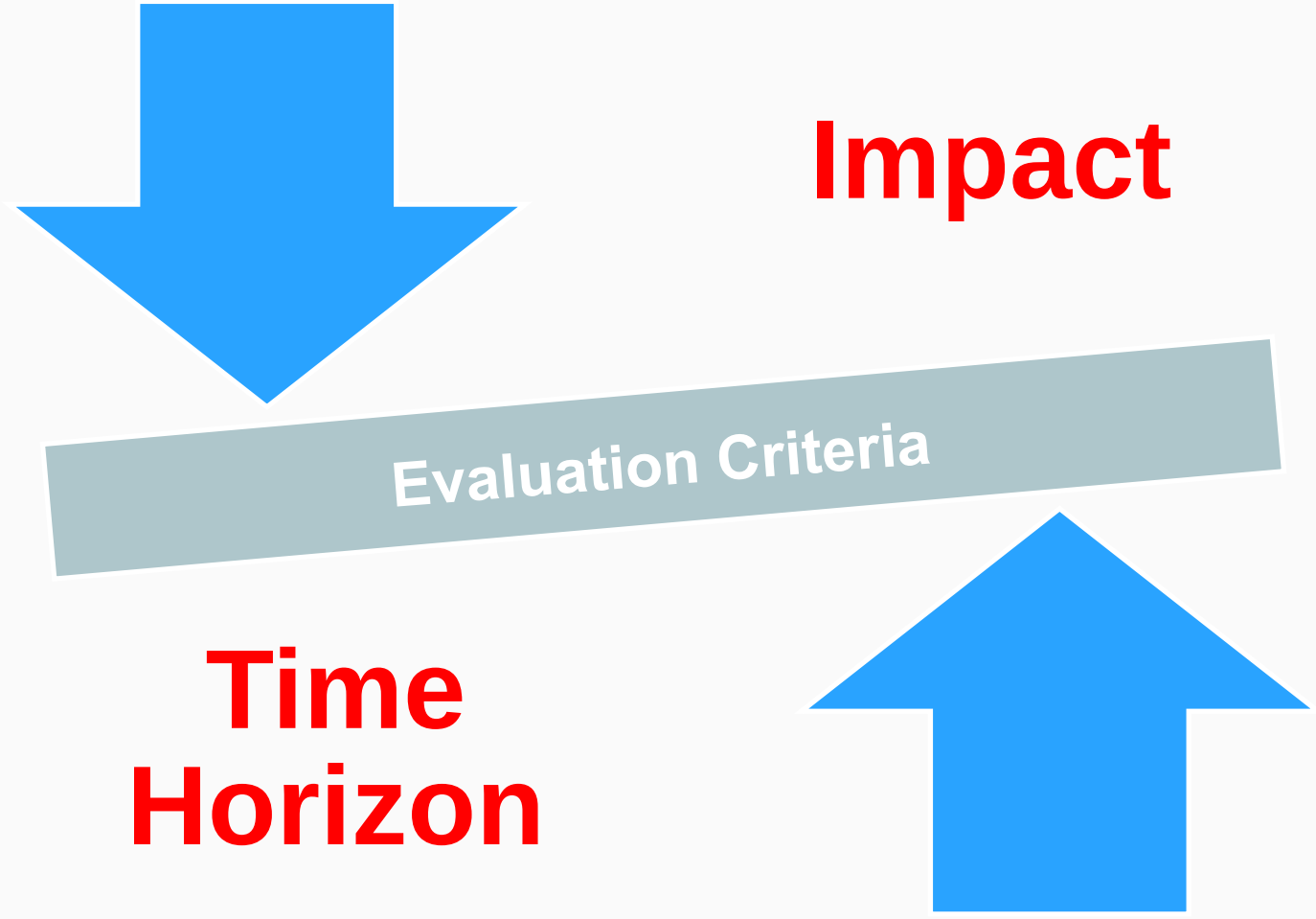

Managing Emerging Risks
The Alternatives

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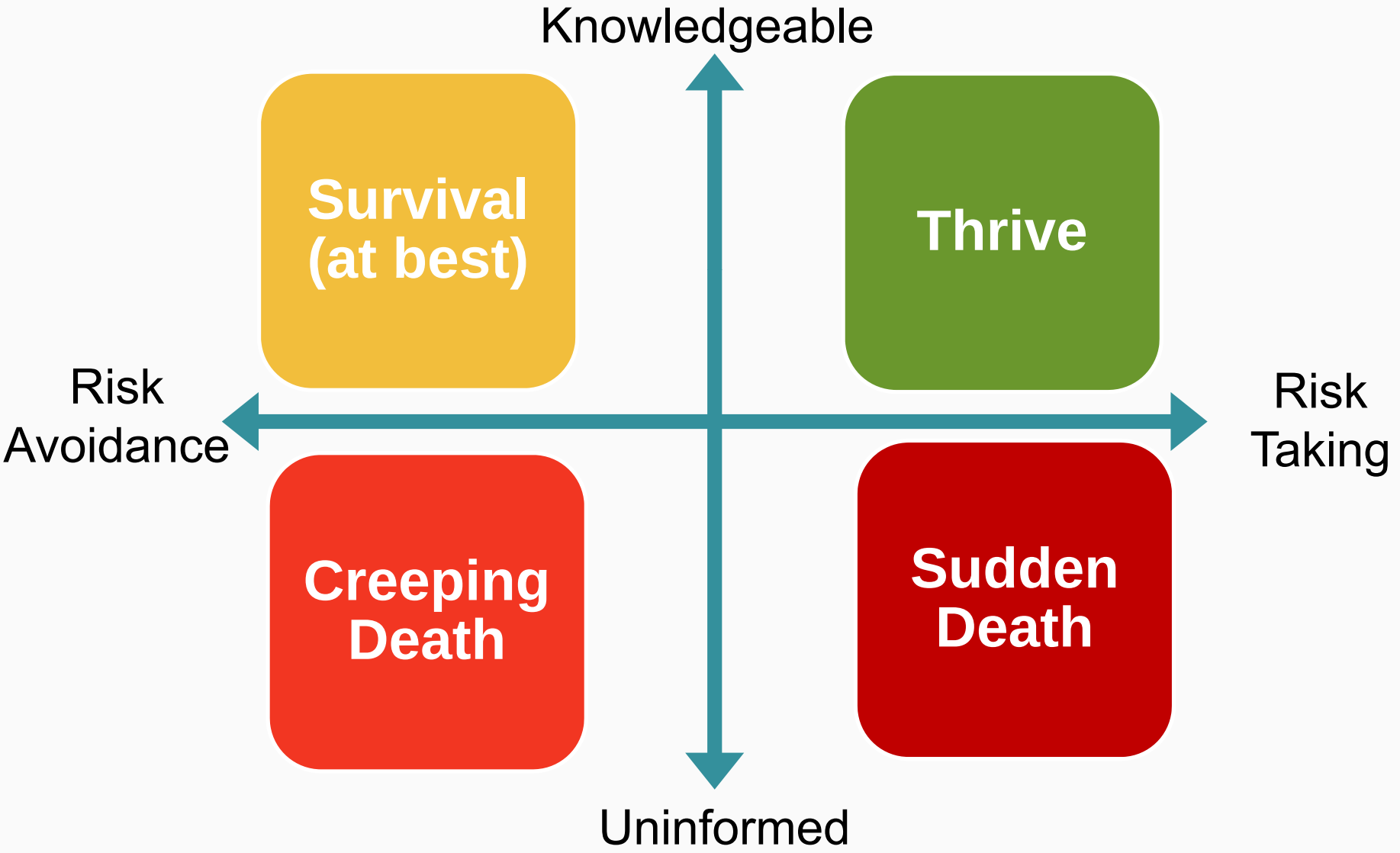

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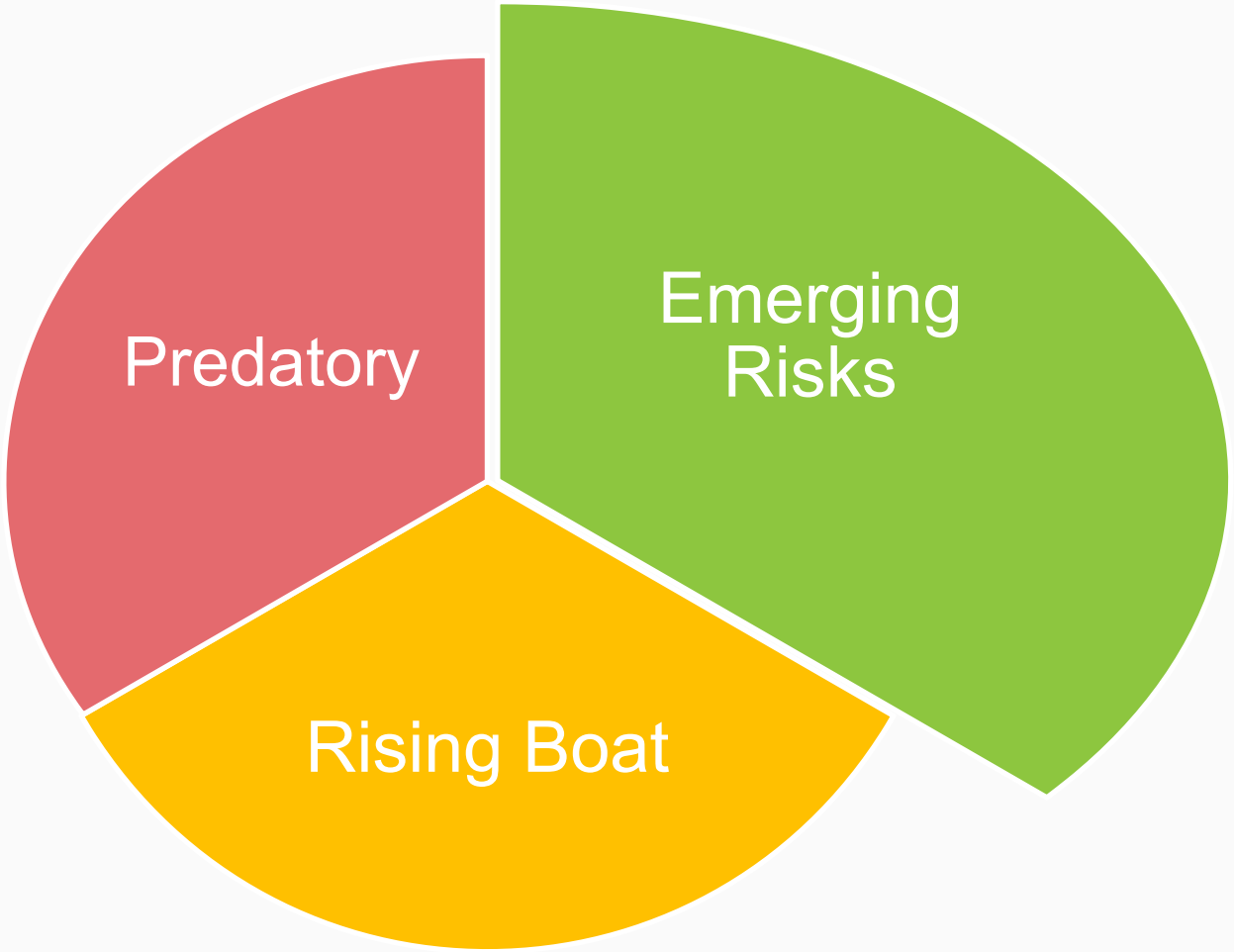
How Does the Insurance Industry Grow?



Emerging Risks
Key Takeaways

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- Central to a developed / developing Society/Economy…and our Business
- Many Drivers – Technology is a Key
- Systemic Risk Potential – Risk of Change – Needs to be effectively managed
- Great Opportunities as well as Threats
- Legal Landscape ….still evolving and a major challenge
- Knowledge, leading to effective action, is Power

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Not If…

- New Risks are rapidly emerging and evolving
- Potential benefits are enormous – Innovation leading to:
  - Jobs
  - Economic Growth
  - Enhanced social impact

…But How

- Risks are uncertain in many respects
- Insurance Industry has a major role to play: Risk Management and Financing…
- Need to fully Understand the Risks

Understand the Risks

Develop Solutions

Be an Informed Enabler

Emerging Risks : Success is built on Knowledge

When the sun comes up…

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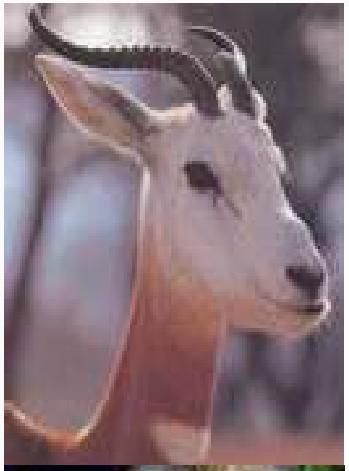

African Proverb

Every morning in Africa, a gazelle wakes up.
It knows it must run faster than the fastest lion or it will be killed…….
…….Every morning in Africa, a lion wakes up.
It knows that it must outrun the slowest gazelle or it will starve to death.

It doesn't matter whether you are a lion or a gazelle.
When the sun comes up, you better start running.
- *The World is Flat*, by Thomas Friedman

For those that assume risk for a living -
Knowledge is Speed

Emerging Risks and the Role of Insurance

Buckeye Actuarial Continuing Education Meeting

Columbus, OH

Thank You

Gerry Finley, Senior Vice President,
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