Emerging Risks and the Role of Insurance
CPCU Reinsurance Symposium
March 16, 2018
Philadelphia, PA

Gerry Finley, Senior Vice President,
Casualty Treaty Underwriting,
Underwriting Services
Munich Reinsurance America, Inc.
gfinley@munichreamerica.com
Emerging Risk Overview
Agenda

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

...Defined
3 Drivers of 20th Century Industrialized US Economy

A look Back…20th Century Industrialization

What Will Drive the 21st Century Economy?

What Role will the (Re)Insurance Industry Play?

Automobile

Workers Compensation

Asbestos
Defining Emerging Risk

Life Span of Emerging Risks

Insurance Perspective

Stage 1
Unknown / Unknowns

Stage 2
Known / Unknowns

Stage 3
Mature / Evolving Risks

Time Frame can be Months or Decades

Stage 1 today may be Stage 3 Tomorrow
Emerging Risk

Drivers

GLOBALIZATION

- Natural / Environmental
  - Climate Change: Storm Frequency or Severity
  - Oil Spills
  - Pollution
  - Hydrofracking
  - Asbestos
  - Alternative Energy – Wind, Solar, etc
  - Crypto Currency
  - Autonomous Vehicles
  - E-Cigarettes
  - Internet of Things
  - GMO
  - Drones
  - Pharmaceutical
  - Cyber/Internet
  - 3D Printing
  - Nanotechnology

- Social / Political / Regulatory
  - Employment Practices
  - Obesity / Litigation
  - Tort Reform/Trends
  - Construction Defect
  - Medical Malpractice
  - Aging
  - Demographics
  - Sharing Economy
  - Marijuana
  - Terrorism
  - Health Care Reform
  - Runaway Inflation
  - Financial / Economic
    - Financial Reform
    - Discrimination, Sexual Harassment
    - Growing Income Disparity
    - Recession

Science / Technological
Emerging Risks

...Challenges and Opportunities
Emerging Risk Challenges

More Qualitative than Quantitative

How do you Identify, Measure, Classify, Price Risks?
Out of Risk …

……………Comes Opportunity

Challenges

Underwriting

- Imperfect Information
- Unique Coverage
- Non-standard Pricing techniques

Claims

- New Legal Theories
- New Claim Scenarios / Modeling issues

Success Depends on

Risk Understanding and Expertise

Willingness to be uncomfortable

Tools to monitor

Risk/Loss Containment

Courage to Act

Heavy Reliance on Science
Emerging Risks

Opportunity Evaluation

**Nature of the Risk**
(Main Drivers, Nature/Scope of Impact, etc.)

**Time Horizon/Impact**
(Short Term / Long Term
Smaller/Larger)

**Nature of Support**
(Financing, Risk Management, Product Development, etc)

**Innovative Solutions**
Non-traditional; Imperfect Information; Taking Measured Risk
Emerging Risks

Importance
Emerging Risks

---Why is it important to understand?

- 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
Emerging Risks

……Wrap Up
Emerging Risks
Importance to the Insurance Industry

How Does the Insurance Industry Grow?

- Predatory
- Emerging Risks
- Rising Boat
Emerging Risks

Key Takeaways

- 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
- Legal Landscape …. ….still evolving / major challenge
- Imperfect Information & New Claiming Theories
- Great Opportunities as well as Threats…it’s where the real growth will come from
- The Key…Knowledge……leading to effective action
- Some Risks require specialized UW, Actuarial and Claims Expertise

“The Times They are a-Changin” – Bob Dylan

“The Word Turned Upside Down”
- Lin –Manuel Miranda (Hamilton)

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

“The Future ain’t what it used to be”
– Yogi Berra
Two Emerging Risk Examples:
.....Technology (3D Printing)
.....Social (Marijuana)
3D Printing: “Factory of the Future”???
Introduction

Market Place

Impact: Social and Economic

Legal/regulatory Landscape: Insurance View

Impact: (Re)Insurance Exposures, Loss Scenarios, Coverage

Wrap Up
Introduction
3D Printing
Introduction.....What It Is

Traditional Manufacturing.....”Subtractive” Manufacturing

Subtracting
- Grinding
- Cutting
- Bending
- Molding
- Forging
- Etc…

Then….Reconstructing
- Welding
- Screwing
- Gluing
- Assembling
- Nailing
- Etc……..
3D Printing – a.k.a “Additive Manufacturing“:
(Some also refer to it as “Desktop Fabrication“ but that’s misleading because the “printers“ can be pretty large.)

Creation of 3 Dimensional Objects using Computer Assisted Designs (CAD)

Thousands of Layers Created....... Building the Object from the Ground Up
Additive Manufacturing…… 2 Main Inputs

What Do We Want to Build
3D Digital File/Models - Created by Either:

- CAD – Computer Aided Design (typically generated by others)
- 3D Scanner
- Digital Camera and Photogrammetry Software

Communicate the Dimensions of Each Required Layer (or “horizontal slice”) to the Printer…..creating the object

What Do We Want it to be Made of?
Raw Materials: Either Liquid or Powder Forms, include

- Plastics
- Synthetic resin
- Plaster powder
- Glass powder
- Thermoplastics
- Metal powder
  (Steel, Aluminum, Silver, Titanium,)
- Wax

- Ceramics
- Bone
- Living Tissue
- Gels
- Photopolymers
- Polycarbonate
- ABS plastic, PLA, polyamide (nylon)

Materials Used
Constantly Evolving and Increasing
Leading Global Materials @ March 2016

- **Most commonly used 3D printing materials; Some respondents used multiple materials**

- **Top 3:**
  - Plastics 73%
  - Resins 26%
  - Metals 23%

Likely to Change over time as Technology and Use Goals expand

2016 Survey by Sculpteo (Global Leader in on-line Digital on demand 3d Printing)

Source: Statistica | Forbes [ID 560323](#) Further information regarding this statistic can be found on [page 8](#).
3D Printing
Introduction.....What It Is

Additive Manufacturing….Varied Processes…To Match Object Needs

✓ Many types, methods, and materials used ;
✓ Methods vary by application and material requirements
✓ Multiple Trade Names - for these processes, imposed by the manufacturers, which can cause confusion
✓ Commonality is the extremely accurate nozzle deposition system to place or omit materials as appropriate

Material Extrusion uses build materials and an adhesive to cement micron-sized particles. These are the largest installed base of AM machines today and include the home 3-D printers made by a number of manufacturers.

Material jetting machines use precision droplet deposition to build up the ink-jet printing of prototype models.

Binder jetting is a process that uses liquid binding agents to cement powdered material. Various materials can be used as the “powder” including metals, which later can be filled with liquid metals for investment grade castings.

Selective Laser Sintering uses powered materials (plastics, ceramics, glass nylon, metals) for concept models, proto-types and end-use products for dentistry, aerospace and other industries.

Vat photo polymerization, also known as Stereolithographic Apparatus (SLA) uses UV light to cure a photosensitive liquid material.

Powder Bed Fusion is synonymous with Selective Laser Sintering (SLS) and consists of high-energy laser sintering or welding of powdered material and provides the most durable polymer and metal products.

Fueled Deposition Modeling uses melted thermoplastic material to form layers – commonly used in industrial printing for rapid prototyping and manufacturing

Electron beam melting (EBM) performs a melting of the materials. These are industrial machines used for many in aerospace applications.
Additive Manufacturing.....In Sum

Multiple Processes & Materials: Build up Parts & Layers of various Micron-size Materials

Inputs
- Raw Materials
  - Plastics
  - Powders
  - Binders
  - Sand
  - Resins
- CAD Files
  - Generated
  - By-Others
- Scanned Files
- Repairs

3D Printing Processes
- Material Extrusion
- Material Jetting
- Binder Jetting
- VAT Photo Polymerization
- Powder Bed Fusion
- Electron Beam Melting (EBM)

Post Printing Operations
- Part Cleaning
- Dust Collection
- Recycling Ops
- Grinding / Finishing
- Oven Curing
- Hardening

Finished Product

Image: Copyright 2014 Hartford Steam Boiler and Inspection Company
### Pros and Cons…3D Printing v. Traditional Mfg.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Creation of more complex shapes</td>
<td>- Mass production capability is limited</td>
</tr>
<tr>
<td>- Low level of human intervention</td>
<td>Only able to produce objects as big as its platform</td>
</tr>
<tr>
<td>- Waste reduction</td>
<td>- Variety of materials used in 3D printing</td>
</tr>
<tr>
<td>- Reduced cost/time to change models</td>
<td>- some printers have limited capacity for handling wide range of multiple</td>
</tr>
<tr>
<td>- Ease of customization</td>
<td>materials</td>
</tr>
<tr>
<td>- Convenience in remote areas or in cases of specialty parts</td>
<td>- Performance of parts printed on different printers may lack consistency</td>
</tr>
<tr>
<td>- Reduced inventories</td>
<td>due to lack of standardization</td>
</tr>
<tr>
<td>- Rapid global distribution</td>
<td>- Concerns about long-term durability of 3D Printed products</td>
</tr>
</tbody>
</table>

**Bottom Line:**

- **Disadvantages:** Mass Production Capability Currently Limited (viewed as a temporary issue)
- **Advantages:** Less Expensive; Faster; Customization; Superior (lighter, stronger); Less Waste Material
3D Printing
Introduction…..What It Is

IT’s ALIVE!!!!!!........From 3D To 4D

Hybrid material: Potential for 4-D-printed adaptive devices

Using Specific Geometric Code + Responsive Printing Material

3D Printed Objects that have the ability to change shape after they are produced

In response to changing Environmental Conditions (moisture, movement, light, temperature, etc.)

University of Pittsburg and Clemson

• Experimenting with a hybrid material – combination of photo-sensitive fibers and thermo-responsive gels

• Can reconfigure into different shapes when exposed to light and heat
3D Printing
Introduction…..What It Is

And It’s Stronger………. 3D To 5D

3D Printing
- Objects Created in Horizontal layers… All Layers going in the Same Direction
- Weak Points if Force Pushing in Opposite Direction…Forces layers to Separate

5D Printing
- Print Plate & Printer Head Move Created in Layers of Various Directions:
- …. Follows the Shape of the object Being Printed

Result: Object is 3 to 5 Times Stronger than 3D Printed (Still Being Tested)

https://3dprint.com/139742/mitsubishi-electric-5d-printing/
Marketplace
Early Adaptors/Applications

Industries that have embraced it early on include………..Aerospace, Automotive and Healthcare

- Automotive: Spare Parts
- Aerospace: Spare Parts
- Medicine/Dental: Implants

Growing Use in Other Industries include

- Engineering, Architecture, Construction: Models, Component Parts
- Toys: Production
- Textiles; Prototype; Production
- Industrial design: Model
- Art: Statues
Moving Toward Mass Production

2016 Professional Use (Personal Use not Reflected):
- 67% Prototyping
- 50% Production
- 41% Proofs of Concept

Some Respondents Reported Multiple uses

2016 Survey by Sculpteo (Global Leader in on-line Digital on demand 3d Printing)
Market Projections.....Industries

Current Application / Future 3D Printing Potential ....By Industry (circa 2016)

Source: EY analysis based on 2016 EY global 3D printing survey.
Global 3D Printer Market Projections….

**Global Unit Shipments of 3D Printers from 2015 to 2020**

- **2015**: 219,168
- **2016**: 455,772
- **2020**: 6,700,000

**3D Printer Unit Shipments**

- **Global**: Dramatic Increase Projected in the **Number of Printers used**

Source: Statistica I Gartner [ID 370297]; Further information can be found on page 8.
Global 3D Printer Market Projections….

Global revenues for the 3D printing market…..

More than Double in 5 Years

…..From $15.9b in 2016

…….To $35.4b in 2020.

Source: International Data Corporation (IDC) Worldwide Semiannual 3D Printing Spending Guide 8/19/16
Americans Who Support Private Ownership of 3D Printers

In 2013...

62% of Americans Support Private Ownership of 3D Printers

Potential for Significant Increased Use as.....

...Awareness Increases...and .....Costs Decreases
Impact: Social and Economic
3D Printing

Potential Impact

Entire Supply Chain May Be Impacted

Raw Material ➔ Manufacturing ➔ Sales ➔ Use
Where and What are the Jobs of the Future???

20th Century Factory Jobs are **not** going to other Countries….

……..They’re going to **machines** and higher skilled workers

Robots, Automation .......... and 3D Printing

THE KEY QUESTION:
As with all Automation in the Workplace:

Will It Create More 21st Century Jobs....

Than Century Jobs that it Eliminates?
This is what a 21st Century Factory Job May Look Like

Versatility: On Demand Factory

https://www.youtube.com/watch?v=AhuQPlf90oU

3D Printing

Potential Impact (An Example)

Healthcare....Body Parts and Medical Devises
(e.g., Hearing Aids; Surgical Instruments; Implants; Prosthetics; Dosage Specific Drugs)

Advantages

- Cost efficient
- Product customization
- Increased access

Source: USPS

FIGURE 11: The 3D-printed metal face cover on this prosthetic leg is delicate yet strong and reflects the wearer’s individuality.

source: asap.io

FIGURE 12: These 3D-printed structures — kidney (top left), ear (top right) and finger — could one day help address the organ shortage and the need to repair if not replace damaged body parts.

Source: Wake Forest Institute for Regenerative Medicine

https://commons.wikimedia.org/wiki/File:3d_printed_hand (1564662457).jpg
Transportation

Advantages

- Engine Parts for Aerospace and Auto industries
- Prototyping
- Cost Efficiencies
3D Printing

Potential Impact (An Example)

Retail

Amazon: If 30-minute drone delivery is too slow... 3D-printing trucks

Amazon Patent Pending

- Amazon can manufacture products “on site” (in strategically placed trucks/sites)
- No need to stock the inventory
- Guarantee to have the products available
3D Printing: Solution for Ultra-Tall Wind Turbine Towers?

Wind Turbines

- The Bigger and Higher the Better

- Problem:
  - Transporting Ultra large Turbine Parts (Blades, Tower, etc)

- Solution?
  - ... On Site Manufacture

3D Printing

Potential Impact (An Example)

Advantages

- Cost Efficient: Faster; Less Labor; Safer
- Environmentally Friendly:
  - Reduce carbon footprint associated with shipping materials and prefabricated structures to construction site
  - Reduce waste
  - Use Recycled materials
- More Flexibility

House: 2,000 sq. ft.; Built in 24Hrs.; Cost < $5,000

- Offsite and Onsite
- Unique parts

Material: Cement and Glass Fiber Construction Waste
3D Printing

	Potential Impact (An Example)

---

Clothing....Marijuana ......and Turtles

Levi's Test 3D Printing Technology

A new 3D-printed cannabis inhaler by Syqe lets doctors administer medical marijuana remotely.

Source: Levi's

August 07, 2017 3D Printing Progress
http://www.3dprintingprogress.com/articles/11477/levi-tests-3d-printing-technology

Levi's Test 3D Printing Technology

Brazilian Tortoise lost 85% of Shell in a Forest Fire is fitted with a 3D Printed Replacement

The Week 6/3/16

The Green Economy January 01, 2017 QUARTZ

Syqe inhaler with wireless connectivity. (Syqe Medical)
3D Printing

Potential Impact (An Example)

**Advantages**

- Speed
- Help Food Challenged Areas
- Space Travel (NASA)

Layered Cartridges of powder and oils used to produce Food Quickly

![Food images](image-url)
3D Printing

Potential Impact (An Example)

Social Impact: Personal Use.....The Home Market

Micro 3D Printer

As Low as $299

The Week 5/18/15
3D Printing

Social Impact: Personal Use…..The Home Market

A Variety of Models, Capabilities and Costs

Colido Diy 3D Printer
$299.99
Staples

DA Vinci Mini 3D Printer
$295.99
Walmart

MakerBot Replicator
$1,299.00
USI Laminate

Dremel®
$999.00
Rockler Woo…

Formlabs Form 2 SLA 3D...
$3,499.00
Formlabs

MakerBot Replicator +...
$2,499.00
USI Laminate

CoLiDo X3045 Duo 3D Printer
$2,154.10
Walmart

MakerBot Replicator...
$6,499.00
USI Laminate

Readily Available
3D Printing

……….Potential Impact (An Example)

Social Impact: Personal Use…..The Home Market

Toys……

Tools…

Gadgets /Equipment Parts

Guns????

Source: CSC

Mumbai RE
3D Printing

Potential Impact (An Example)

Where will 3D Printing Take Place other than at Manufacturing Plants......

US POSTAL SERVICE

Multiple Locations...

- Your Home
- Staples/Office Max
- Amazon
- Post Office
- United Parcel Service

CAD:
Bring Your Own....
....Or Buy on Site

UNITED PARCEL SERVICE: ALREADY 3D PRINTING SERVICE
3D Printing

Potential Impact (An Example)

Supply Chain.....From Global to Local

The Face of Global Supply Chains Will Change Significantly......

Global
Overseas Traditional Manufacturing and Global Distribution

Local
Local Additive Manufacturing and Local Distribution

Potential Advantages:
- Production closer to the consumer
- Printing on demand without build-up of inventories
- Shipping of designs instead of products
- New industry for designs for printing
- New industry for productions of AM systems and cartridges

Source: Atlantic Council Strategic Foresight Report October, 2011
Low-cost 3D printing enables anyone with a digital design to bypass the traditional supply chain and manufacture a product themselves.

What are the implications for companies operating in the supply chain?

Source: CSC
Legal and Regulatory: An Insurance View
3D Printing

Legal/Regulatory Landscape

Common Theme
With New Risks…The Law Typically Lags

New Science
Evolving Technology
Rapid Market Growth
New Loss Scenarios

Increased Judicial Risk
3D Printing

Legal/Regulatory Landscape

Regulatory Standards ..... Just Evolving

**Standards are Critical:**
Provide Base Line (requirements, specifications, guidelines or characteristics)

Ensure that Materials, Products, Processes, and Services are fit for their Intended Purpose

**But…. May Also Impact Litigation**

Either:
- Positively ... As a Defense (But may Not Always Carry the Day)
- Negatively...As a Target

Currently:

Only NIST and FDA Have 3D Printing Specific Initiatives

Others (e.g., EPA, CPSC) regulate as any other activity

Public Safety

Economic Development
Impact: (Re)Insurance Exposures, Loss Scenarios, Coverage
1st Party……Minimal Exposure…Similar to other Equipment Risk …Liability for damage may flow to Manufacturers (via subrogation) as Liability

- Fire/Explosion/ Time Element - Business Interruption, Extra Expense; Contingent Business Interruption
- Equipment Breakdown
- Perishable Good …Input material that is not stored properly – powders may be compromised by loss of power or improper temperature bacteria to grow or liquid materials hardening and not being usable)

3rd Party……Major Exposure

- WC/Pollution – Powders; Fumes
- GL/Products Liability/Recall…Most Exposure
  - Tampering
  - New Material - Properties Uncertainty, especially Long Term Behavior
  - Product testing shifted backwards in 1st lifecycle
- GL/Personal Injury…… Intellectual Property
- Personal Liability (Homeowners)

Cyber

- Privacy Breach and Internet iof Things Breach
3rd Party Liability Coverages …Questions

Key Questions:
1. Is a Digital Design a “Product”
2. Was the Code Used Properly (Intellectual Property)

Litigation and Regulation
To date, 3D lawsuits have centered on intellectual property. Related lawsuits and regulations are likely to follow.

Case Law and Regulations will develop over time to clarify the legal landscape and by extension application of coverage.
Litigation Issues…The Lack of Court Precedent

Policy Coverage…Heavily Litigated
…Regardless of the Line of Business

High Defense Costs
…Highly Technical Nature of the Subject

Causation and Allocation…Major Challenges.
…3D Printing Process…Multiple Parties

Blurred Lines of Responsibility
…Harder to determine who is responsible for damages

Basis of Liability May Include:
- Design or Manufacturing Error
- Failure to Warn;
- Improper Use;
- Modifying a Digital Design, etc.

- 3D Code Designer
- Printer Designer and Manufacturer
- Raw Material Manufacturer or Supplier
- Retailer Selling Printer and/or Raw Material
- User of the 3D Printer – Person or Company
- Product Customer
Wrap Up
Market Projections... Cost and Capability Spur Growth

Siemens:
- 3D printing will be 50% cheaper and up to 400% faster in the next five years.
- 3D Printing will be a €7.7B ($8.3B) global market by 2023.

Source: Solmas. 3D Printing Facts and Figures.
3D Printing Marketplace.....Overtime

Market Timeline …

Additive Manufacturing Adoption Timeline

Additive Manufacturing has been slowly gaining traction, specifically within design, however, new technologies have the potential to amplify growth and extend usage within production.

From Only Prototype (1986) to Low Volume; Highly Specialized Products (2020)

To Wide Scale Mass Production (2030)
3D Printing - A Disruptive Technology …we haven’t seen a change like this since the dawn of the industrial age 150 years ago…It will change commerce dramatically. Along with the way we work and even live our lives.

Additive Manufacturing won’t replace Conventional Manufacturing …But…. It is expected to revolutionize many niche areas…..Exponential growth is on the horizon.

Prices will continue to decrease Applications and Use will increase – both for industrial use and personal use Benefits and Risks will continue to evolve

3D Printing is a growing and expanding technology….Projections vary ..but all are Trending Up…Allows everyone to be in the custom manufacturing business whether for profit, expediency or for fun….

Profitable Solutions Possible: Underwriting / Risk Management based on Pro-Active Informed Decision-making
More In the "I'm getting old" department..

...a kid saw this and said, "oh, you 3D-printed the 'Save' Icon

Bill Gross– Founder of Technology Incubator Idealab  
[Link to tweet](https://pic.twitter.com/rwgCpSjfDQ)
Marijuana
Marijuana Agenda

Introduction

Legal / Regulatory Considerations

Insurance Implications

Closing Thoughts
Introduction
What it is

Cannabis Plant (Cannabis Sativa)

Hashish
- THC (dela-9 tetrahydro-cannabinoidal)
- Main psychoactive ingredient ("the high")
- Smoked only, often mixed with tobacco

Marijuana
- THC (dela-9 tetrahydro-cannabinoidal)
- Main psychoactive ingredient ("the high")
- Smoked by itself; mixed with food; injections, etc

Hemp
- Minimal THC (dela-9 tetrahydro-cannabinoidal)
- Not Ingested; Most commonly used for clothing, plastics, cosmetics paper, textiles, insulation, etc.
- Agricultural Act of 2014 Legalizes certain uses

http://norml.org/
Marijuana Versatility

Multiple Ways of ingesting marijuana make it highly attractive for both Medical and Recreational use

- Smoked/Vaped (flower)
- Beverage
- Eaten (Candy, Lozenges, Brownies, Cookies, etc)

Note: Data via Headset Inc.  
http://headset.io/
Noted Benefits/Positives (Not Universally Accepted)

Medical Value Reported

Multiple conditions, including:
- Stress, anxiety, migraines, PTSD, chronic pain, glaucoma, etc
- Neurodegenerative diseases such as:
  - Alzheimers
  - Multiple Sclerosis
  - Cerebral Palsy
  - Epilepsy
  - Parkinson’s
  - Cancer/HIV
  - Increase appetite
  - Treats side effects of treatments – pain; nausea; vomiting;

Economic Benefit Reported

Marijuana.. Next Mega Industry
(Tax Foundation Fiscal fact #509 – May 2016 Analysis)
- 2016 - ~$45 billion Total Sales
- 2016 - ~0.28 percent of US GDP (26 million pounds)

Creating Jobs
- Could Overtake manufacturing Jobs by 2020
- 2017 – ~100,000 to 150,000 jobs; ~ 280,000 by 2020

Tax Revenue: (Fed, State, Local) @2016 – A Mature Marijuana Industry
(Tax Foundation Fiscal fact #509 – May 2016 Analysis):
- ~ $28b Tax Revenue (Fed, State, Local)
- Including ~ $7.0b – Federal Business & Payroll Tax

2017 Tax Plan – May Prompt more states with high income/property taxes to look at Marijuana Tax Benefit

If Legalized Nationally:
$132b in Federal Taxes and 1mm Jobs Projected

Food & Drug Administration
Has not been engaged due to illegal status under Federal law

However

World Health Organization
(11/17 Report):
Cannabinol (CBD) which represents 40% of the Plant’s extract is “generally well tolerated with a good safety profile”.
In 2018 will study (THC) in depth

World Health Organization
Cannabinol (CBD) which represents 40% of the Plant’s extract is “generally well tolerated with a good safety profile”. In 2018 will study (THC) in depth
Pharmaceutical Industry...Marijuana Reduces Use of Prescription Narcotics

Fewer pills prescribed in medical pot states

Difference between annual drug doses prescribed per physician in medical marijuana states, and in states without medical marijuana laws, by drug category

<table>
<thead>
<tr>
<th>Condition</th>
<th>Doses Reduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>1,826</td>
</tr>
<tr>
<td>Anxiety</td>
<td>562</td>
</tr>
<tr>
<td>Nausea</td>
<td>541</td>
</tr>
<tr>
<td>Psychosis</td>
<td>519</td>
</tr>
<tr>
<td>Seizures</td>
<td>486</td>
</tr>
<tr>
<td>Sleep disorders</td>
<td>362</td>
</tr>
<tr>
<td>Depression</td>
<td>265</td>
</tr>
<tr>
<td>Spasticity</td>
<td>32</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>35 more doses</td>
</tr>
</tbody>
</table>


- **Medicare Costs Decreased** (U. of Georgia Study - [http://content.healthaffairs.org/content/35/7/1230.abstract](http://content.healthaffairs.org/content/35/7/1230.abstract))

- **Significant Reduction in Prescription Painkiller Abuse and Deaths in States with Medical Marijuana** ([http://www.nber.org/papers/w21345](http://www.nber.org/papers/w21345))
Marijuana vs. Opioids

**Opioid Epidemic**

- **2016 Center for Disease Control Report**
  - 2014 - EVERY DAY 46 people die from an overdose of painkillers such as Opioids, Vicodin, OxyContin, Opana or Methadone
  - 2012 - Doctors write 259m prescriptions for painkillers

  - Annual Opioid Deaths decreased 25% between 1999 and 2010 in states that legalized marijuana

- **2015 RAND Study Conclusions**
  - States with legalized medical marijuana .....experience decreases in both opioid addiction and opioid deaths compared to states without legalized medical marijuana

---

**Noted Benefits/Positives**

**Medical (Studies)**

- 2014 - EVERY DAY 46 people die from an overdose of painkillers such as Opioids, Vicodin, OxyContin, Opana or Methadone
- 2012 - Doctors write 259m prescriptions for painkillers


- Annual Opioid Deaths decreased 25% between 1999 and 2010 in states that legalized marijuana

**2015 RAND Study Conclusions**

- States with legalized medical marijuana .....experience decreases in both opioid addiction and opioid deaths compared to states without legalized medical marijuana
Noted Benefits/Positives
......Economic (Estimates Vary)

More on Marijuana Tax Revenue

The Tax Revenue & Politics:
- Marijuana legalization is highly politicized;
- Tax Revenue is central to the debate

State Excise Taxes - Various Types:
- Retail sales – most effective
- THC levels
- Marijuana plants
- Production/processing

Current Range: 10% (ME) to 75% (MO)
- Most in the 15%-25% range....

Federal Tax (section 280E of Tax Code)
...intended to penalize drug dealers
- Federal Legislation Proposed to modify
  (Small Business Tax Equity Act)

CA – 2018 (1st Yr of Recreational) $643m in Taxes projected
(LA Times 1/10/18)

Source: Tax Foundation; compilation of state laws and proposals.
Tax Foundation Special Report No. 231 May, 2016Marijuana Legalization and Taxes - Lessons for Other States from Colorado and Washington

http://norml.org/
Legal Marijuana Sales Growth = Economic Growth (Medical and Recreational)

Noted Benefits/Positives
……..Economic (Estimates Vary)

- 2014: $4.6 Billion ($352mm Recreational)
- 2015: $5.4 Billion ($998mm Recreational)
- 2016: $6.7 Billion (est)
- 2020: $21.8 Billion (est)
- 2026: $50.0 Billion (est)

ArcView Market Research; Fortune 2/1/16 and
Marijuana industry could be worth $50 billion annually by 2026; Market Watch Apr 22, 2017
Introduction

...Concerns

THC acts on numerous areas in the brain (in yellow).

Short Term Effects (1-3 Hours)

- Impaired cognitive capability (impact: school, employment, driving, etc.) for 1-3 hours
- THC may remain in the body for days or weeks (complicates testing)
- Extreme doses may lead to anxiety, fear, acute psychosis rather than a relaxed euphoria

A Word About “Synthetic Marijuana” (“Spice”; “K2”)

Actually not marijuana:

- Designer drug consisting of herbs, incense, other leafy material
- Sprayed with lab created chemicals attempting to mimic the effect of THC
- Can be more potent than marijuana and may have dangerous side effects

Banned Nationally in 2012...but FDA has approved one variant (Marinol) for treatment of migraines, epilepsy; Alzheimer’s, HIV, etc.
Addiction…To Marijuana?

- “Marijuana Use Disorder” (MUD) - form of dependence in about 30% of regular marijuana users
- Those that started young are more prone
- Severe cases of MUD may lead to addiction in extreme cases

Gateway to Other Drugs?

- Possible if other factors are at play (e.g., life style/social environment, propensity for addictions, etc)…Not more so, and probably lower, than over use of nicotine, alcohol, opioids and other pain remedies
- Regular use by Teen Boys – Increased risk of psychotic symptoms e.g., paranoia, hallucinations (American Journal of Psychiatry 8/16)

Decreased IQ and Socio-Economic Mobility?

- Frequent, Extended use, starting when very young; lasting for decades

Key Question:

....Do the Health and Economic benefits… ..... make the Risks Worth Taking?

Sources: National Institute on Drug Abuse (NIH) Research Report March, 2016; Impact of adolescent marijuana use on intelligence 1/19/16 Proceedings of the National Academy of Sciences of the USA) ; UC Davis Research April, 2016 – LA Times George Skelton , "Longtime marijuana use may make you a loser"
Arguments For……And Against

…...Much is Still Less Than Conclusive……Much Additional Research Needed

Many Supporters of Legalization Cite Marijuana’s Health Benefits
Among the 53% who think marijuana should be legal, main reason why you feel this way ... (%)

- Medicinal benefits: 41
- Not as dangerous as other drugs: 36
- Benefits of regulation, such as tax revenue: 27
- Current enforcement is expensive, problematic: 12
- People should be able to do it if they want to: 9


PEW RESEARCH CENTER

Opponents of Legal Marijuana Cite Dangers to Individuals and Society
Among the 44% who think marijuana should be illegal, main reason why you feel this way ... (%)

- Hurts society, bad for individuals: 43
- Dangerous, addictive drug: 30
- Should be illegal, needs to be policed: 19
- Gateway drug: 11
- Bad for young people: 8
- Recreational should be illegal, medicinal okay: 7


PEW RESEARCH CENTER
# What Do You Think?

<table>
<thead>
<tr>
<th>How Does Marijuana Compare?</th>
<th>Is Marijuana Better (More Benefit)?</th>
<th>Is Marijuana Worse (More Risk or Harm)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarettes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-Cigarettes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opioids and other Pharma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Football</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gambling</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Just some food for thought.....but keep in mind, all of the listed items are legal.
What Do You Think?
……Some Polls

Which Is More Harmful?
NBC News/Wall Street Journal (1/19/18)

- Tobacco: 41%
- Alcohol: 24%
- Sugar: 21%
- Cannabis: 9%

2016 U.S. Sales

- Tobacco: $118.5 Billion
- Alcohol: $223.2 Billion
- Marijuana: $6.7 Billion

Sources:
https://www.forbes.com/sites/debraborchardt/2017/01/03/marijuana-sales-totaled-6-7-billion-in-2016/
https://www.statista.com/topics/1593/tobacco/
https://www.statista.com/topics/1709/alcoholic-beverages/
Legal / Regulatory Considerations
Key Federal Laws….Through The Years

- **Marijuana Tax Act – 1937** – Intent is to discourage production… 70% Tax

- **Banking Secrecy Act and Anti-Money Laundering Provision -1970**
  - Requires US financial institutions to maintain records regarding currency transactions and customer relationships.
  - Rules implemented under that law require financial institutions to file Suspicious Activity Reports (SARs) to report “suspicious transactions”.
  - **Does Not Apply to Insurance Companies**

- **Controlled Substances Act (CSA) – 1970**
  - Marijuana classified as a Class I Controlled Substance
  - Illegal to grow, cultivate, posses, use or distribute
  - No accepted medical use; high potential for abuse; lack acceptable safety evidence

- **18 US Code Sections 1956 and 1957**
  - Prohibits financial transactions involving the proceeds of unlawful activity or criminally derived property.
  - Separate and distinct from the Bank Secrecy Act, so they could be applied to anyone dealing with and accepting money from marijuana-related businesses, which under federal law are engaged in criminal activity.
  - Applies to Insurance Company Transactions
Drug Free Workplace Act – 1988
- Requires larger federal contractors to maintain drug-free workplaces

Omnibus Transportation Employee Testing Act – 1991
- Requires drug and alcohol testing for drivers, pilots and other “safety-sensitive” jobs
  https://www.transportation.gov/

OSHA – General Duty Clause
- May apply to marijuana
- Requires employers to maintain safe workplaces

Hemp – Technically Still Illegal under the CSA…but
- Agricultural Act of 2014 (section 7606) legalized Hemp cultivation under certain circumstances
- Industrial Hemp Farming Act of 2017 (HR 3530), if passed and signed into law will expand legalization by removing hemp from the definition of ‘marijuana’ under the CSA
### Controlled Substance Act of 1970…(part of the “War on Drugs”)

<table>
<thead>
<tr>
<th>Schedule Level</th>
<th>Potential for Abuse</th>
<th>Medical Value</th>
<th>Potential Negative Impact of Abuse (Physical or Psychological)</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>High</td>
<td>None</td>
<td>Severe for both</td>
<td>Heroin; LSD; <strong>Marijuana</strong></td>
</tr>
<tr>
<td>II</td>
<td>High</td>
<td>Yes</td>
<td>Severe for both</td>
<td>Cocaine; Opium; Oxycodone; methadone</td>
</tr>
<tr>
<td>III</td>
<td>High, but less than Schedules I and II</td>
<td>Yes</td>
<td>Moderate or low physical dependence; High psychological dependence</td>
<td>Anabolic steroids; Marinol (synthetic marijuana)</td>
</tr>
<tr>
<td>IV</td>
<td>Lower than Schedule III</td>
<td>Yes</td>
<td>More limited than Schedule III</td>
<td>Ambien, Valium</td>
</tr>
<tr>
<td>V</td>
<td>Lower than Schedule IV</td>
<td>Yes</td>
<td>More limited than Schedule IV</td>
<td>Cough suppressants (Codeine) other preparations that contain Opium</td>
</tr>
</tbody>
</table>

Even so, US holds patent (No. US 6,630,507 B1 specifying Marijuana’s multiple therapeutic benefits.
Marijuana Legalization…..a “Growing” Phenomena…@ January, 2018

Marijuana State Legalization

Drivers of Growth:
- Medical Benefits
- Tax Revenue

22 years later…..
- 20 Medical Only
- 10 Recreational/Medical (incl. DC)

Likely More to come in the next few Years

1996 - California is first

Graph: Munich Re America

1996

2017

Medical
Rec / Med
61% (~198,011,000) of US Population ……Now Live in States that have Legalized Marijuana

20% (~63,627,000) of US Population ………Now Live in States that have Legalized Recreational Marijuana

Sources: [Link](https://www.census.gov/quickfacts/table/PST045216/00)

[Map Image]
### State Marijuana Laws @ January, 2018

#### Legal Medical & Recreational Use
- Alaska
- California*
- Colorado
- District of Columbia
- Maine*
- Massachusetts*
- Nevada*
- Oregon
- Vermont***
- Washington

#### Medical Use Legal / Decriminalized
- Arizona
- Arkansas*
- Connecticut
- Delaware
- Florida*
- Hawaii
- Illinois
- Maryland
- Michigan
- Minnesota
- Montana
- New Hampshire
- New Jersey
- New Mexico
- New York
- North Dakota*
- Ohio*
- Pennsylvania*
- Rhode Island
- West Virginia**

#### Limited Access Laws (Low THC/High Canibiidiol)
Medical or Legal Defense Only
- Alabama
- Georgia
- Iowa
- Kentucky
- Louisiana*
- Mississippi
- Missouri
- No. Carolina
- Oklahoma
- So. Carolina
- Tennessee
- Texas*
- Utah
- Virginia
- Wisconsin
- Wyoming

*Law is considered non-functional as it requires a physician "prescription" which can't be done as long as it is illegal at the federal level.

Only 5 states - Idaho, Indiana, Kansas, Nebraska and South Dakota ..... ............HAVE NOT Decriminalized or Legalized Marijuana to some extent

Marijuana
……State Law Breakdown

Recent or Projected Activity……..Two Examples….and Beyond

1/22/18
Vermont becomes 9th U.S. state to legalize Recreational Marijuana

Unique:
• 1st one done exclusively through legislation rather than ballot initiative
• Applies only to Personal Growth and Use…Not Commercial production/Sale…(for now)

2018 Additional Potential State Activity:

2017 New Federal Tax Reform:
Restriction of SALT deductions may spur additional States to legalize recreational marijuana to generate additional tax revenue?.

Recreational
• Michigan
• Delaware
• Rhode Island
• Connecticut
• Ohio
• New Jersey

Medical
• Oklahoma
• Kentucky
• So. Dakota
• Utah
• Missouri
Often Regulated (similar to the sale of liquor)...but with more limitations

<table>
<thead>
<tr>
<th>Who can “prescribe” (recommend)</th>
<th>Form (smoke, food, pill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where it can be used (public, private)</td>
<td>Employment previsions: Employee or employer protections</td>
</tr>
<tr>
<td>Where You can Grow, Sell, Buy, Use</td>
<td>Taxes and fees</td>
</tr>
<tr>
<td>How Much Quantity and dosage (THC level)</td>
<td>Eligible Medical Conditions (Usually very specific)</td>
</tr>
</tbody>
</table>

Who Can Grow, Process, Buy or Sell
(age limits, licensed growers, dispensaries; certification often required)

Even Existing Laws are Constantly Evolving (e.g., in 2016 both IL and NJ expanded use for PTSD; IL reduced Marijuana Penalties)
Federal vs. State Legal Uncertainty

Federal: Continues to be classified as Illegal – Schedule 1 Substance

States: Increasingly Legalizing Marijuana – Medical and Recreational

The Challenge?………
………How To Reconcile??
Marijuana Legal Landscape

State/Federal Law Reconciliation

Judicial Activity……Mixed and Unclear

- **2005 - Gonzales v. Raich** - US Supreme Court Established Federal Preemption for Marijuana based on US Constitution Commerce Clause

- **2016 - Courts in 2 states applied or modified State Marijuana law**
  - …but **DID NOT** apply Federal Marijuana Law, i.e., supported State law
    - **Hartwick (2016; MI Circuit Ct.)** – Defendant guilty of illegally growing/processing marijuana in violation of state medical marijuana

- **MT Supreme Court (2016)** Upheld a 2011 amendment to the 2004 Medical Marijuana Law that limited how much & who can sell marijuana.

- **US Supreme Court (2016 Nebraska v Colorado, No. 144)** - “Punts” (for now) – Declined to hear a case brought by OK & NE citing CO law violates Federal law

- **2016 - Ninth Circuit Court of Appeals Decision** - Unanimously ruled that the DOJ **CAN NOT** prosecute medical marijuana cases for violating the CSA as long they are in full compliance with state laws legalizing medical marijuana…… Reinforced a 2014 budget measure (Rohrabacher-Farr Amendment)
Marijuana Legal Landscape
……State/Federal Law Reconciliation

Rohrabacher- Blumenauer Amendment to the Federal Appropriations Bill

- Doesn’t change the illegal Federal Status of Marijuana ….
  ……..but does Protect Marijuana and Hemp …

- Prohibits use of Federal Funds to interfere with State Medical
  Marijuana laws and activities that are consistent with State laws

- Increasing Bi-partisan support …..But
  ……..has to be renewed every year as part of US Spending Bill
    - 2018 Senate Budget – Renewed for 2 Years…..Rohrabacher Continued

Congress Doesn’t Give the DOJ Money to Enforce Federal Law !!!
Marijuana Legal Landscape
……State/Federal Law Reconciliation

Enforcement Activities……..

- **2009 - Department of Justice (DOJ) Ogden Memo**
  - Would not Enforce Federal Preemption (Federal resources should not focus “on individuals whose actions are in clear and unambiguous compliance with existing state laws providing for the medical use of marijuana.”)

- **2011 and 2013 – Cole Memorandum on Medical Marijuana**
  - Clarification and Guidance to US Attorneys regarding the Ogden Memo
    - Applicability to States that have legalized Medical Marijuana
  - DOJ is committed to enforcing the CSA…but broad discretion granted recognizing resource priorities:
    - Priority is prosecuting “significant traffickers in illegal drugs” including “commercial operations cultivating, selling or distributing marijuana” …however…..
    - To the extent that States have legalized marijuana and have adequate enforcement in place, Federal enforcement in conflict with those State Laws is not a priority

- **2018 – Jeff Sessions DOJ Memo - Rescinded Cole Memo**

Net Effect For Marijuana Legalization Proponents:????????
Marijuana Legal Landscape

State/Federal Law Reconciliation

Enforcement Activities

What does the Sessions DOJ Rescission of Cole mean???

- **Is It More Cosmetic than Substantive??**
  - *Cole Memo didn’t prohibit Federal Enforcement; Sessions Memo doesn’t require Enforcement*

- **Rohrabacher Amendment** - Prohibits use of Funds to Enforce the CSA in States where it is legal…as long as it continues

- **Will Congress or Trump Allocate other Resources…** Perhaps diverting funds earmarked to fight terrorism to closing marijuana Dispensaries??…..Probably Not

- **Other States** - Moving Forward with Plans to Legalize

- **If legal Action is Taken**
  - *Will it Finally Motivate Congress Act??* – Pass a Law Legalizing Marijuana Federally or making State marijuana Law Pre-emptive to the Federal CSA
Marijuana Legal Landscape

...State/Federal Law Reconciliation

Federal Legislative / Regulatory Activity…….Proposed/Pending

A Glimpse Into the Future??????

2015 Legislation Introduced
- HR 667: Veterans Equal Access Act
- S 683/ HR 1535: CARERS (Compassionate Access, Research Expansion and Respect States)
- HR 1940: Respect State Marijuana Laws Act of 2015
- S 1726: Marijuana Businesses Access to Banking Act
- HR 1013: Regulate Marijuana Like Alcohol Act

2016 Legislation Introduced
- HR 5549 (114th): Medical Marijuana Research Act of 2016

Bottom line:
- All - Seek to Decriminalize marijuana at the Federal level…
- …….at least for Medical
- All - Leave it to the States
- All - Either in Committee or will be
- Most are Bi-partisan

2017 Legislation Introduced
- HR 975 - Respect State Marijuana Laws Act of 2017
- HR 1227: Ending Federal Marijuana Prohibition Act of 2017
Insurance Implications
Marijuana - Insurance Market

Insurance Market in Transition

Current Market Limited due to Federal Legal Status
- ~ 30 Carriers:
  - E&S,
  - Specialty;
  - Captives…

Liability Coverage Required for a License

Potential Market
- Farms
- Manufacturing/Processing
- Wholesale/Distributing
- Medical Professional
- Retail Dispensing
- Ancillary Activities: e.g., Real Estate, Security

Underwriting Risk Is Manageable

Lines of Business
- Farm/Homeowners (1st and 3rd)
- Commercial Property
- General and Product Liability
- Crime
- Malpractice/E&O
- Plus……

If/When Federal Law changes….
… the market is expected to expand rapidly

Lines Of Business Already Exposed/Covered
- Workers Compensation (Use and Treatment Costs)
- Employment Practices (Drug Testing)
- Auto (DUI)
Oregon Coverage Clarification Requirements

Oregon Bulletin DFR 2017-04……Two Basic Requirements:

"….policies that would otherwise cover marijuana items or activities should explicitly state whether those risks are covered or excluded."

In order to exclude loss, damage, or liability associated with marijuana items and marijuana activities: Policies … ……must contain language in the policy explicitly stating the extent to which marijuana items and activities are excluded."

ISO and AAIS: Filed a series of Marijuana Exclusions in Response to the Oregon requirement that carriers clearly specify in their Property/Casualty Policies if and to what degree Marijuana is Not Covered or Covered. ISO Will form Ad Hoc Group to Develop Coverage Endorsements
Closing Thoughts
State laws change from time to time, with the recent trend being toward an expansion of marijuana use. Up to date details on any state marijuana law may be found at the following websites: http://norml.org/states and http://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx
Marijuana - Where does Marijuana fit?

How Big is Marijuana Already?

In spite of the ongoing debate

In 2015

…..Marijuana Outsold Many Common Food Products .....by a wide margin

Even though its legal in only about half the country…

…… and is legal recreationally in only 10 Jurisdictions…
**Marijuana**

.........An Interesting Development

---

**High Tech Marijuana……Sign of Mainstreaming??????**

**Syqe inhaler** *(Syqe Medical)*

......wireless connectivity

Manufactured with 3D Printing Technology

---

Microsoft

Teaming with *KIND (ATM mfg)*…

Develop software to help sell…. and track marijuana sales…

....through MARIJUANA ATMs
Marijuana - State Law
 ....A Reminder

State of the States @ January, 2018

61%
(~ 198,011,000)
of US Population
 ........Now Live in
States that have
Legalized
Marijuana
https://www.census.gov/quickfacts/table/PST045216/00

Of Which

20%
(~63,627,000)
of US Population
 ........Now Live in
States that have
Legalized
Recreational
Marijuana
https://www.census.gov/quickfacts/table/PST045216/00

Now a Majority of Americans Support legalization...53%
Over 30 Years.....Increasing Public support for Marijuana legalized.....
Marijuana Summary

Opportunities...

Insurance Market Emerging
(Captives; Traditional)

Coverage Questions Need Clarity

Legal Issues
Unsettled and Evolving

Use and Acceptance
Expanding

Many Moving
Parts

...Underwriting and Claims
Challenges in Short Term