# The Good, The Bad, and the Uncertain:

## *Public Perception of the Chemical Enterprise*


Mark Jones

*Executive External Strategy and Communications Fellow*
The Dow Chemical Company


***21 September 2017***

SATA
SOUTHERN AEROSOL TECHNICAL ASSOCIATION

FALL MEETING
SEPTEMBER 20-22, 2017
HILTON HEAD ISLAND, SC

DOW

MIDLAND DAILY NEWS


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EXXON
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Monsanto
Hoechst Celanese
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BASF
AMOCO
Mobil
Kodak
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Chevron
ARCO
ROHM AND HAAS
AlliedSignal
AIR PRODUCTS
BAYER
RHÔNE-POULENC
CYANAMID
Ashland
HERCULES
PHILLIPS 66
Ciba-Geigy
Quantum
BFGoodrich
AKZO
LYONDELL
ALCOA
TEXACO
DOW CORNING
National Starch
FMC
Ethyl CORPORATION
ATO
UNOCAL
degussa.
Lubrizol
HUNTSMAN
TENNECO
Olin
76
NALCO
PPG
CABOT
IMC
Great Lakes CHEMICAL CORPORATION
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Dow


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GE
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Lubrizol
HUNTSMAN
TENNECO
Olin
76
NALCO
PPG
CABOT
IMC
Great Lakes
IMCERA
Morton
EXPIRED
NAME CHANGE
SCIENCES

# Remaining


DUPONT
DOW
BASF
OXY
GRACE
Ashland
always solving
HUNTSMAN
Olin
PPG
CABOT

# Gone


EXXON
UNION CARBIDE
Monsanto
Hoechst Celanese
AMOCO
Mobil
Kodak
Chevron
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degussa.
Lubrizol
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IMC
Great Lakes CHEMICAL CORPORATION
IMCERA
Practical Help for Business
Morton

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MORE THAN

**96%**

OF ALL MANUFACTURED GOODS ARE DIRECTLY TOUCHED BY THE BUSINESS OF CHEMISTRY

THE BUSINESS OF CHEMISTRY IS AN

**$800**

BILLION ENTERPRISE

CHEMICAL COMPANIES INVESTED

**$93 BILLION**

IN RESEARCH AND DEVELOPMENT IN 2015

American Chemistry Council

JUNE 2016

DOW


THE BUSINESS OF CHEMISTRY SUPPORTS NEARLY 26% OF THE U.S. GDP
THE BUSINESS OF CHEMISTRY ACCOUNTS FOR 14% OF U.S. EXPORTS
$184 BILLION IN 2015, AND IS THE LARGEST EXPORTER IN THE U.S
A LEADER IN PRODUCTION, THE U.S. CHEMICAL INDUSTRY PROVIDES OVER 15% OF THE WORLD'S CHEMICALS
American Chemistry Council
JUNE 2016

DOW


FOR EVERY JOB CREATED BY THE BUSINESS OF CHEMISTRY, 6.3 ARE GENERATED ELSEWHERE IN THE ECONOMY, TOTALING NEARLY
6 MILLION JOBS
THE BUSINESS OF CHEMISTRY PROVIDES
810,000
SKILLED, GOOD-PAYING AMERICAN JOBS
THE AVERAGE ANNUAL PAY IN THE BUSINESS OF CHEMISTRY IS
$94,000
THAT'S 47% HIGHER THAN THE AVERAGE MANUFACTURING PAY
American Chemistry Council
JUNE 2016

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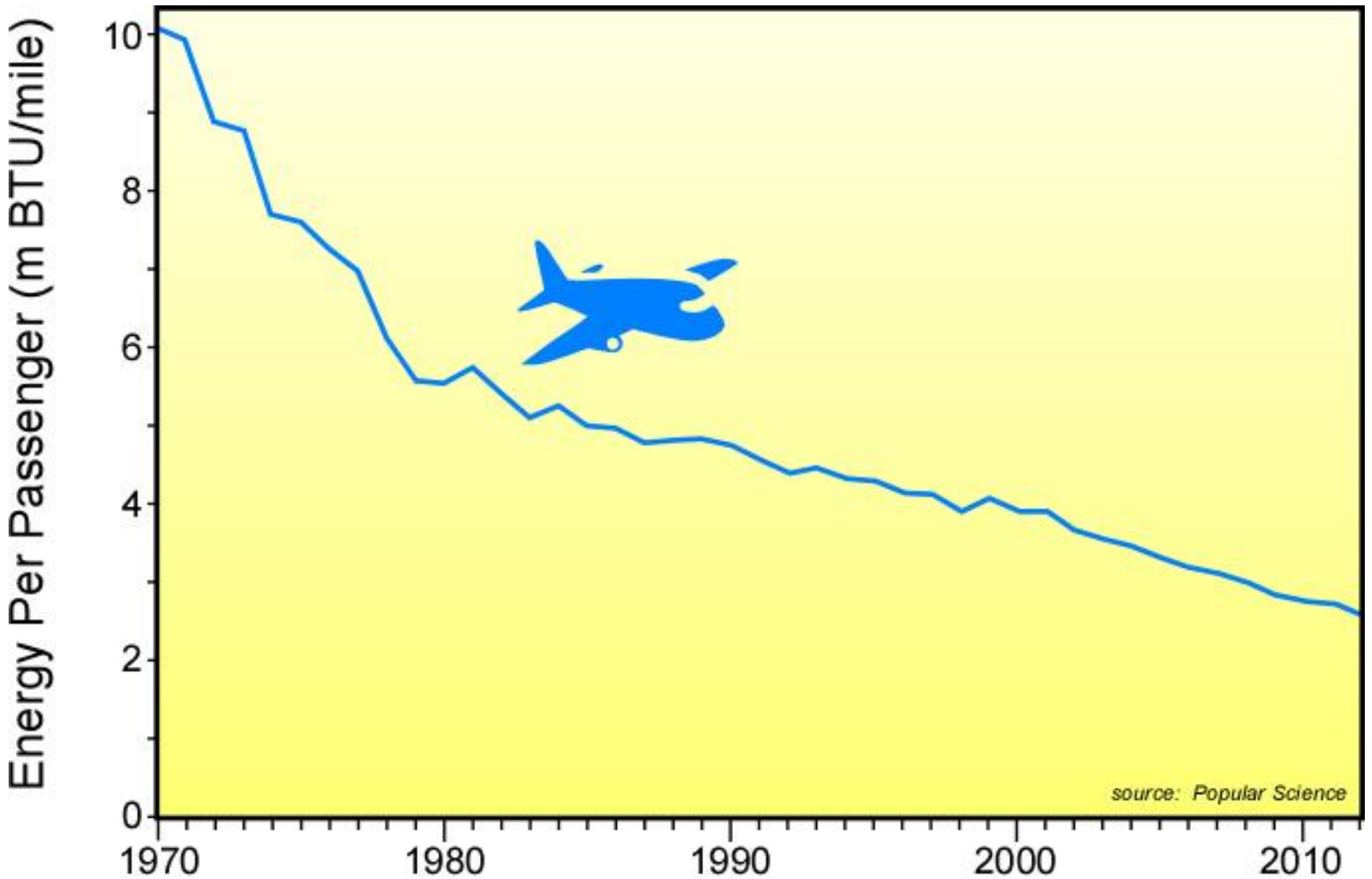
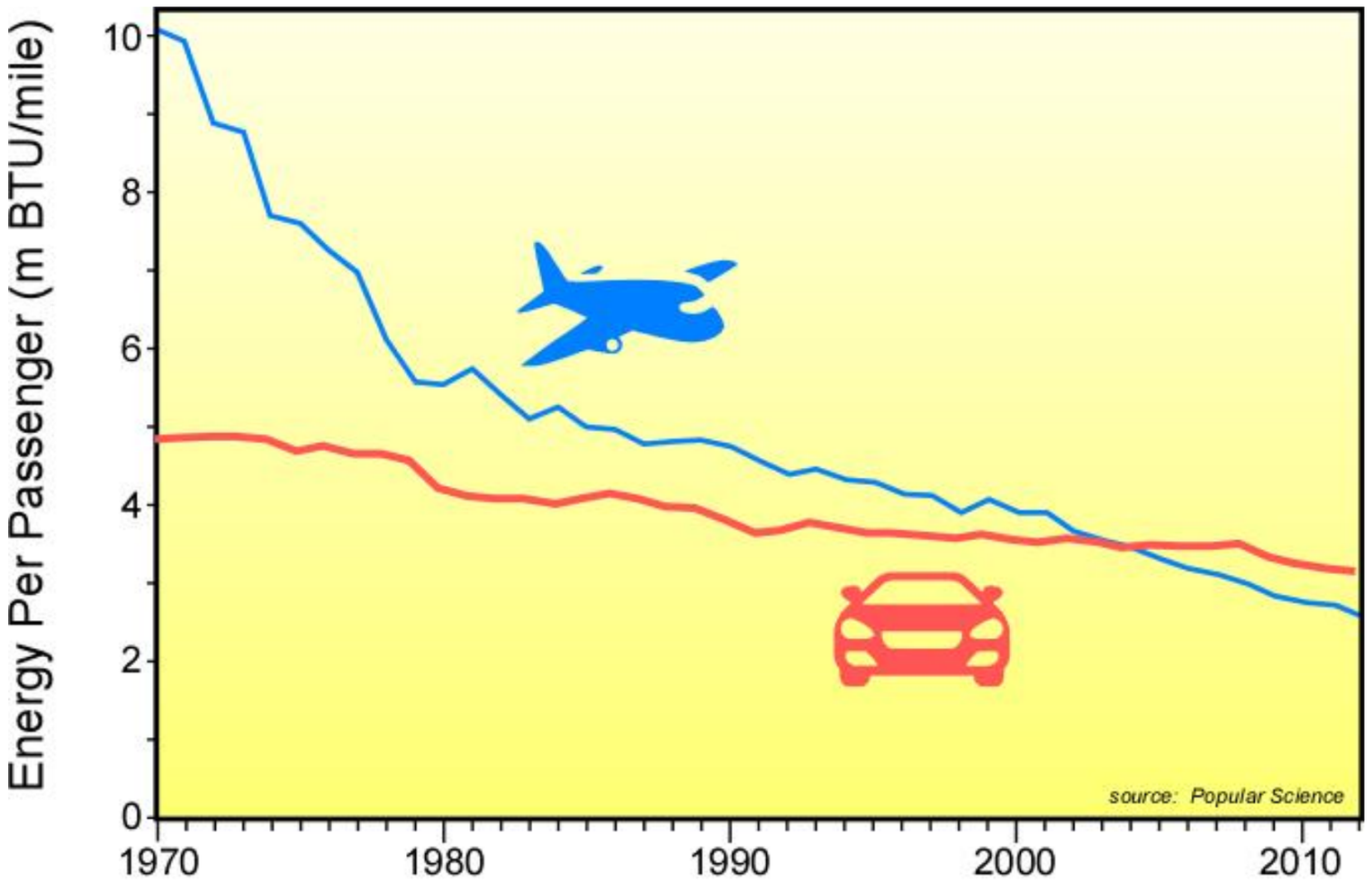
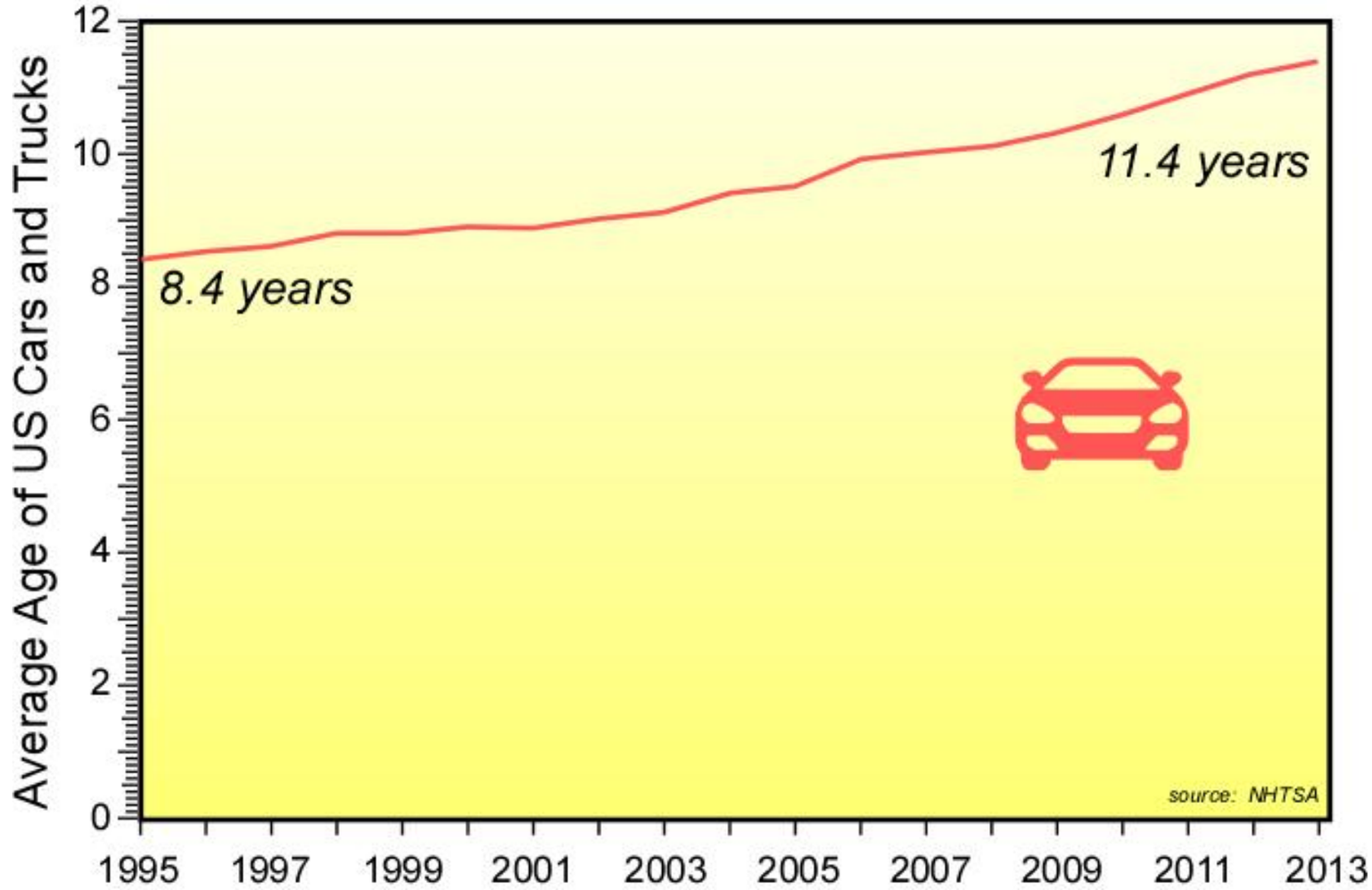
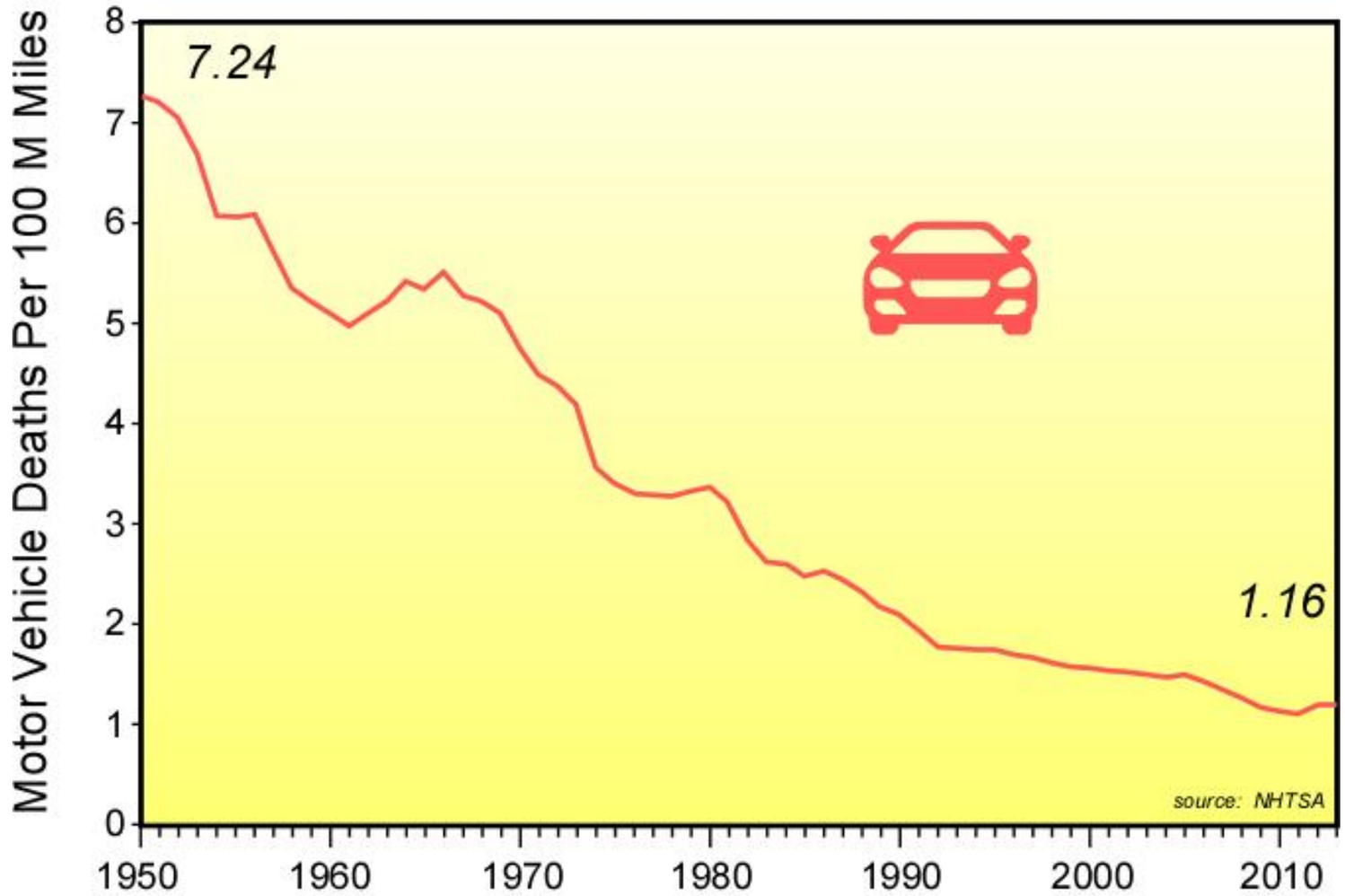
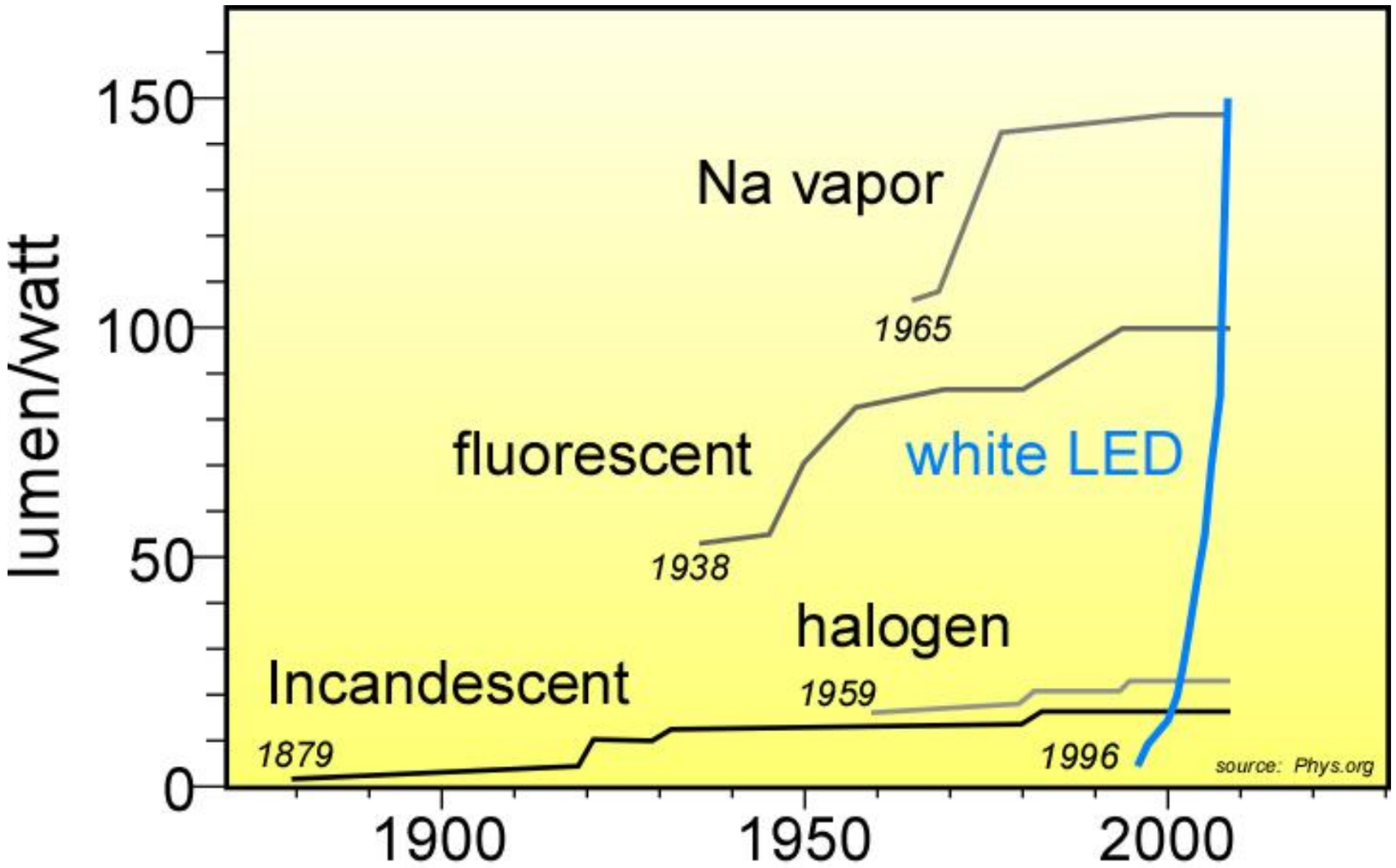

Energy Per Passenger (m BTU/mile)
10
8
6
4
2
0
1970
1980
1990
2000
2010
source: Popular Science

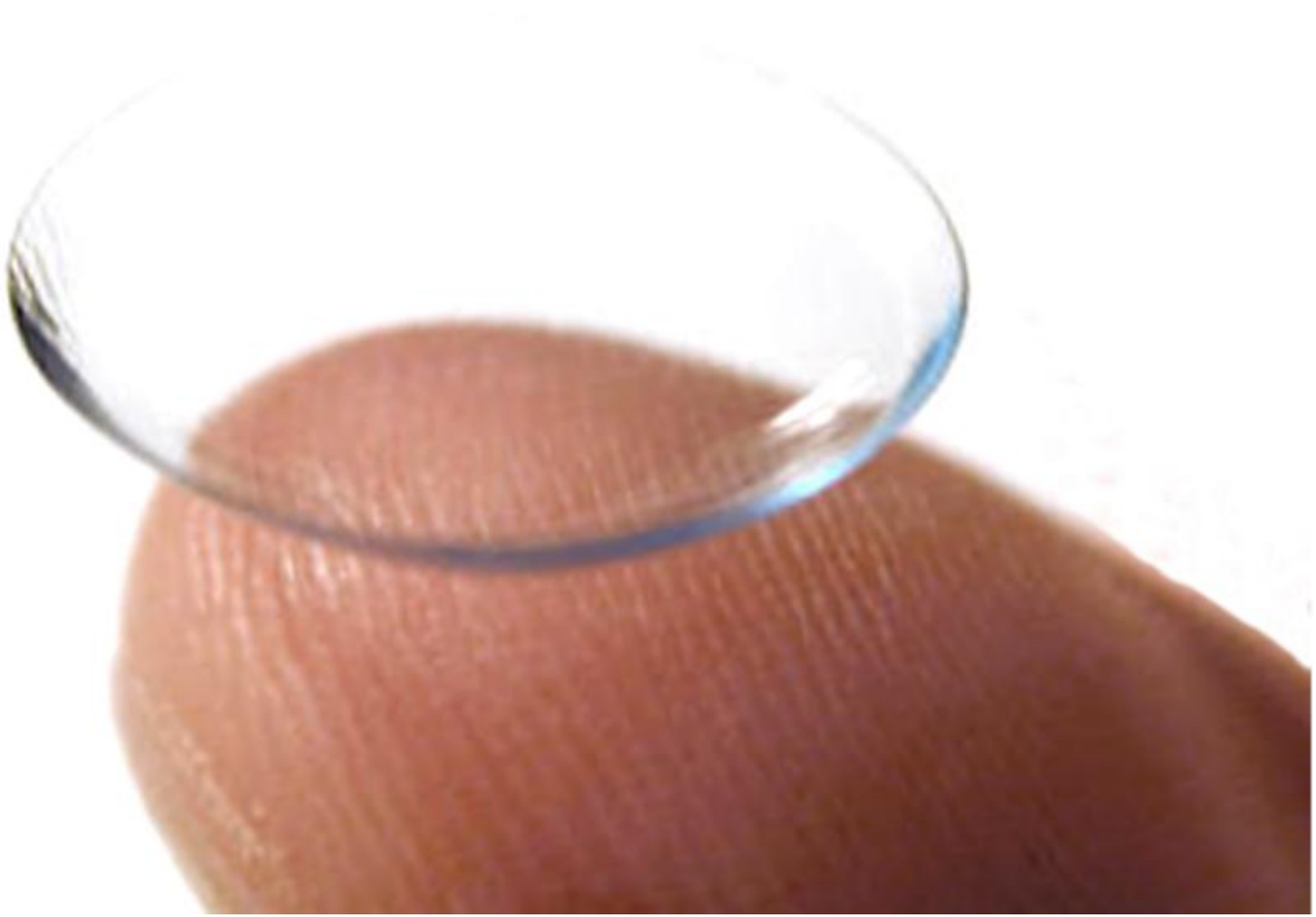

Energy Per Passenger (m BTU/mile)
10
8
6
4
2
0
1970
1980
1990
2000
2010
source: Popular Science


Average Age of US Cars and Trucks
12
10
8
6
4
2
0
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
8.4 years
11.4 years
source: NHTSA


KOYO
JAPAN
6208


Motor Vehicle Deaths Per 100 M Miles
8
7
6
5
4
3
2
1
0
7.24
1.16
source: NHTSA
1950
1960
1970
1980
1990
2000
2010

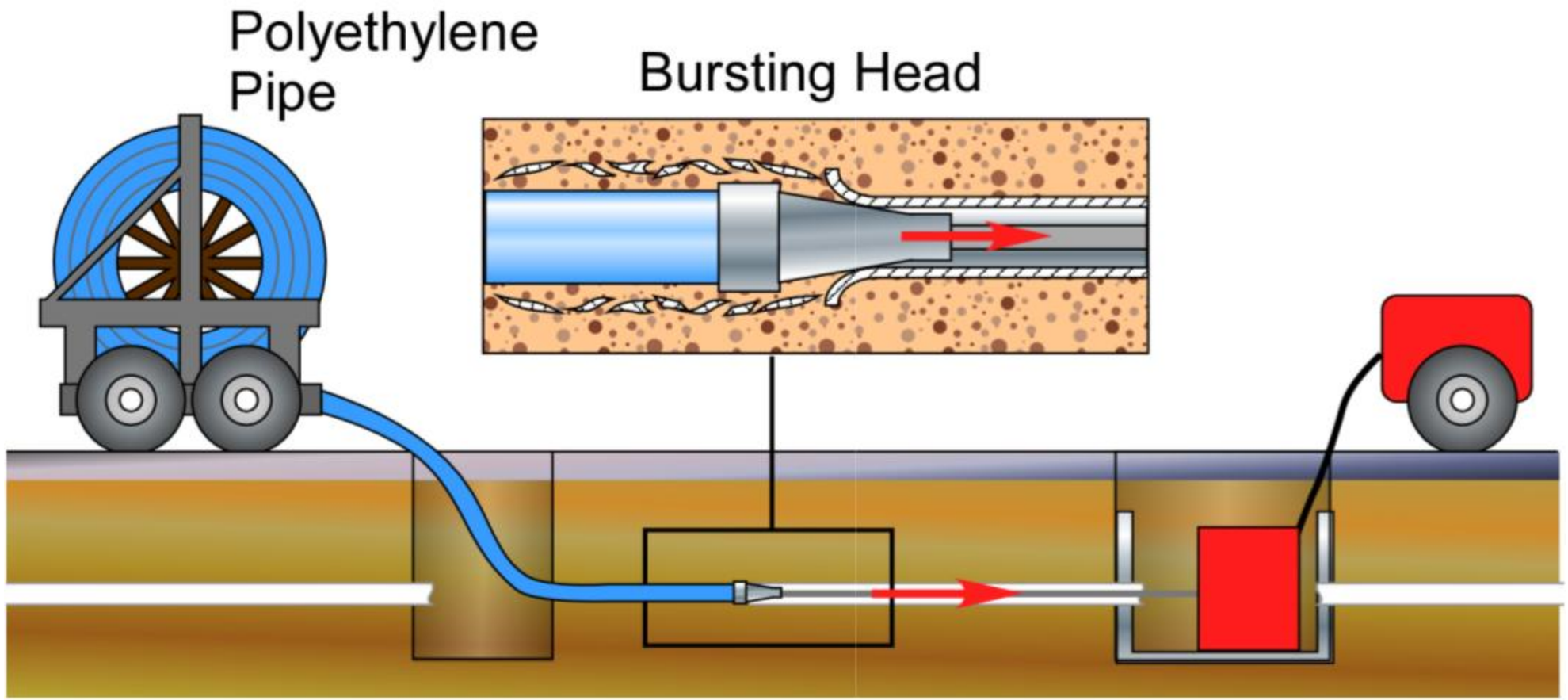

lumen/watt
150
100
50
0
1900
1950
2000
Na vapor
1965
fluorescent
white LED
1938
halogen
1959
Incandescent
1879
1996
source: Phys.org

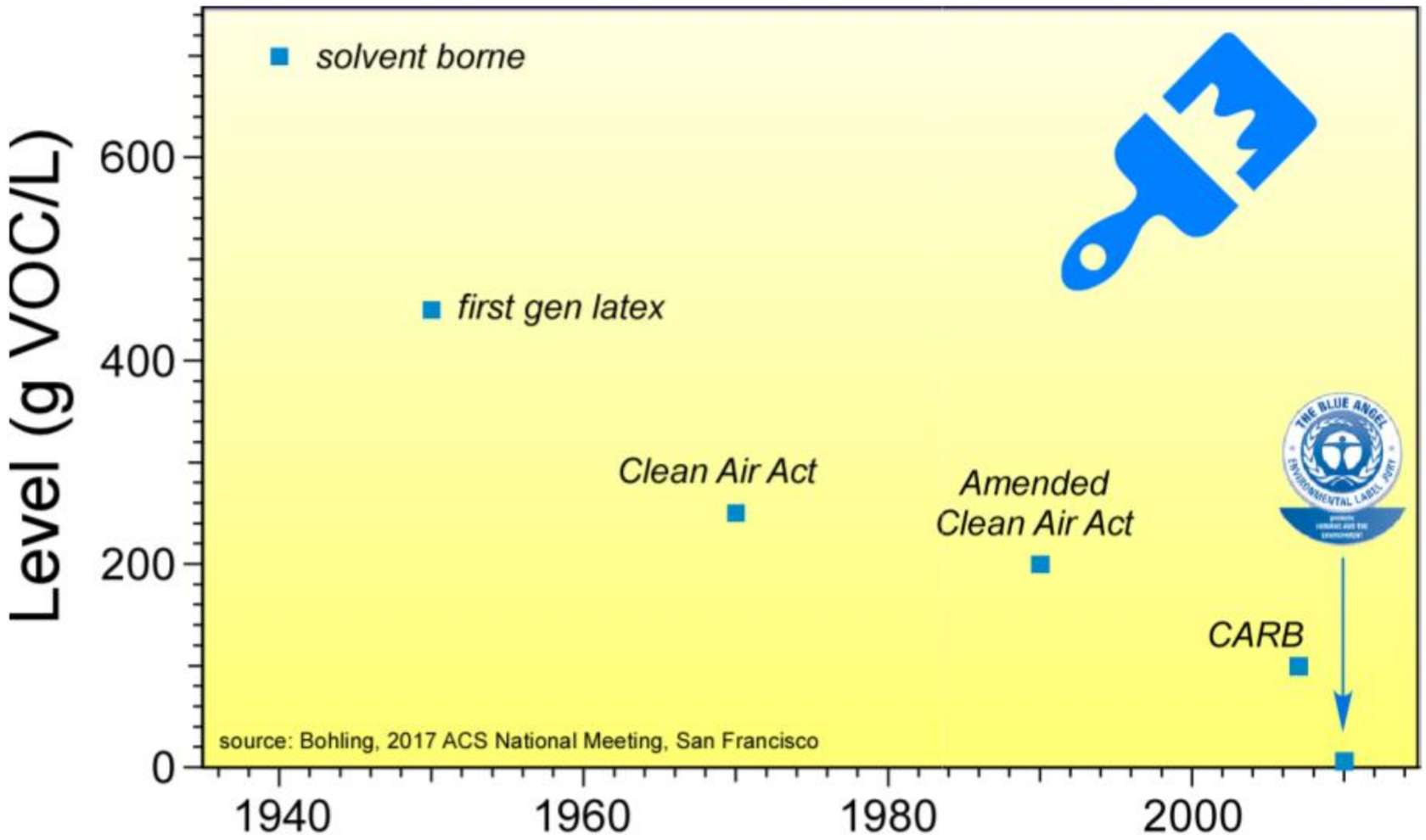


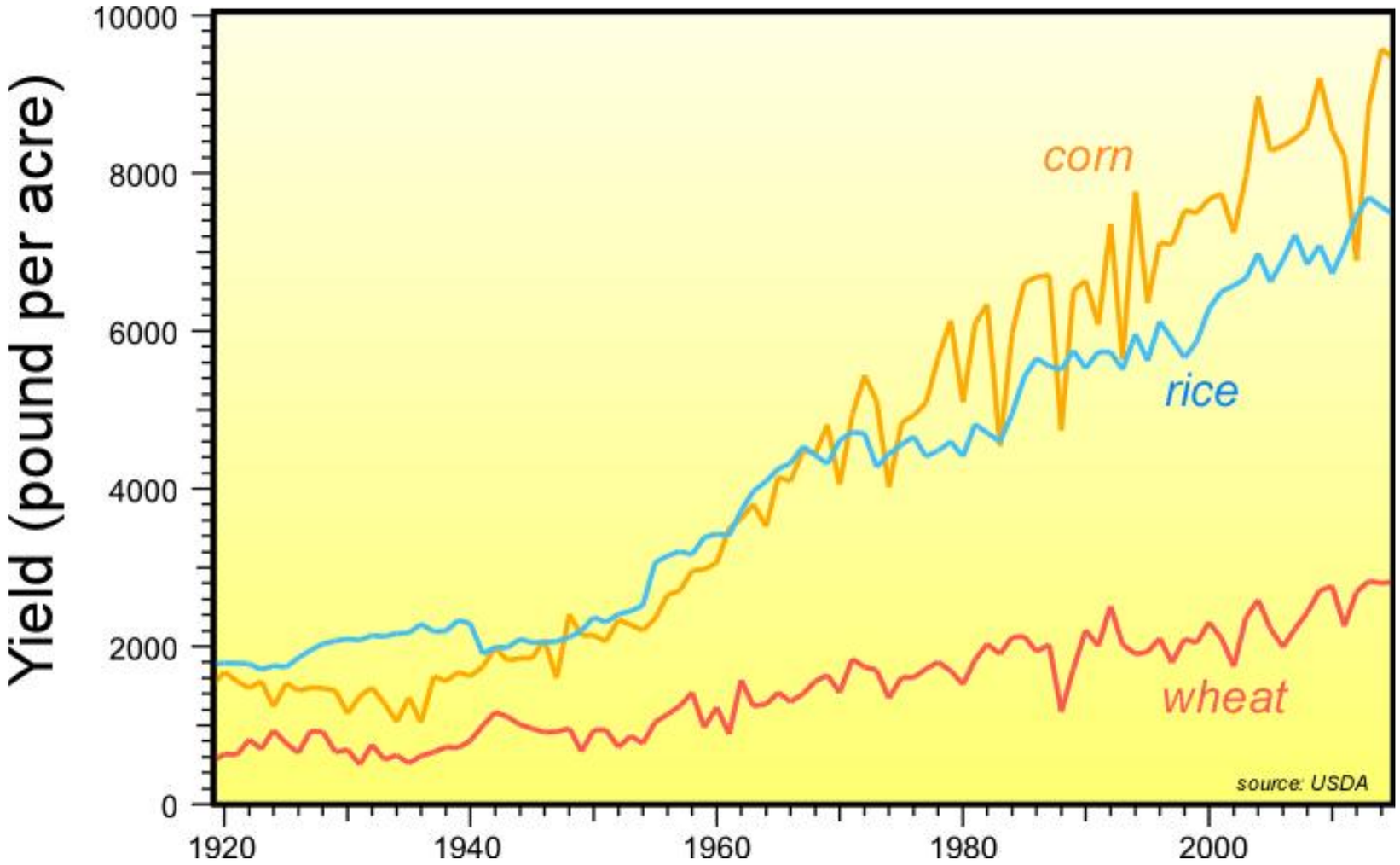

NEW
Lifebuoy
Total 10
with activ naturol shield
100% better germ protection


Pb

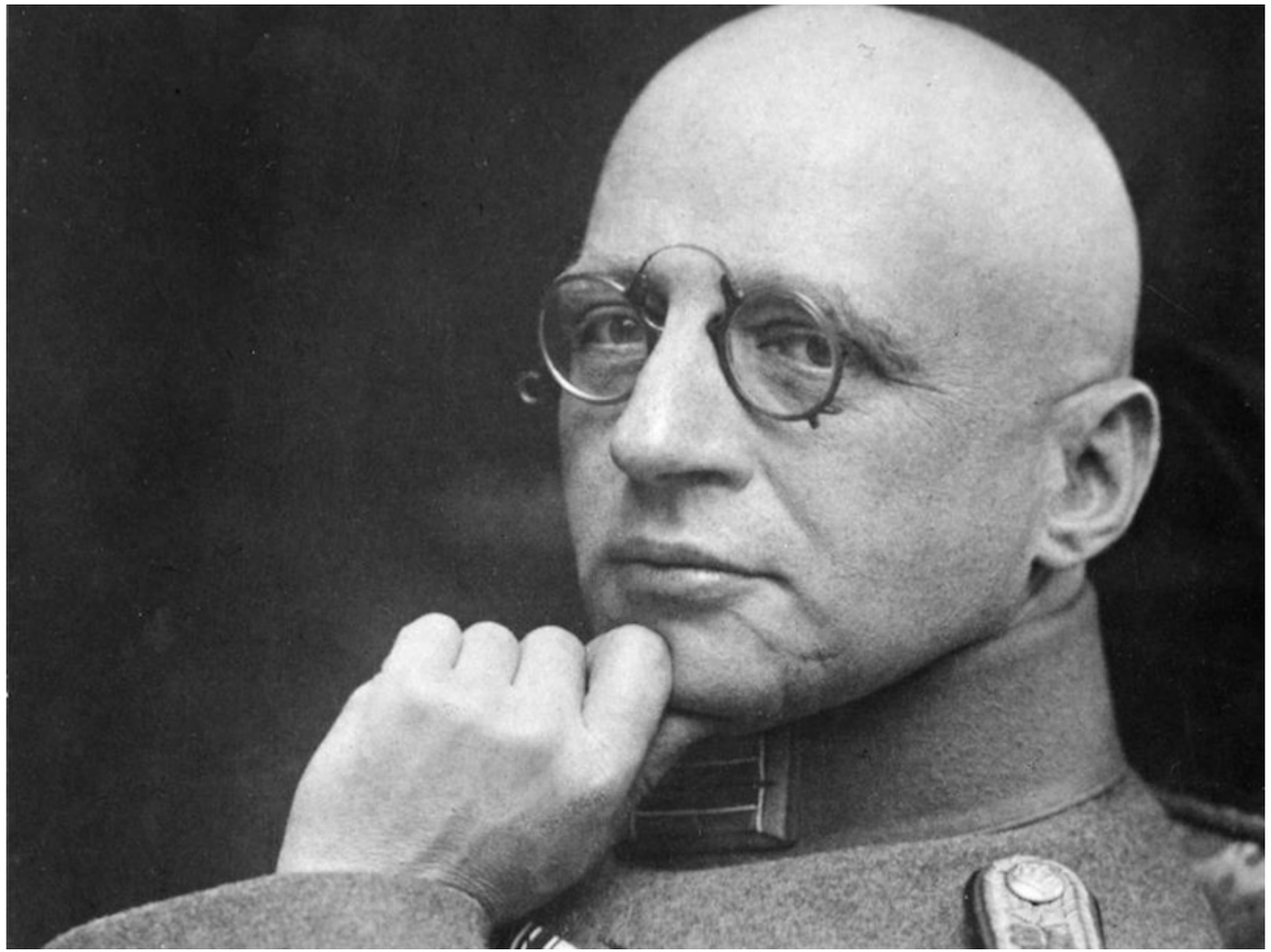
# Pipe Bursting



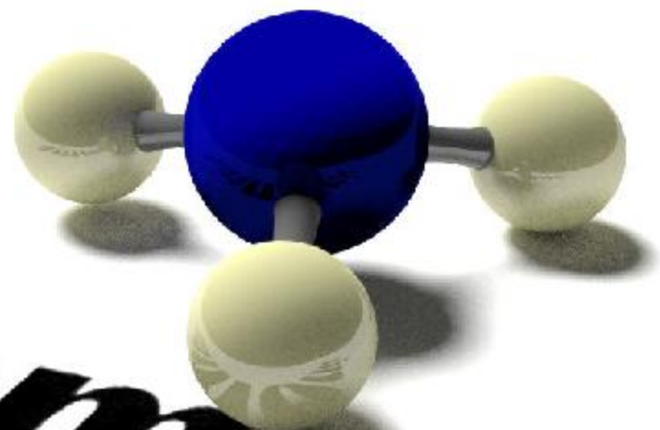

Level (g VOC/L)
600
400
200
0
1940
1960
1980
2000
solvent borne
first gen latex
Clean Air Act
Amended
Clean Air Act
CARB
source: Bohling, 2017 ACS National Meeting, San Francisco


Yield (pound per acre)
10000
8000
6000
4000
2000
0
1920
1940
1960
1980
2000
corn
rice
wheat
source: USDA

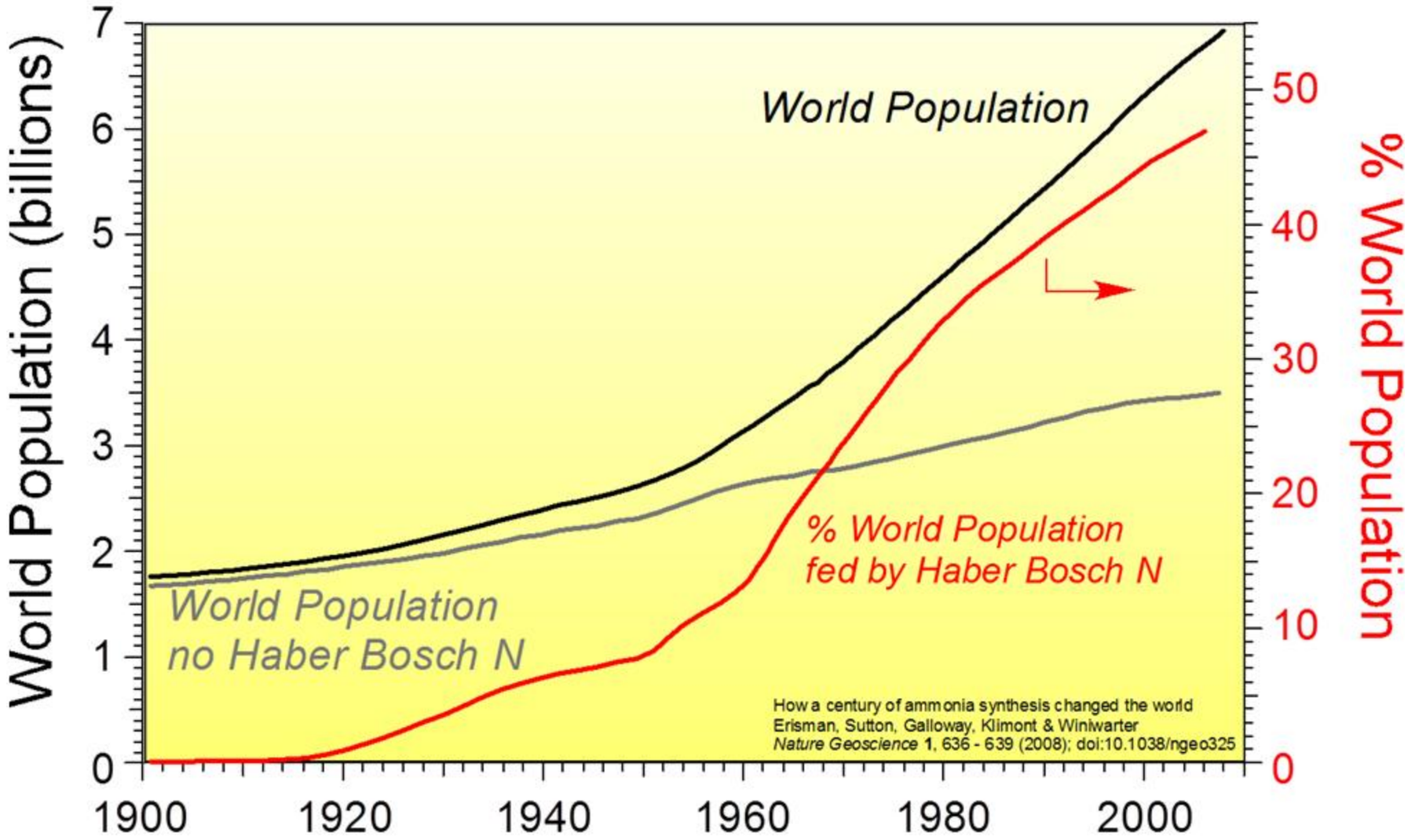

If you ate today...
THANK A
FARMER
If you're a farmer . . .
THANK A
CHEMIST

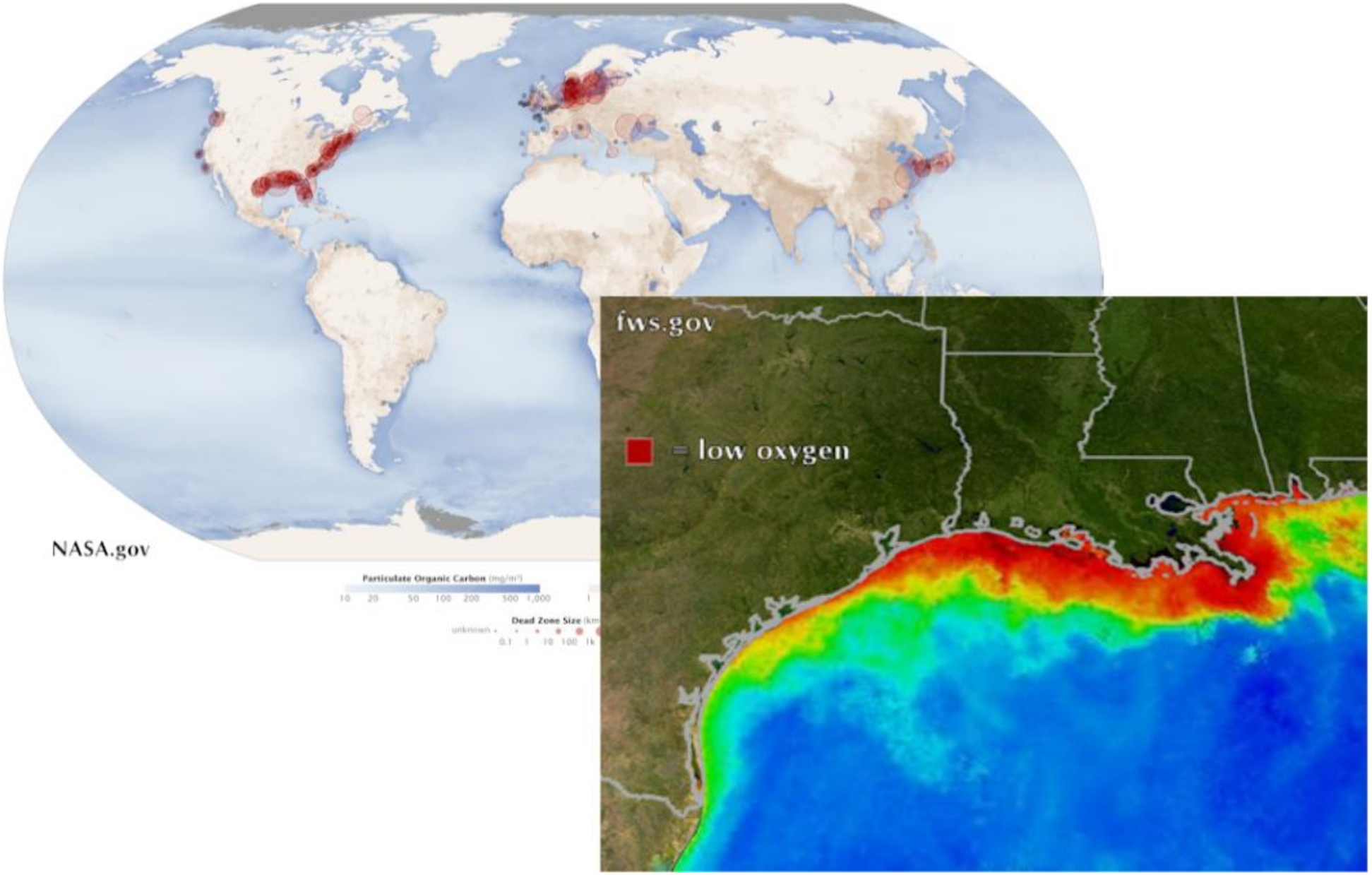


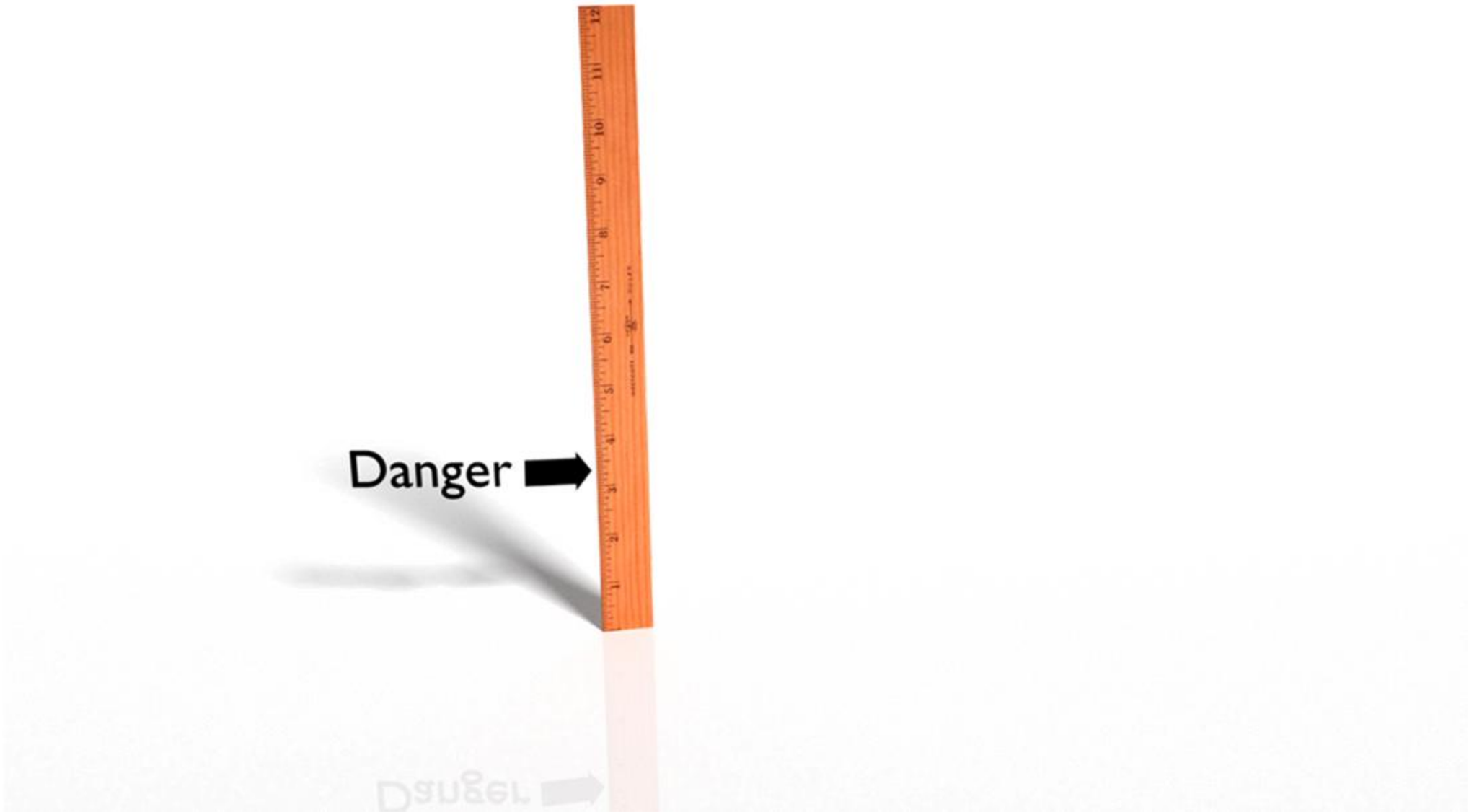
$NH_3$



# Ammonia

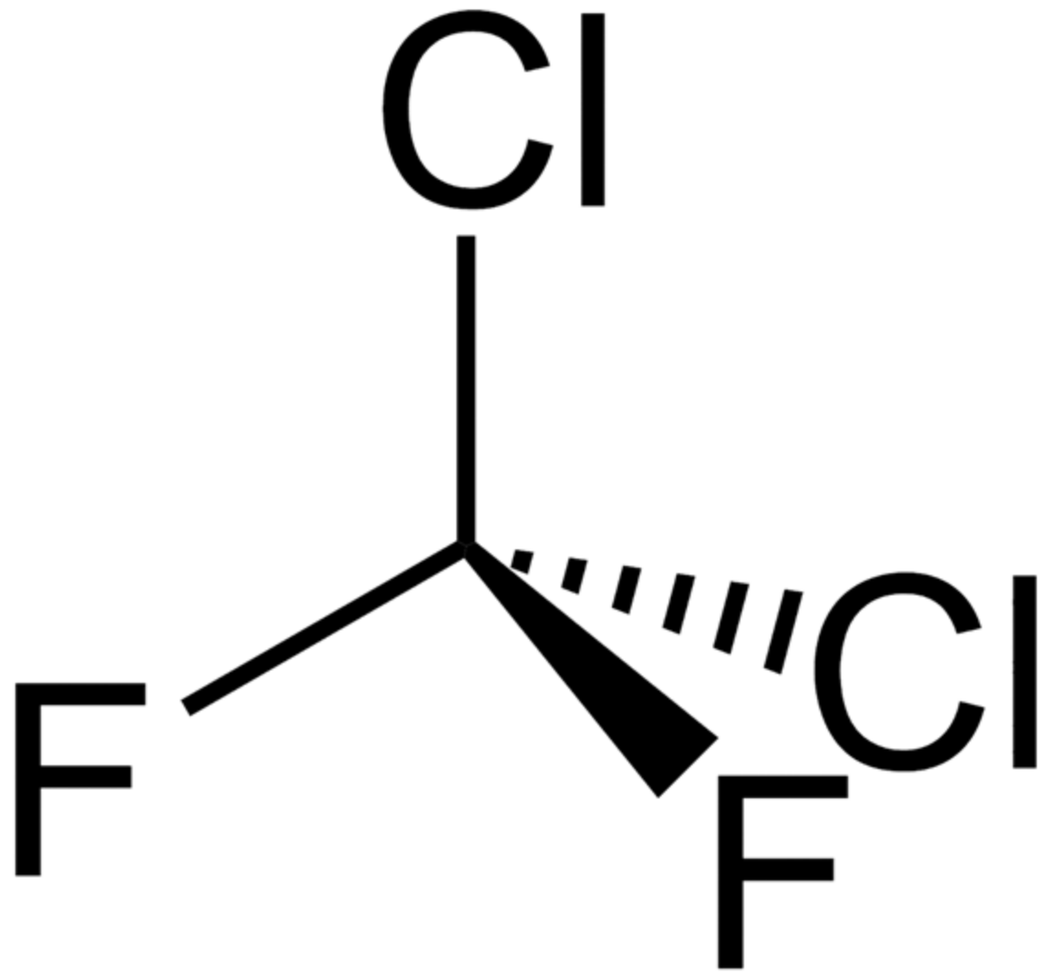

World Population (billions)
% World Population
World Population
% World Population
fed by Haber Bosch N
World Population
no Haber Bosch N
How a century of ammonia synthesis changed the world
Erisman, Sutton, Galloway, Klimont & Winiwarter
Nature Geoscience 1, 636 - 639 (2008); doi:10.1038/ngeo325
0
1
2
3
4
5
6
7
0
10
20
30
40
50
1900
1920
1940
1960
1980
2000

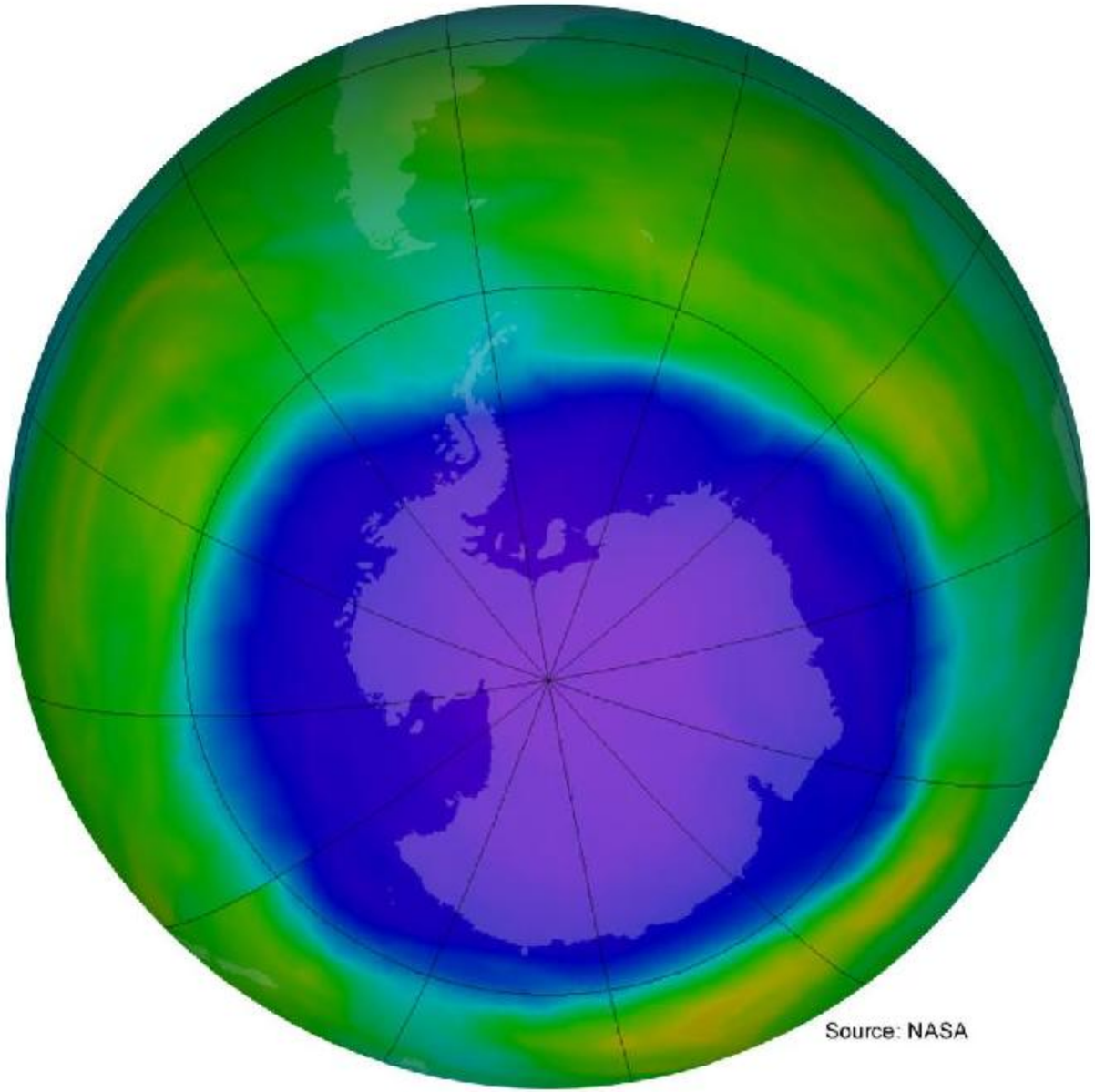

NASA.gov
Particulate Organic Carbon (mg/m³)
10 20 50 100 200 500 1,000
Dead Zone Size (km
unknown
0.1 1 10 100 1k
fws.gov
= low oxygen


Danger

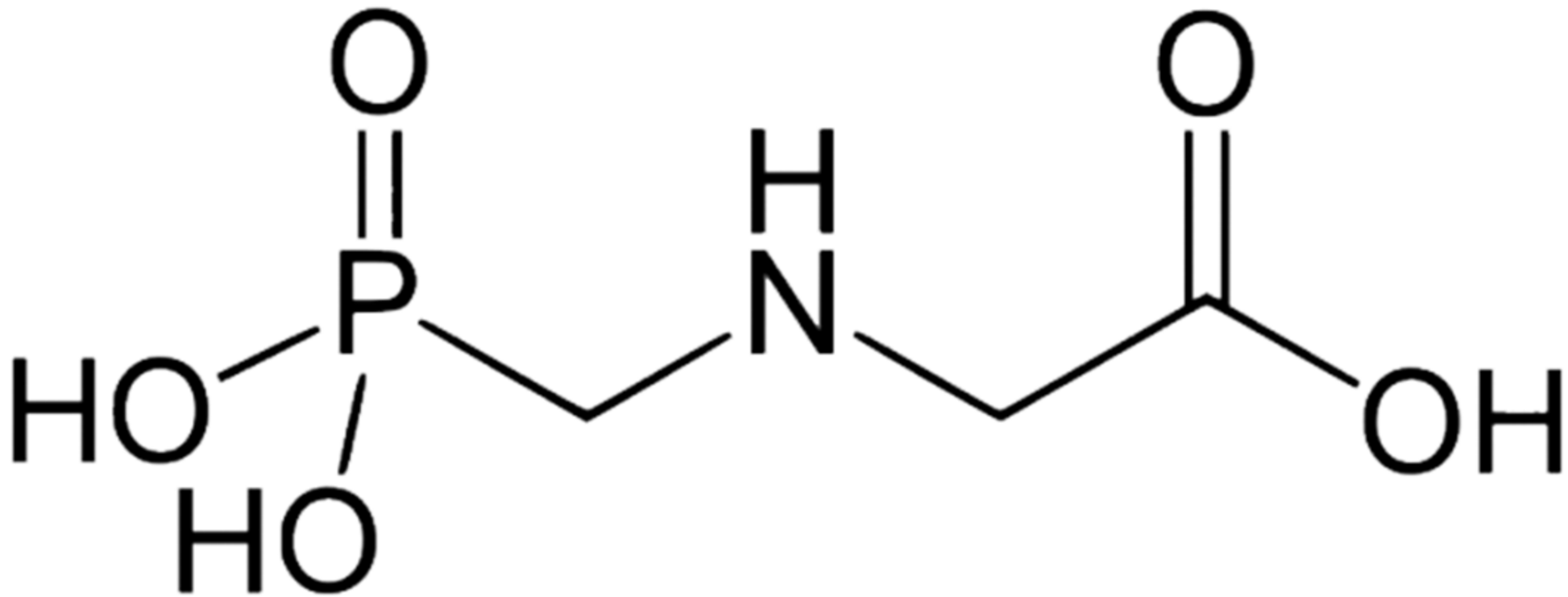

Danger
Risk
Tolerance

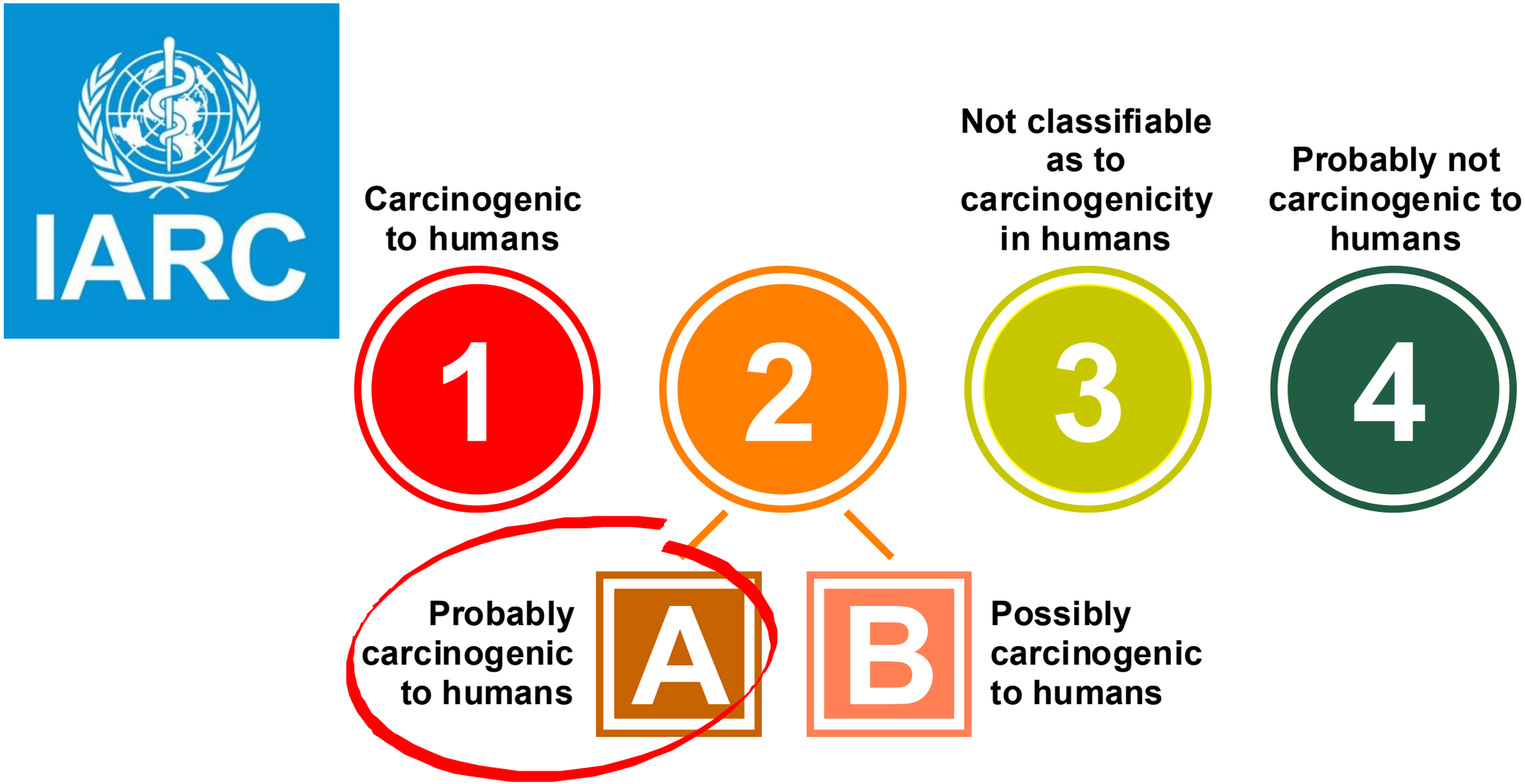

Risk
Tolerance
Danger
Benefit

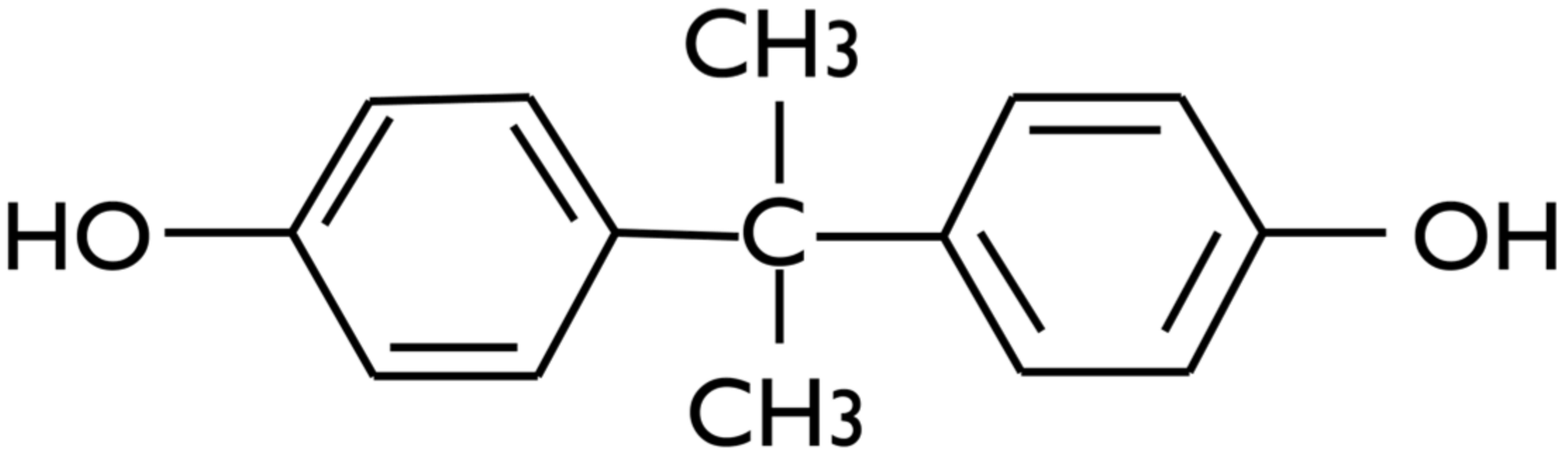

Cl
F
Cl
F



Source: NASA


O
P
HO
HO
H
N
O
OH


IARC
Carcinogenic to humans
1
2
Not classifiable as to carcinogenicity in humans
3
Probably not carcinogenic to humans
4
Probably carcinogenic to humans
A
B
Possibly carcinogenic to humans




BPA Free

BPA FREE

NO PHTHALATES
NO BISPHENOL-A
NON-TOXIC PLASTIC
BPA FREE

BPAFREE

NON-TOXIC
100%
BPA FREE
SAFE
NO BISPHENOL A

BPA FREE
This product does not contain any BPA

DOW

# CANVERA

Dow Coating Materials
CANVERA™

## A Fresh Approach: CANVERA™ Polyolefin Dispersion Technology

CANVERA

a fresh approach to can coatings by DOW

CANVERA™ Polyolefin Dispersions offers an excellent food and flavor protection profile, excellent adhesion, corrosion protection and flexibility without impact on flavor. This innovation eliminates material traditionally found in epoxy or alternative coating systems that are of concern for many consumers.

EDISON AWARDS

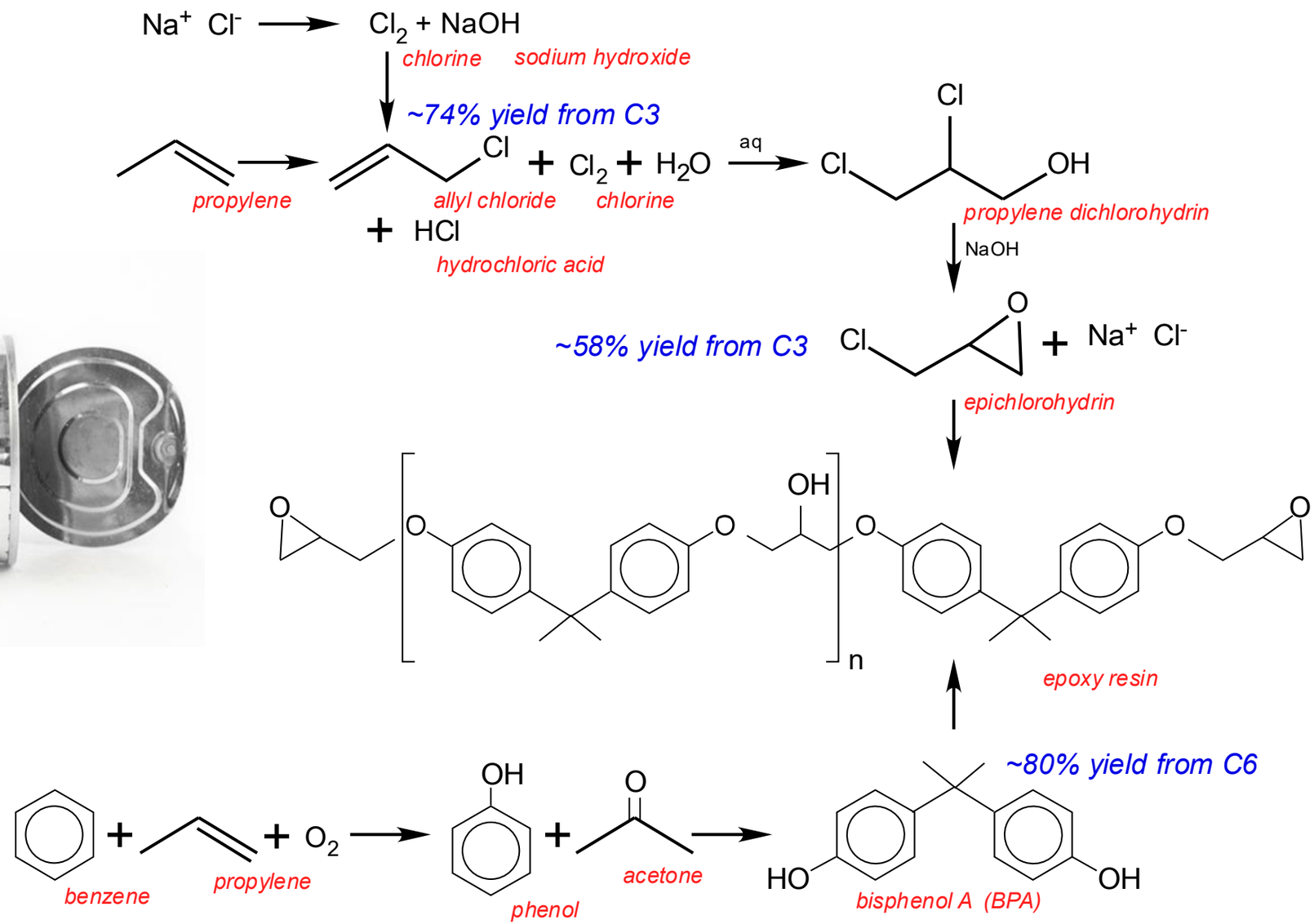
R&D 100
54 Years of Invention

SUSTAINABILITY AWARD 2016

ICIS INNOVATION AWARDS 2016

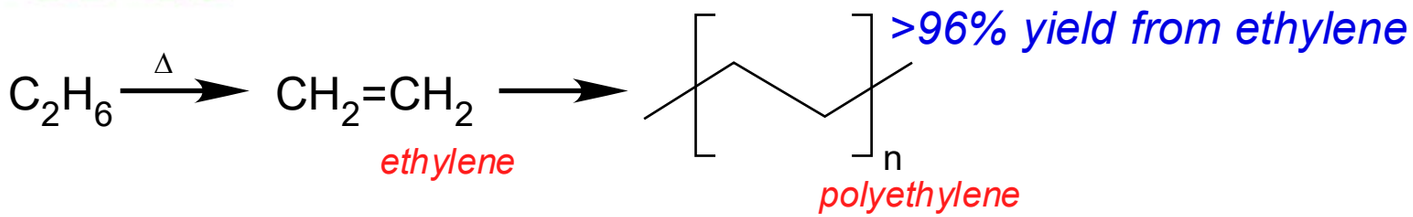
DOW

# Incumbent Epoxy Resin



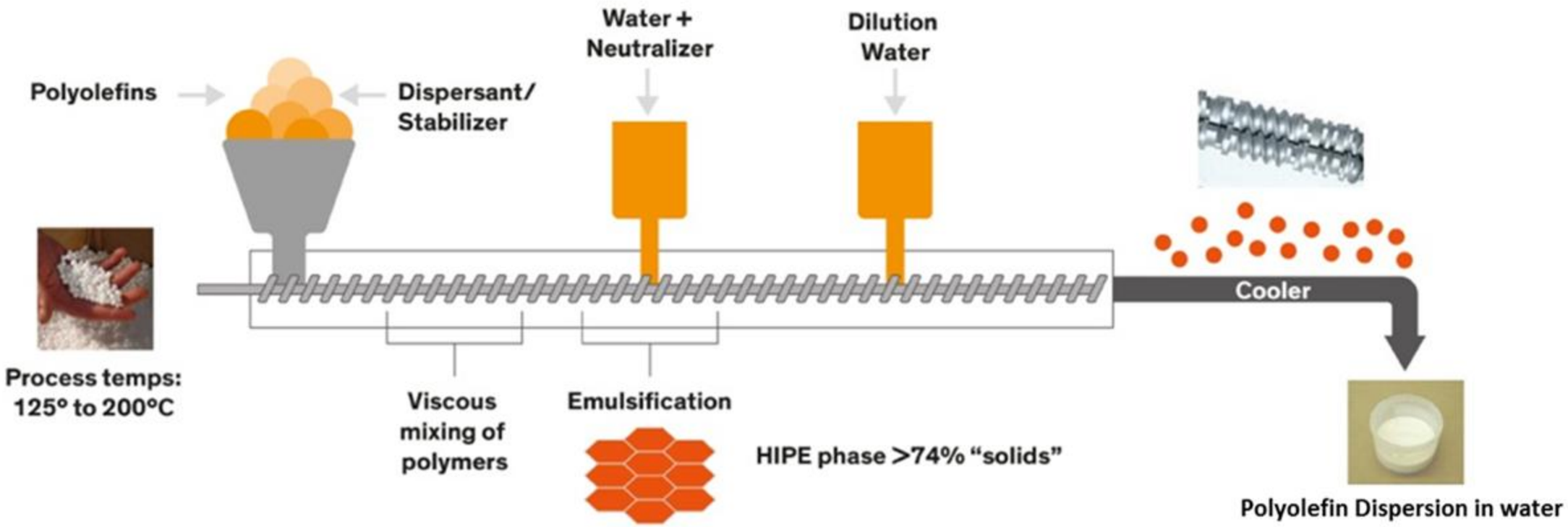

Blackford, *Chemical conversion factors and yields*, Chemical Industries Division, SRI International; 3rd edition (1984)

CANvera




*>96% yield from ethylene*

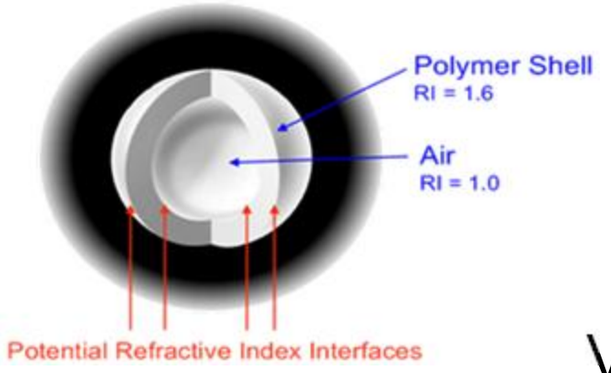
Blackford, *Chemical conversion factors and yields*, Chemical Industries Division, SRI International; 3rd edition (1984)



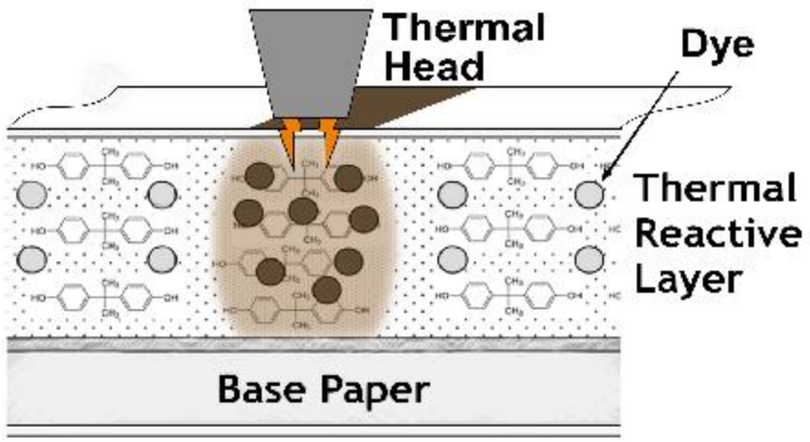

http://coatings.dow.com/en/products/canvera

# Thermal Paper Free of Chemical Developers

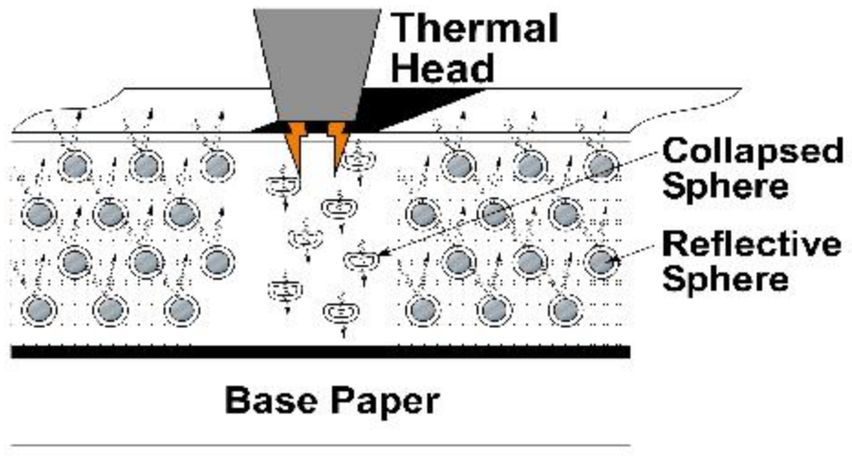
ROPAQUE™ NT-2900 Opaque Polymer for BLUE 4EST™ Thermal Paper




## Conventional




## Voided Layer Technology

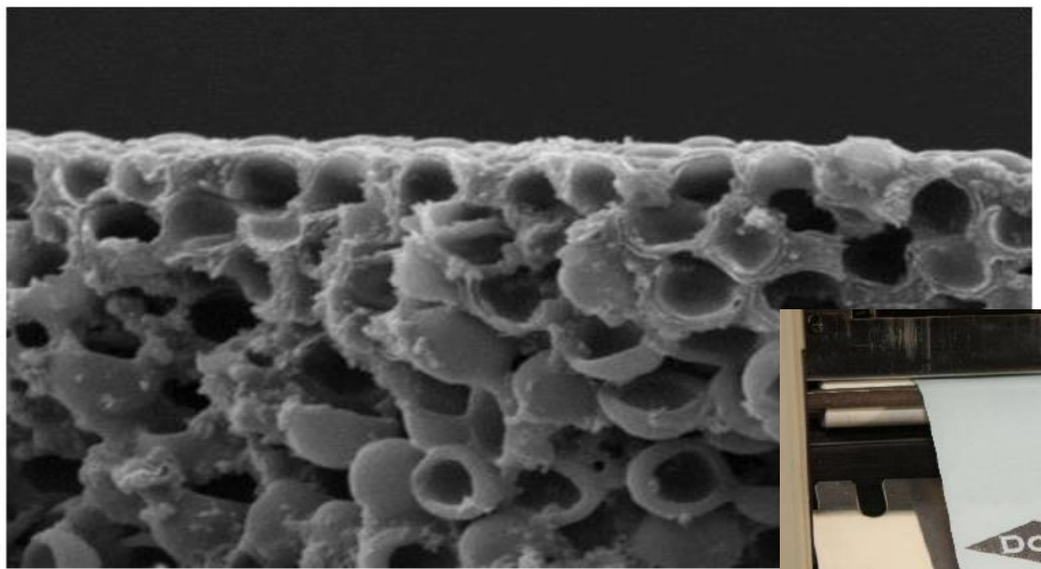



2017 Presidential Green Chemistry Challenge Award
joint with partner Koehler Paper Group

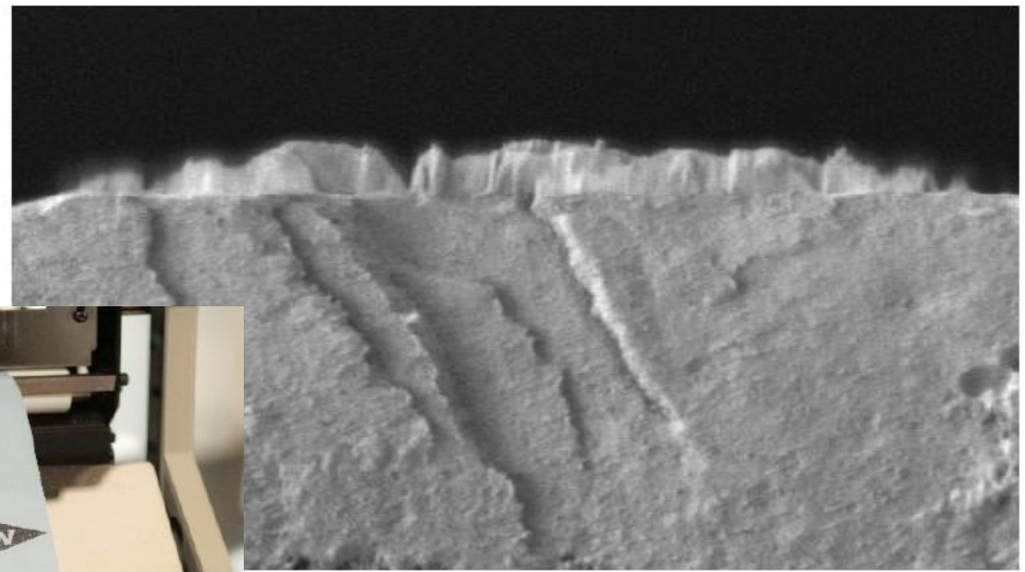
# Thermal Paper Free of Chemical Developers

ROPAQUE™ NT-2900 Opaque Polymer for BLUE 4EST™ Thermal Paper

**Before Printing**



**After Printing**




2017 Presidential Green Chemistry Challenge Award
joint with partner Koehler Paper Group

# 2025 Sustainability Goals

**Leading the Blueprint**
Dow leads in developing a societal blueprint that integrates public policy solutions, science and technology, and value chain innovation to facilitate the transition to a sustainable planet and society.

**Delivering Breakthrough Innovations**
Dow delivers breakthrough sustainable chemistry innovations that advance the well being of humanity.

**Advancing a Circular Economy**
Dow advances a Circular Economy by delivering solutions to close the resource loops in key markets.

**Valuing Nature**
Dow applies a business decision process that values nature, which will deliver business value and natural capital value through projects that are good for the company and good for ecosystems.

**Increasing Confidence in Chemical Technology**
Dow increases confidence in the safe use of chemical technology through transparency, dialogue, unprecedented collaboration, research, and our own actions.

**Engaging Employees for Impact**
Dow people worldwide directly apply their passion and expertise to advance the well being of people and the planet.

**World-Leading Operations Performance**
Dow maintains world-leading operations performance in natural resource efficiency, environment, health, and safety.


http://www.dow.com/en-us/science-and-sustainability/2025-sustainability-goals

# Artifact

## Ethylene


Ethylene is found in plastic bags, antifreeze, bubble gum, PVC piping, polyester, and diapers

Many Americans have probably never heard of ethylene. But this colorless, flammable gas usually made by superheating oil or natural gas is arguably the most important petrochemical on the planet—and much of it comes from the Gulf Coast region savaged by Hurricane Harvey. Ethylene and its derivatives make up about 40 percent of global chemical sales, says Hassan Ahmed, an analyst at Alembic Global Advisors. The U.S. accounts for 1 of every 5 tons on the market, and ethylene plants globally were already running almost full-out before Harvey, Ahmed says. "So any little hiccup—and this is much beyond a hiccup—will dramatically tighten supply-demand balances," he says.

Texas produces almost three-quarters of the nation's ethylene supply. That's critical because this basic chemical building block is the foundation for making plastics essential to U.S. consumer and industrial goods, from car parts used by Detroit automakers to diapers sold by Wal-Mart Stores Inc. Processing plants turn the chemical into polyethylene, the world's most common plastic, which is used in garbage bags, food packaging, and even chewing gum. As ethylene glycol, it's the antifreeze that keeps engines and airplane wings from freezing in winter. It also becomes the polyester used in textiles and water bottles. Because of Harvey's flooding, Texas plants accounting for 87 percent of U.S. ethylene capacity have closed, say analysts at Jefferies LLC. Production may not return to prestorm levels until fall. —*Jack Kaskey, with Lynn Doan*

PHOTOGRAPHED BY CAROLINE TOMPKINS FOR BLOOMBERG BUSINESSWEEK


TARE