

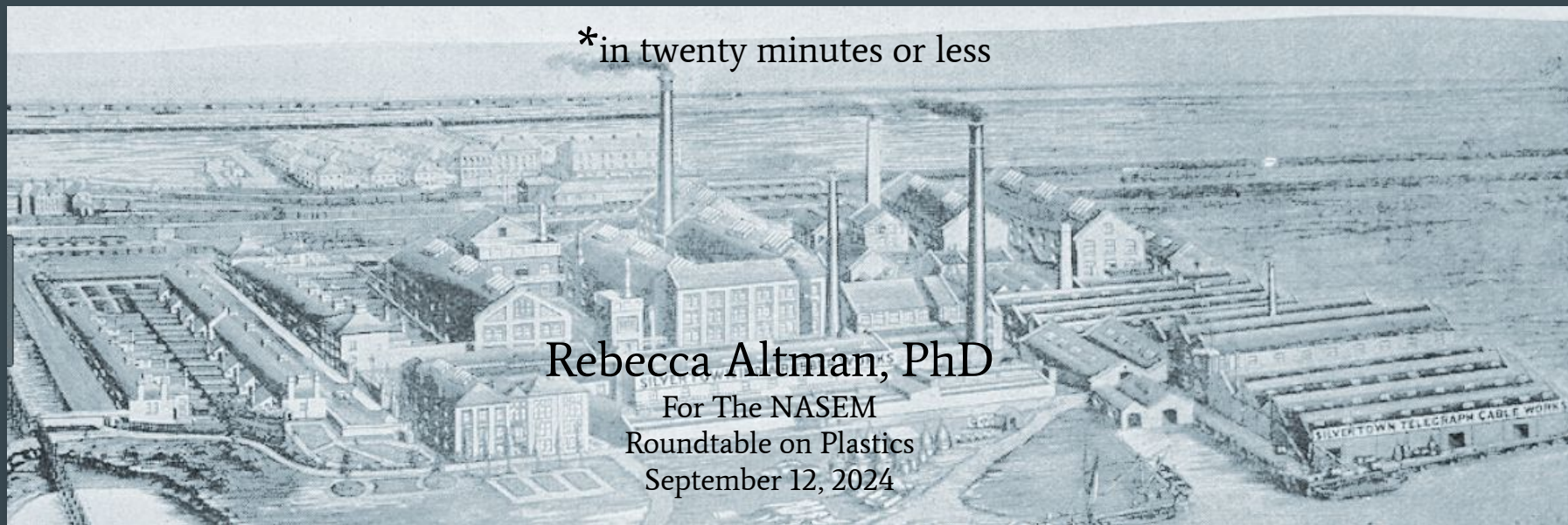
Then, as Now

A Historical Overview of (Some) Industrial Plastics*

*in twenty minutes or less

Rebecca Altman, PhD

For The NASEM
Roundtable on Plastics
September 12, 2024



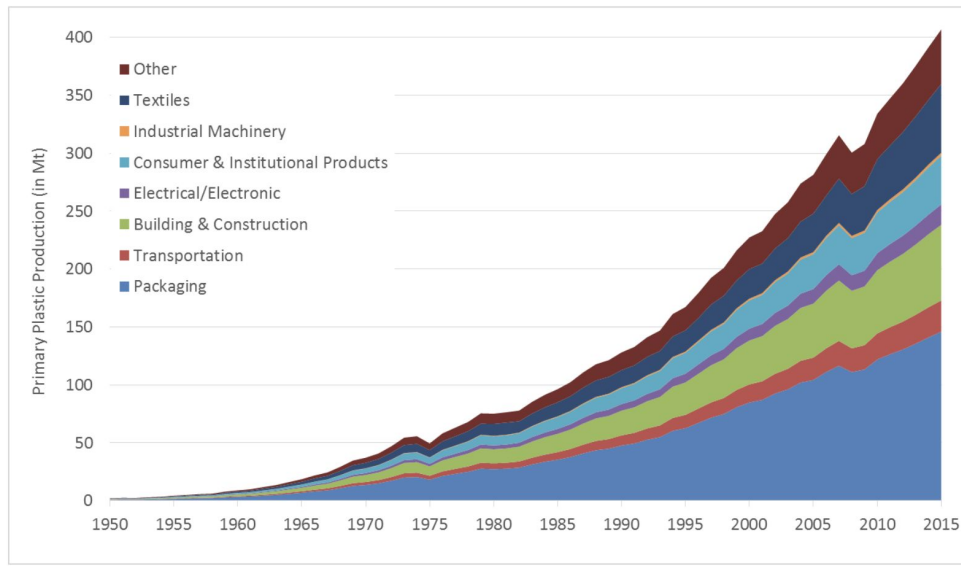


fig. S1. Global primary plastics production (in million metric tons) according to industrial use sector from 1950 to 2015.

Source: Geyer, Jambeck & Lavender Law, 2017

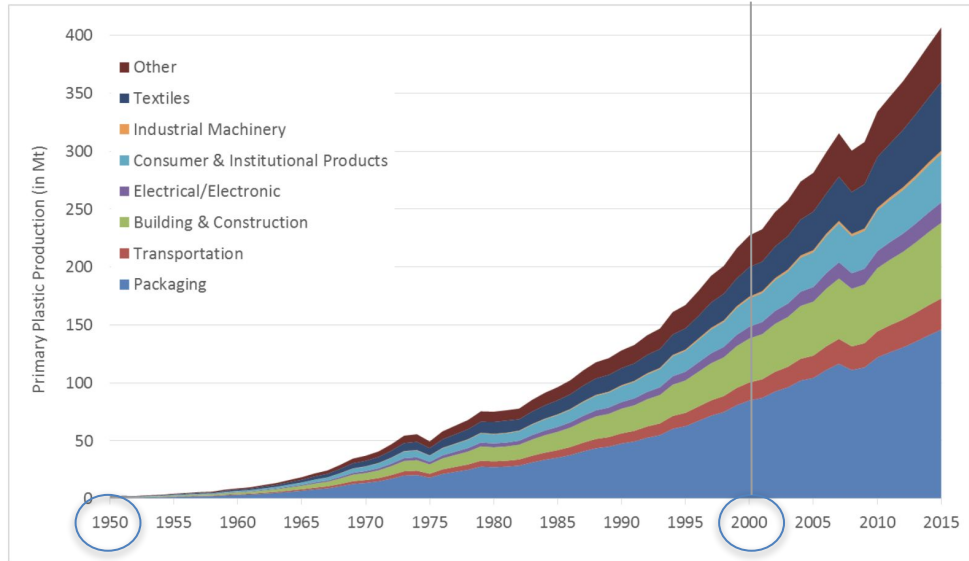
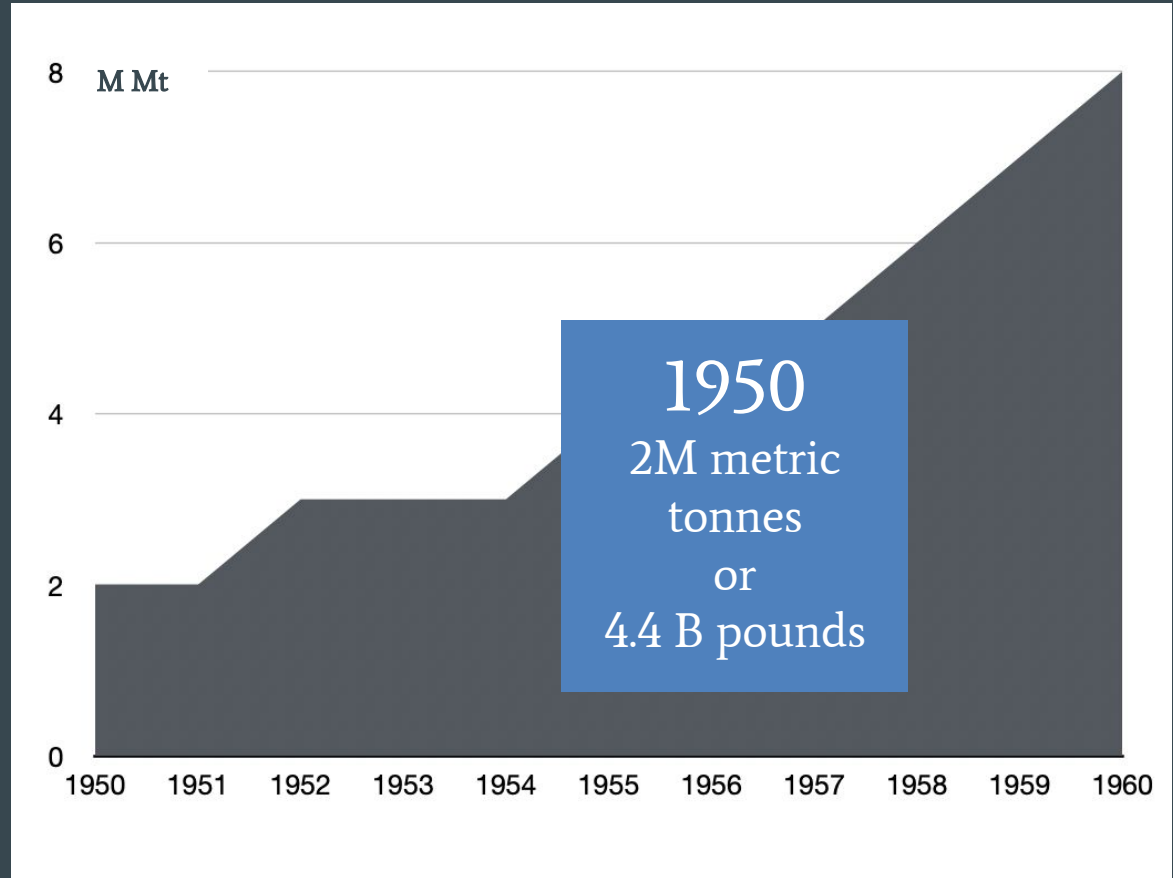
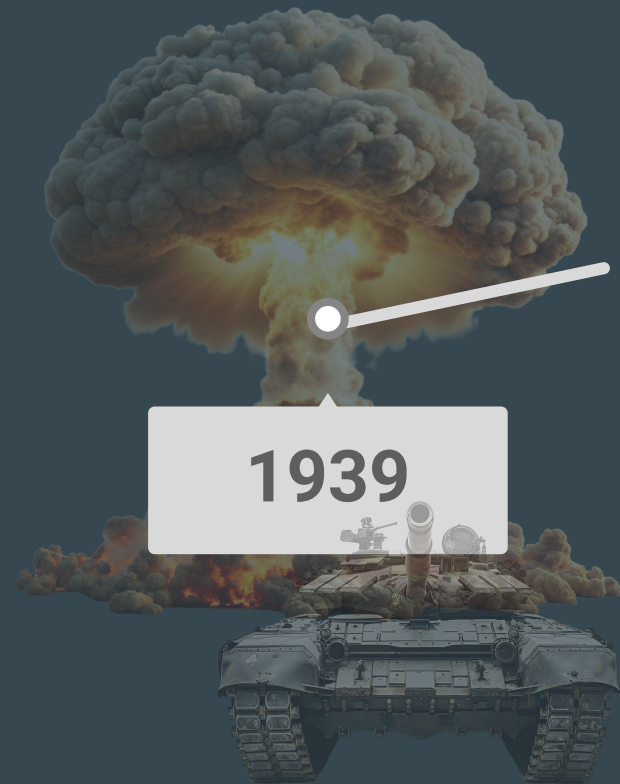
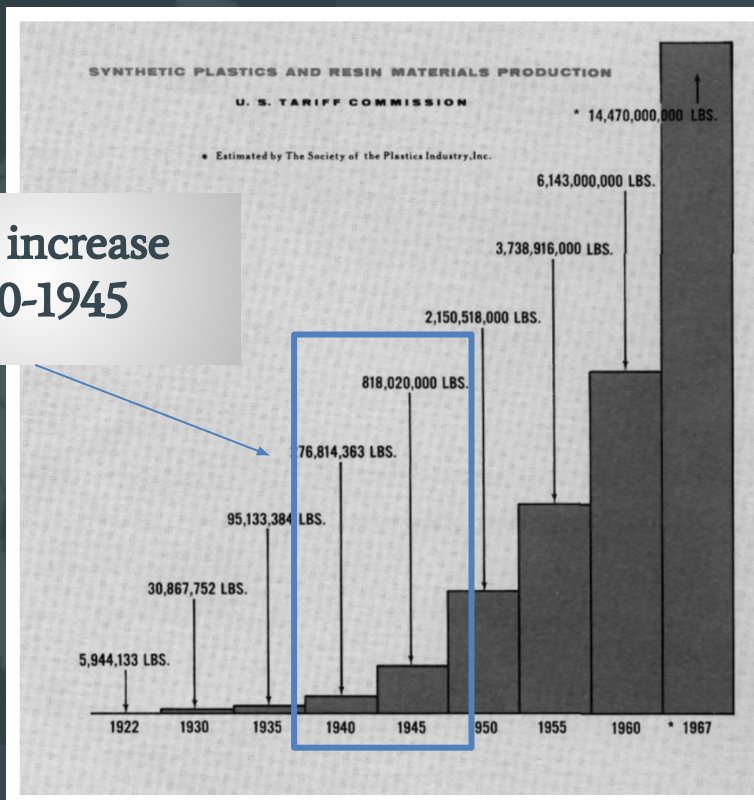


fig. S1. Global primary plastics production (in million metric tons) according to industrial use sector from 1950 to 2015.



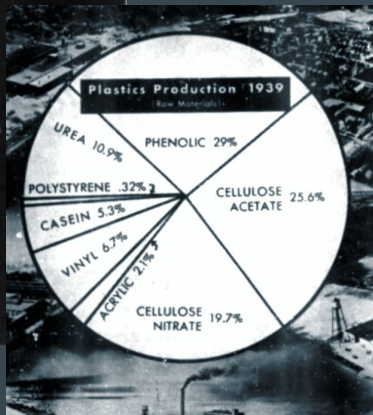


200% increase
1940-1945



1939

Source: *Modern Plastics*, 1940 (based on US Tariff Commission Data, 1939)

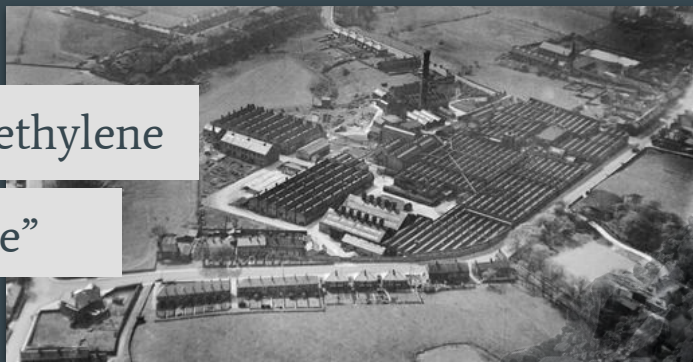


Source: *Modern Plastics*, 1940 (based on US Tariff Commission Data, 1939)



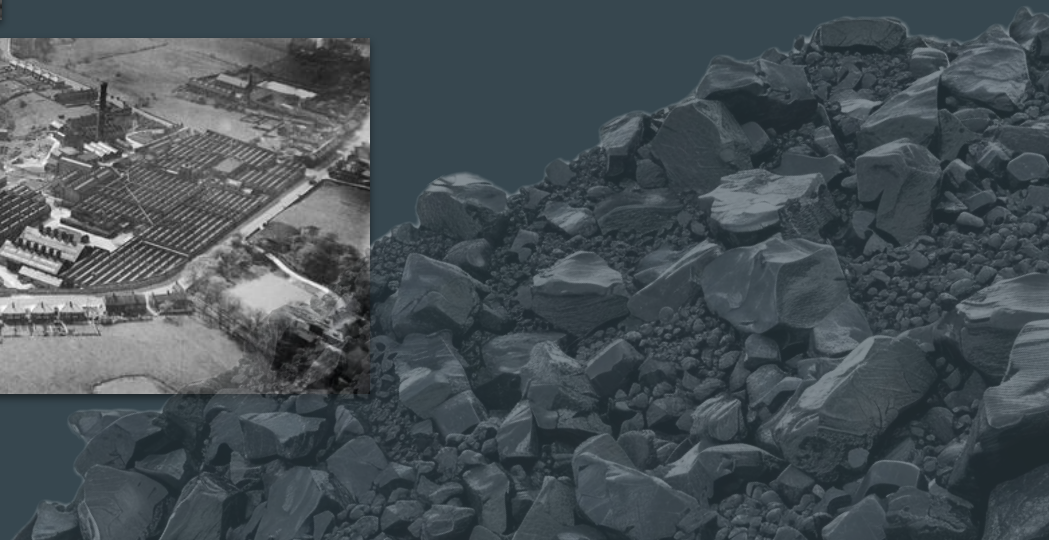


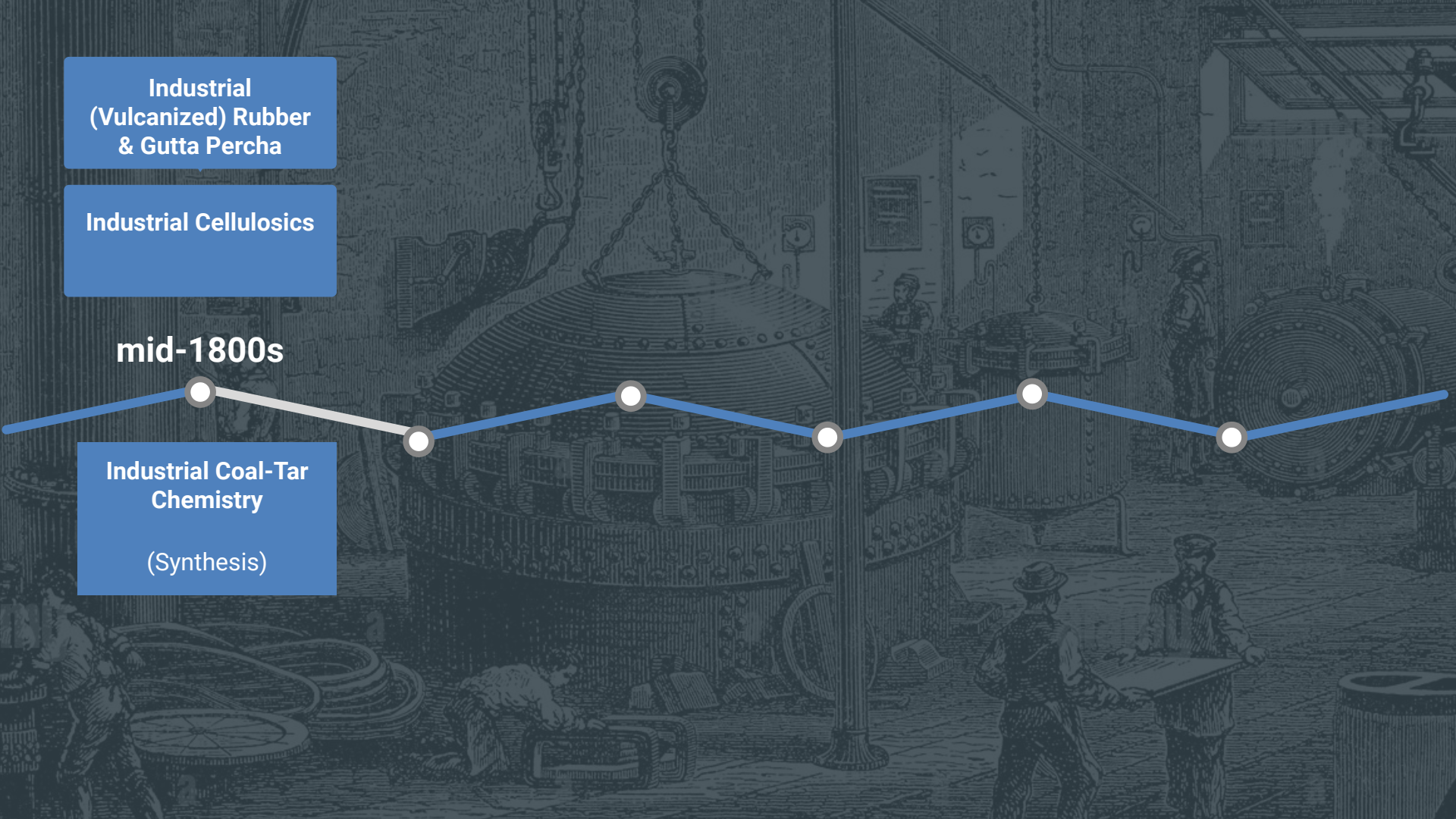
I.G Farben | Polystyrene



ICI (UK) | Polyethylene

“Polythene”





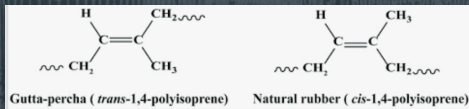
Industrial
(Vulcanized) Rubber
& Gutta Percha

Industrial Cellulosics

mid-1800s

Industrial Coal-Tar
Chemistry

(Synthesis)



Vulcanized RUBBER & GUTTA PERCHA

mid-1800s

INDIA - RUBBER, GUTTA - PERCHA,
AND
TELEGRAPH WORKS COMPANY, LIMITED,
Manufacturers of
VULCANISED INDIA-RUBBER.
Buffer Springs for Locomotive and Railway Trucks, Valves, Sheet
Washers, Suction and Delivery Hose, Tubing for Gas, &c., Machine
Belting, Elastic Steam Packing in Rope, Sheet, and Rings, &c. &c.
EBONITE.
Sheet, Pumps, Taps, Tubing &c. for acids and vinegar, ; Photographic
and Surgical Articles, Speaking Tubing, &c.
GUTTA-PERCHA.
Sheet, Tubing, Pump Buckets, Valves, Machine Belting, Vessels for
chemicals, and acids, &c.
WATERPROOF.
Clothing, Hot-Water Cushions, Matting, Ground Sheets, Aprons, Wago
Covers, &c. &c.
TELEGRAPH INSTRUMENTS.
Insulators, Batteries, Insulated Wire, and every description of Telegraph
Apparatus and Stores.
Vulcanised India-rubber specially prepared to withstand the acti
of tropical climates.
WORKS, SILVERTOWN, ESSEX.
R73

1869

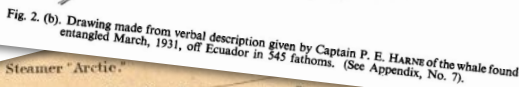
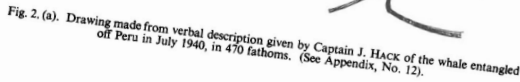
BRUCE C. HEEZEN
(Received 7 January 1957)

INTRODUCTION

The depth to which the same workers scatter layers are grounds.

REPORTS OF DAMAGE TO SUBMARINE CABLES

There are nearly a half-million of the world. In the appendix v about one-sixth of the world's



Vulcanized RUBBER
& GUTTA PERCHA

1850s

Early Cellulosics
(Parkesine, UK)

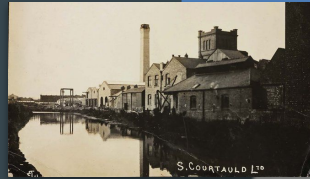
Celluloid Co. (JW
Hyatt, Newark, NJ)

1871 (production began)

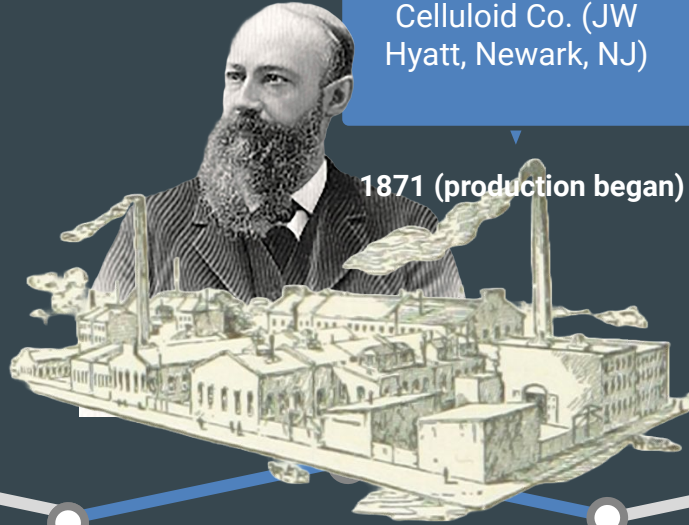
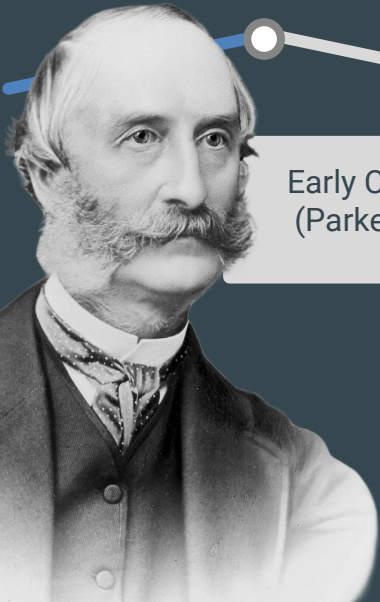
Moulded goods
Fibers
Films
Coatings & Paints

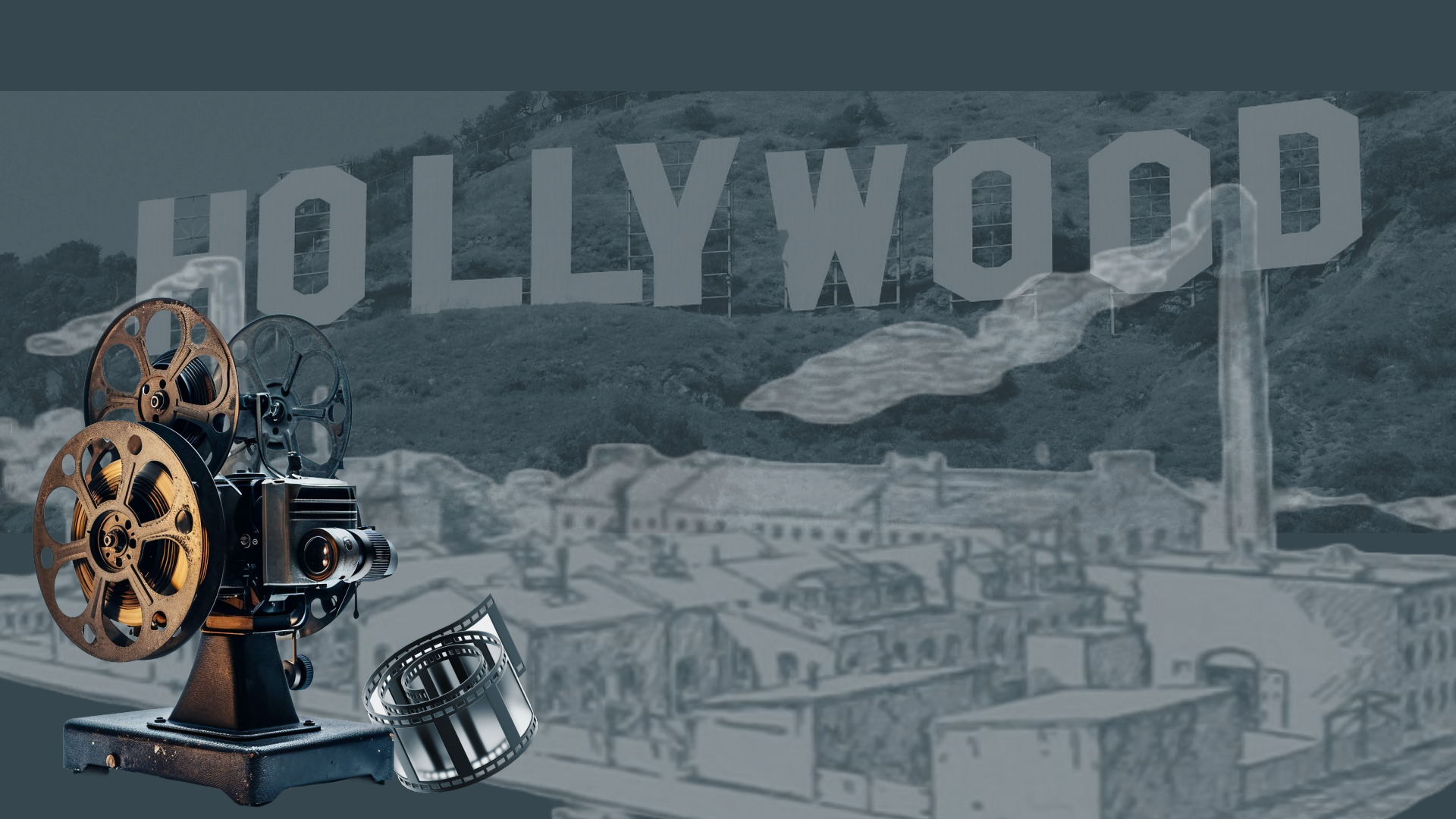
1880s/90s

Viscose Rayon
developed (UK)



Source: Paul Blanc, MD





Industrialization of
Coal-Tar Chemistry
(Dyes & Drugs)

THEORETICAL DEVELOPMENT

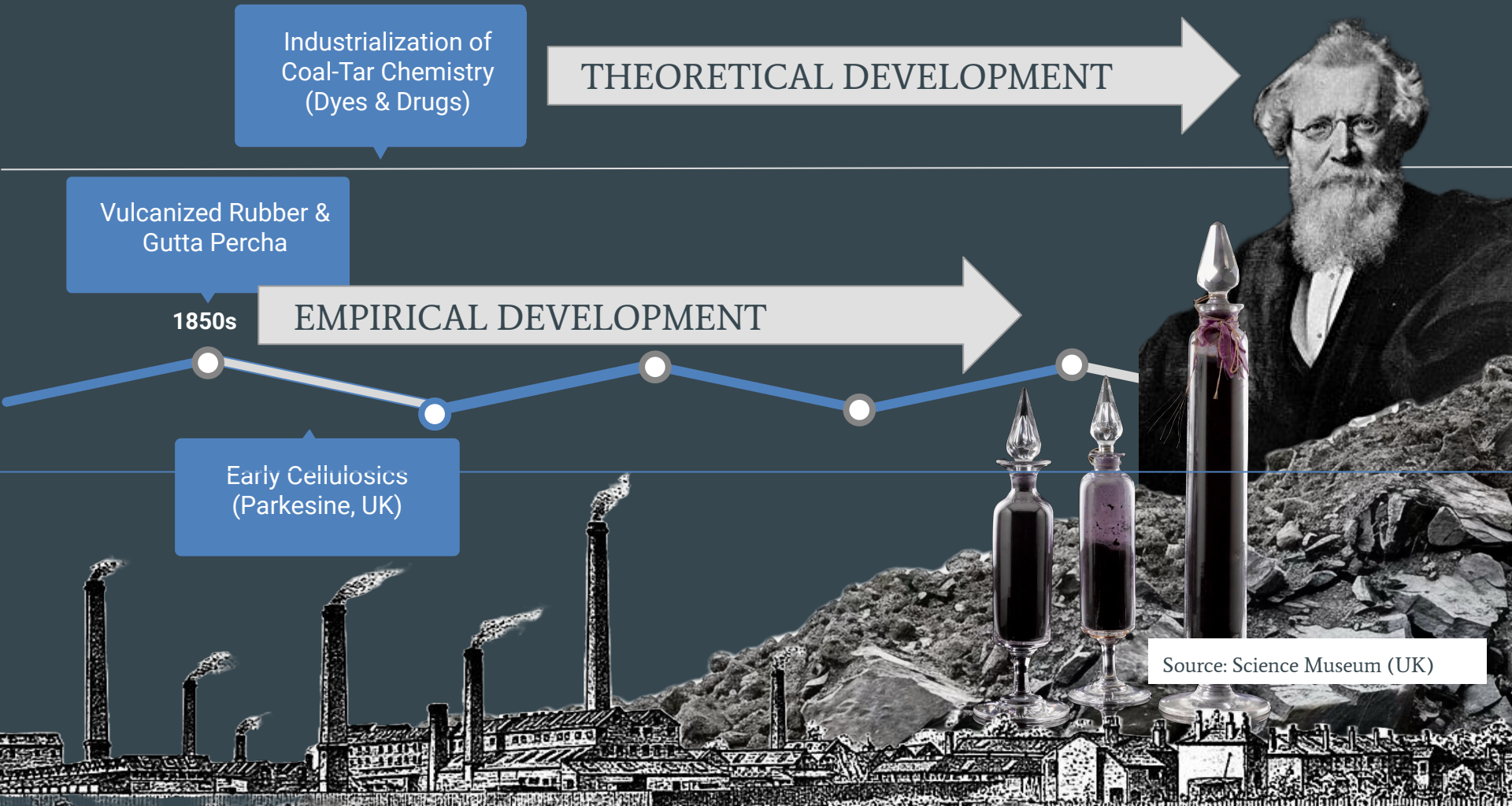
Vulcanized Rubber &
Gutta Percha

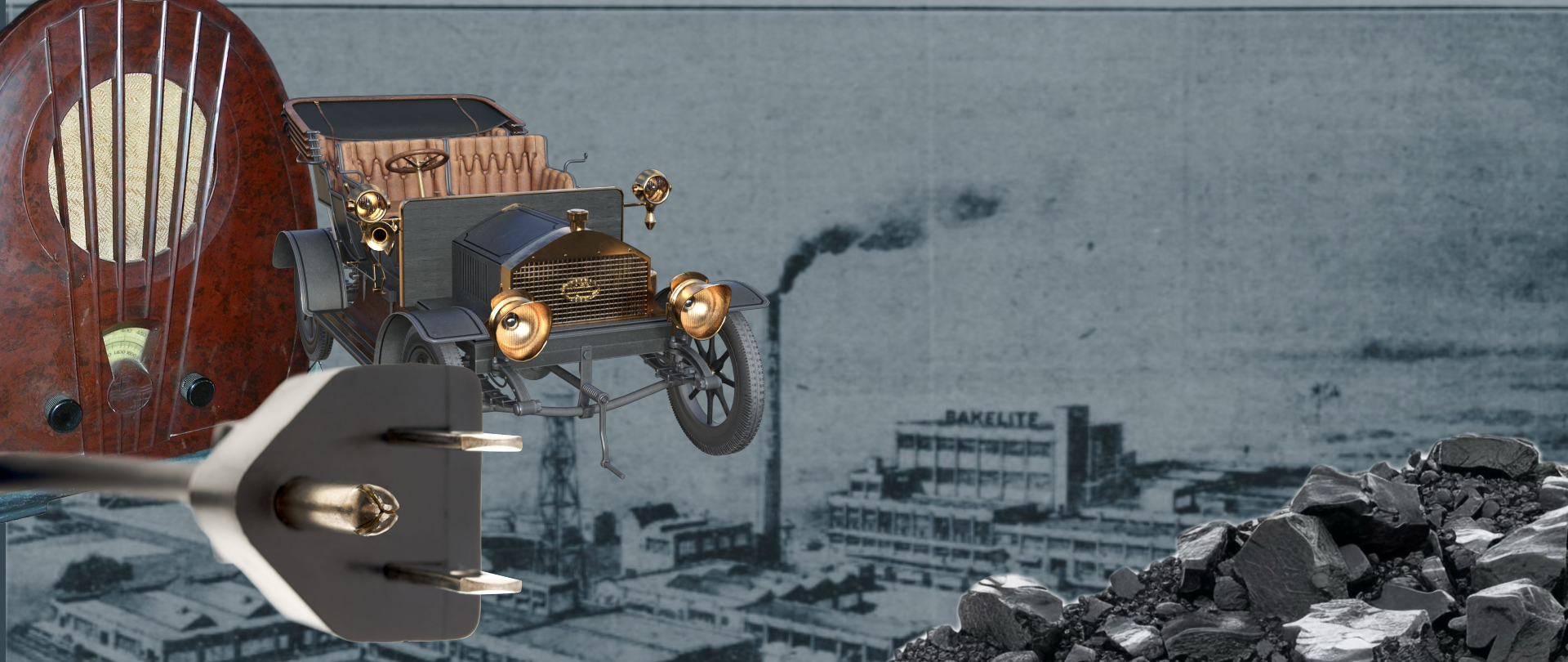
1850s

EMPIRICAL DEVELOPMENT

Early Cellulosics
(Parkesine, UK)

Source: Science Museum (UK)





BAKELITE

REG. U.S. PAT. OFF.

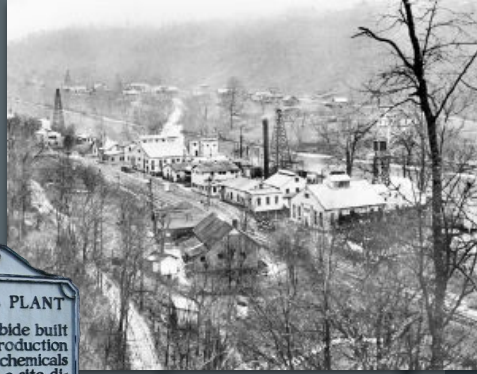
OXYBENZYL METHYLENGLYCOLANHYDRIDE

OR

MODERN MAGIC

Source: Smithsonian, Reindert Groot, Amsterdam Bakelite Collection

petroleum + chemistry = **petrochemistry**



“Plastic” nomenclature

1920

1939



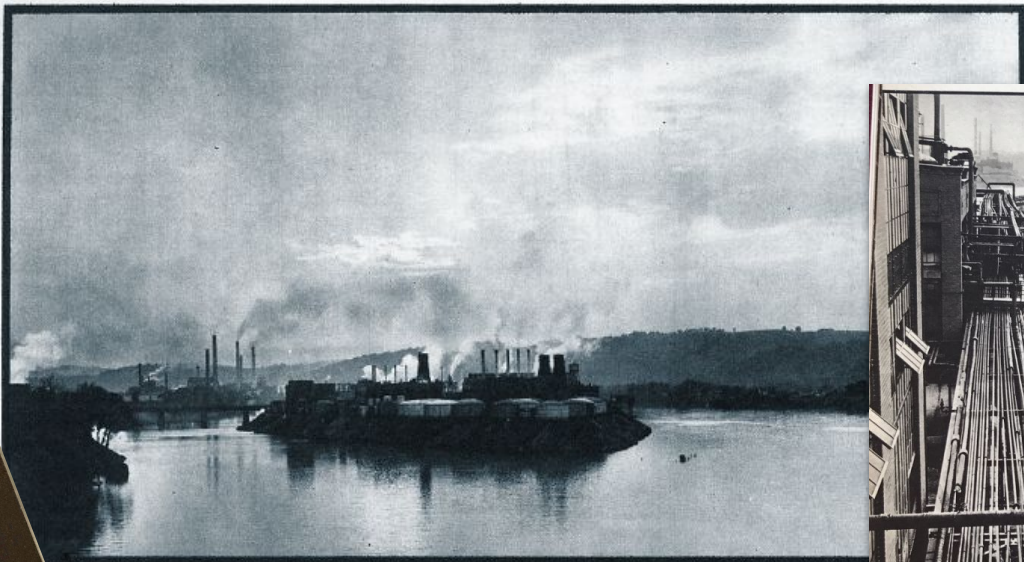
125. H. Staudinger: Über Polymerisation.

[Aus dem Chem. Institut der Eidgen. Techn. Hochschule, Zürich.]

(Eingegangen am 13. März 1920.)

„In der letzten Zeit hat G. Schroeter¹⁾ interessante Ansichten über die Zusammensetzung von Polymerisationsprodukten, speziell über die Natur der polymeren Ketene veröffentlicht. Danach sollen diese Verbindungen Molekülverbindungen darstellen und cyclische Derivate sein, wie früher angenommen. Diese Ketene unterscheiden sich nach den Angaben in wesentlichen Punkten von Cyclopentanone. Synthese aus Aceton-dicarbonester-Deriv-

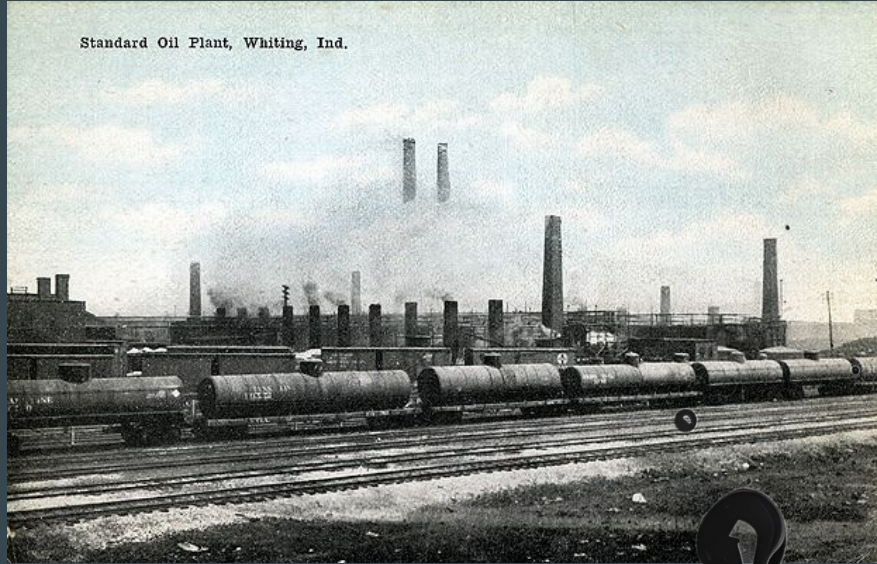
polymer theory (but controversial)

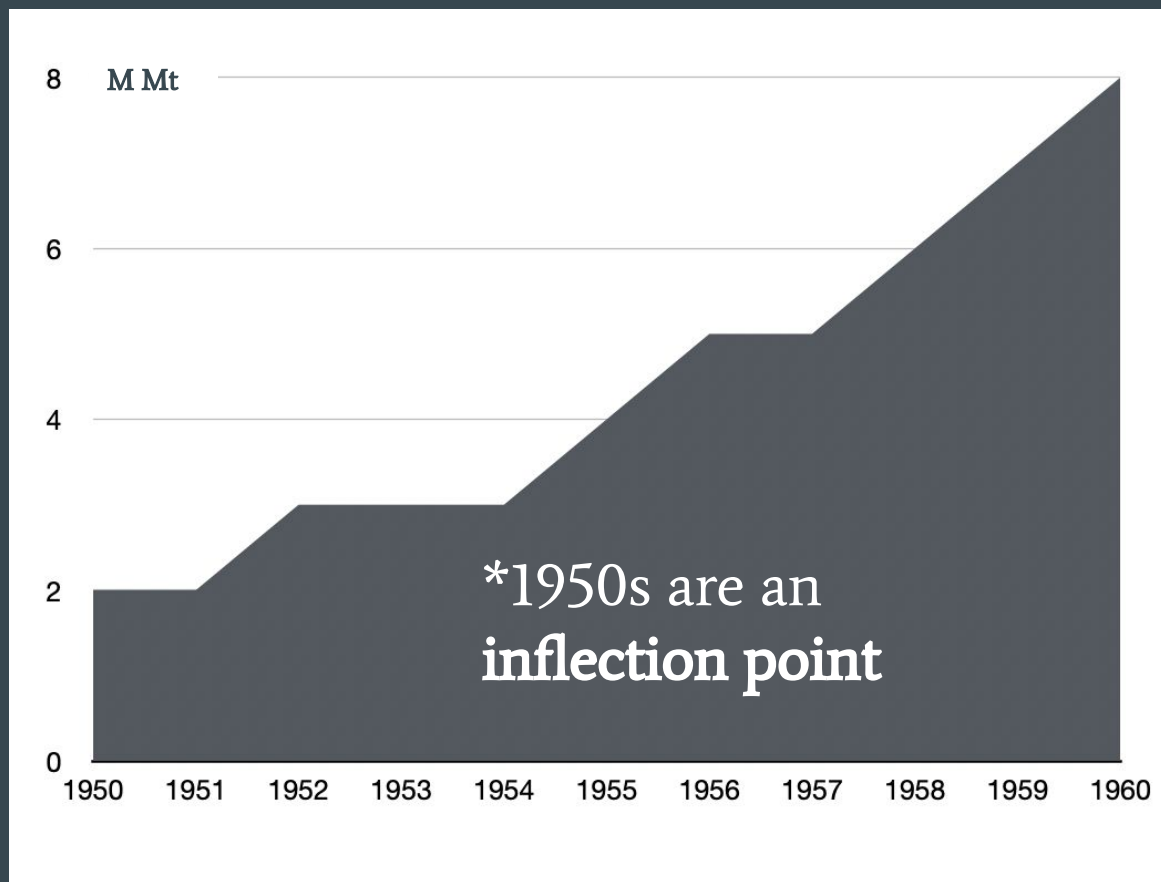


Carbide & Carbon Chemicals

Kanawha River Valley, So. Charleston, WV

Union Carbide, Co-location – 1930s – Buy Bakelite





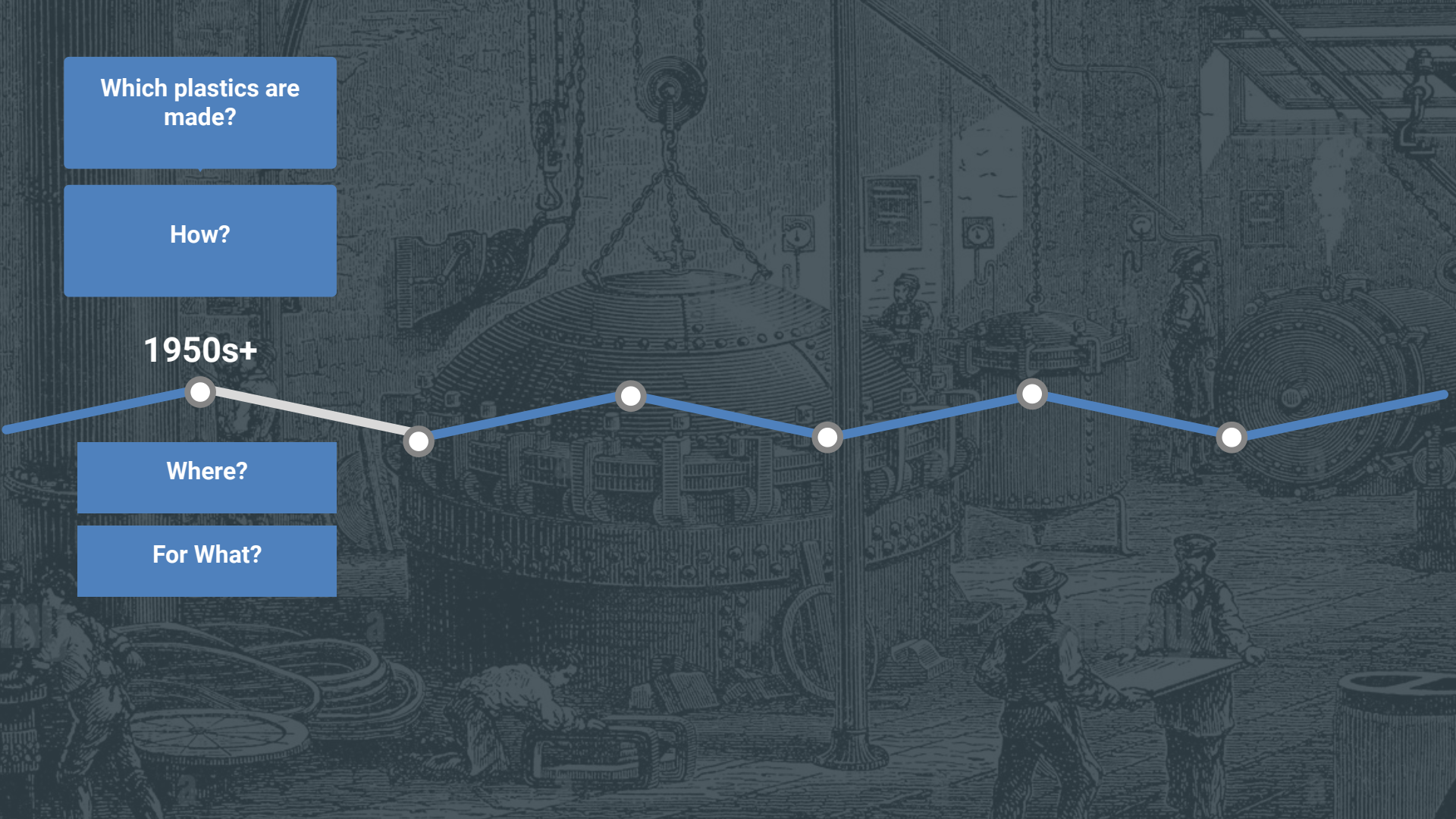
Which plastics are
made?

How?

1950s+

Where?

For What?



Which plastics are
made?

How?

Where?

For What?

Post-war growth of PE, PS; development of HDPE and PP.



Which plastics are made?

Post-war growth of PE, PS; development of HDPE and PP.

How?

Coal >>> crude/gas (Marshall Plan, etc.)
Institutionalization, application of polymer theory

***1950s are an inflection point**

Where?

More countries, new corridors (e.g., Mississippi Corridor), bigger plants

For What?

“...a 10-year tax exemption plan...”

“...friendly taxation...”

NEW ORLEANS WELCOMES THE PLASTICS INDUSTRIES!

WHY NEW ORLEANS FOR YOUR NEW PLANT

Ready raw materials, unexcelled transportation facilities, and a location that facilitates manufacture and business.

COTTON
WOOD PULP
SULPHUR
SUGAR CANE (BAGASSE)
SODA ASH
PETROLEUM PRODUCTS

In addition to above-pictured raw materials—say beans, cellulose, lignite, the acids, carbon black, etc.—are produced nearby. Other needed materials are imported regularly through New Orleans at no extra transportation expense.

MARKETS—TRANSPORT
RESOURCES

NEW ORLEANS INVITES THE PLASTICS INDUSTRIES

A NEW ORLEANS LOCATION MAKES SENSE...and PROFITS!

HERE ARE MARKETS. New Orleans is strategically located to serve two great manufacturers' markets—the rich Mid-Continent area and the fast-growing 10-states Southern market, whose effective buying-in-power has more than doubled in 5 years—and a vast, buy-minded import market comprising all South and Central American republics, Mexico and the Caribbean area.

HERE ARE RAW MATERIALS. In abundance, cotton, cotton linters, soy beans, wood pulp, soda ash, bauxite, the acids, carbon black, lignite, etc.—all are produced within city limits or just a few miles beyond. Imported through the great port of New Orleans are cereals, castor beans and other materials indispensable to the manufacture of plastics—available here without additional transportation expense.

HERE IS TRANSPORTATION. With a combination of facilities unequalled elsewhere. Modern, sheltered harbors, 97 ship and barge lines, trunk railroads, 8 major airlines, well-kept highways, a 13,000 mile network of inland waterways.

LOW COST FUEL. Unlimited natural gas from fields near New Orleans, abundant, economical electricity from gas-fired steam power plants.

SKILLED LABOR. Intelligent, cooperative, permanent labor supply has more than doubled since 1940 and state encourages industrial growth. Investigate now.

SEND FOR YOUR COPY of our industrial study, "Manufacturing Opportunities in Plastics in New Orleans". Address: Dept. 42-A, Greater New Orleans, Inc., 1024 Maison Blanche Bldg., New Orleans 16, La.

APRIL 1948

MISSISSIPPI RIVER CRESCENT, NEW ORLEANS, LA.—30

LET US SEND YOU FREE a copy of our recently completed study, "Manufacturing Opportunities in Plastics in New Orleans". Write:

Greater New Orleans, Inc., 1024 Maison Blanche Bldg., New Orleans 16, La.

Which plastics are made?

Post-war growth of PE, PS; development of HDPE and PP.

How?

Coal >>> crude/gas (Marshall Plan, etc.)
Institutionalization, application of polymer theory

Where?

More countries, new corridors (e.g., Mississippi Corridor), bigger plants

For What?

Post-war (re)building boom, construction & appliances
Packaging
Self-service supermarkets, replacement of glass, paper, tin
Highways, cars, and fast food culture
Durables, Recyclables (Bottles) >>> Disposables

***1950s are an inflection point**

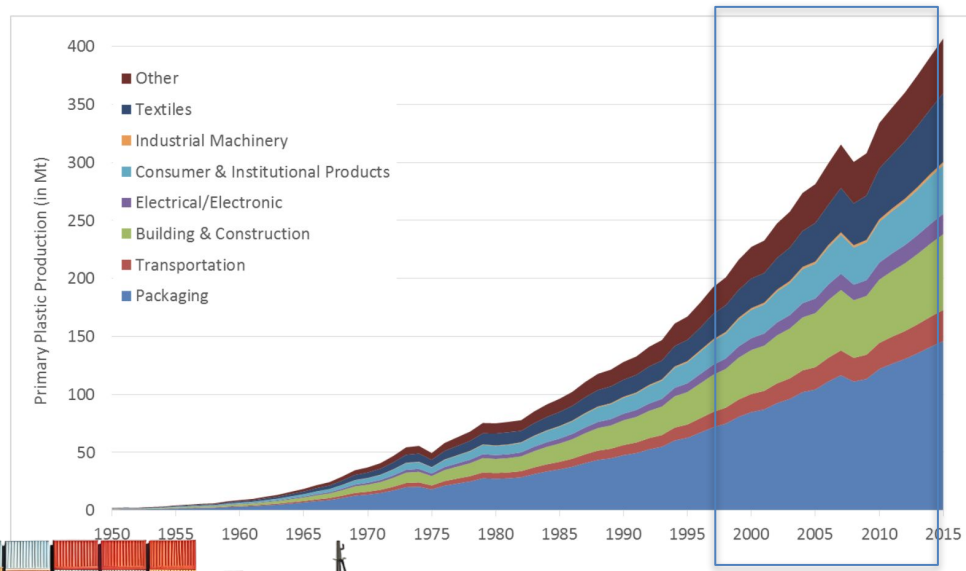


“...the future of plastics is in the trash can...”
(1955)

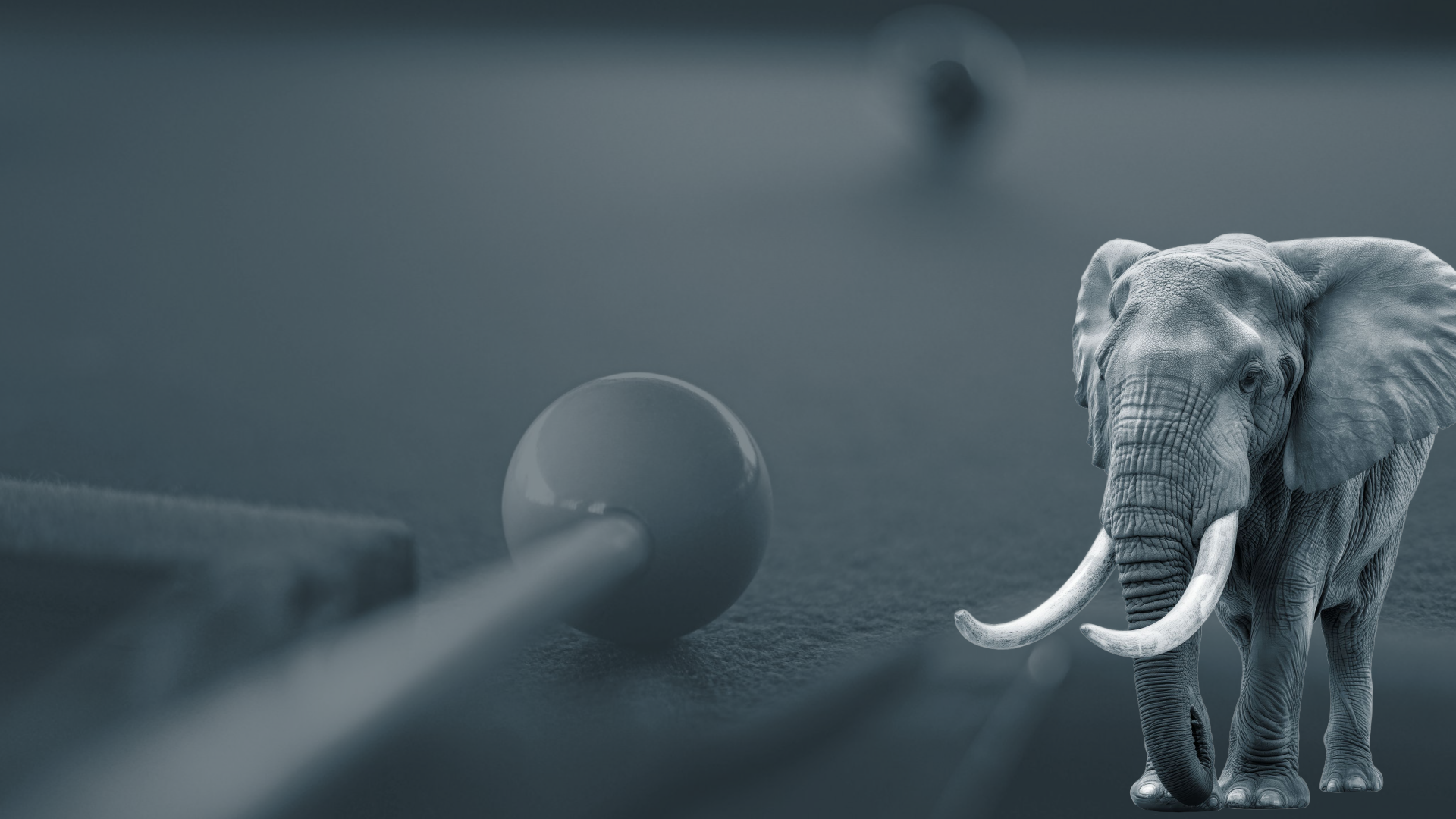
“The happy day has arrived when nobody any longer considers the plastics package too good to throw away.” (1963)

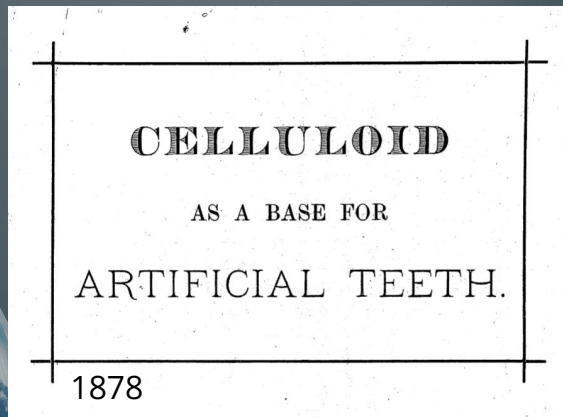
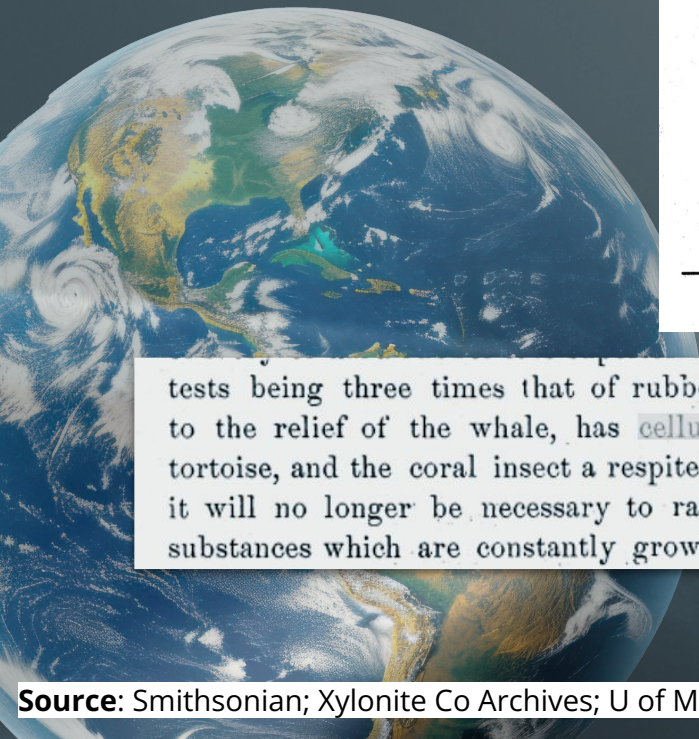


Source: Nat'l Plastics Conference, 1963, courtesy of Dr. Max Liboiron



Source: Geyer, Jambeck & Lavender Law, 2017





tests being three times that of rubber. Thus, as petroleum came to the relief of the whale, has celluloid given the elephant, the tortoise, and the coral insect a respite in their native haunts; and it will no longer be necessary to ransack the earth in pursuit of substances which are constantly growing scarcer. In fact, like the.

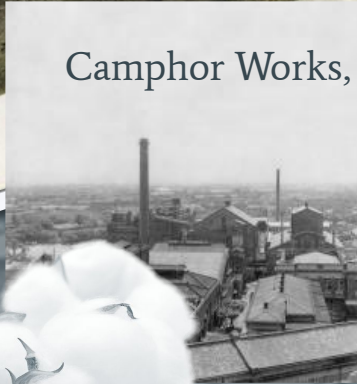


Source: NYPL



Source: reprint

Camphor Works,

[illegible]

Camphor Works, built 1899

Camphor is a natural product derived from various trees, including the camphor tree (Cinnamomum camphora). It has been used for centuries in traditional medicine and as a preservative. The Camphor Works, built in 1899, was a significant industrial facility for the production of camphor. The image shows the large industrial complex with multiple buildings and chimneys, set against a backdrop of trees and a hazy landscape. In the foreground, a large, white, fluffy object, possibly a piece of cotton or wool, is visible, though it is out of focus.



CLAS

This Telegram transferred dictated sign all by the

THE SENDER OF THIS MESSAGE
authorizes us to say that a
TELEGRAPHIC reply is desired
via
WESTERN UNION

WESTERN UNION

NEWCOMB CARLTON, PRESIDENT

J. C. WILLEVER, FIRST VICE-PRESIDENT

The filing time as shown in the date line on full-rate telegrams and day letters, and the time of receipt at destination as shown on all messages, is STANDARD TIME.

ESTERN UNION

SIGNS
DL = Day Letter
NM = Night Message
NL = Night Letter
LCO = Deferred Cable
NLT = Cable Night Letter
WLT = Week-End Letter

Received at 113 Massachusetts Ave., Boston, Mass.

BAR73 38 DL 7 EXTRA XU=WILMINGTON DEL 11 1011A

DR ALICE HAMILTON=

DONT PHONE HARVARD MEDICAL SCHOOL CAMBRIDGE MASS=

RAYON FACTORY HAVING EPIDEMIC OF MENTAL CASES LAID TO

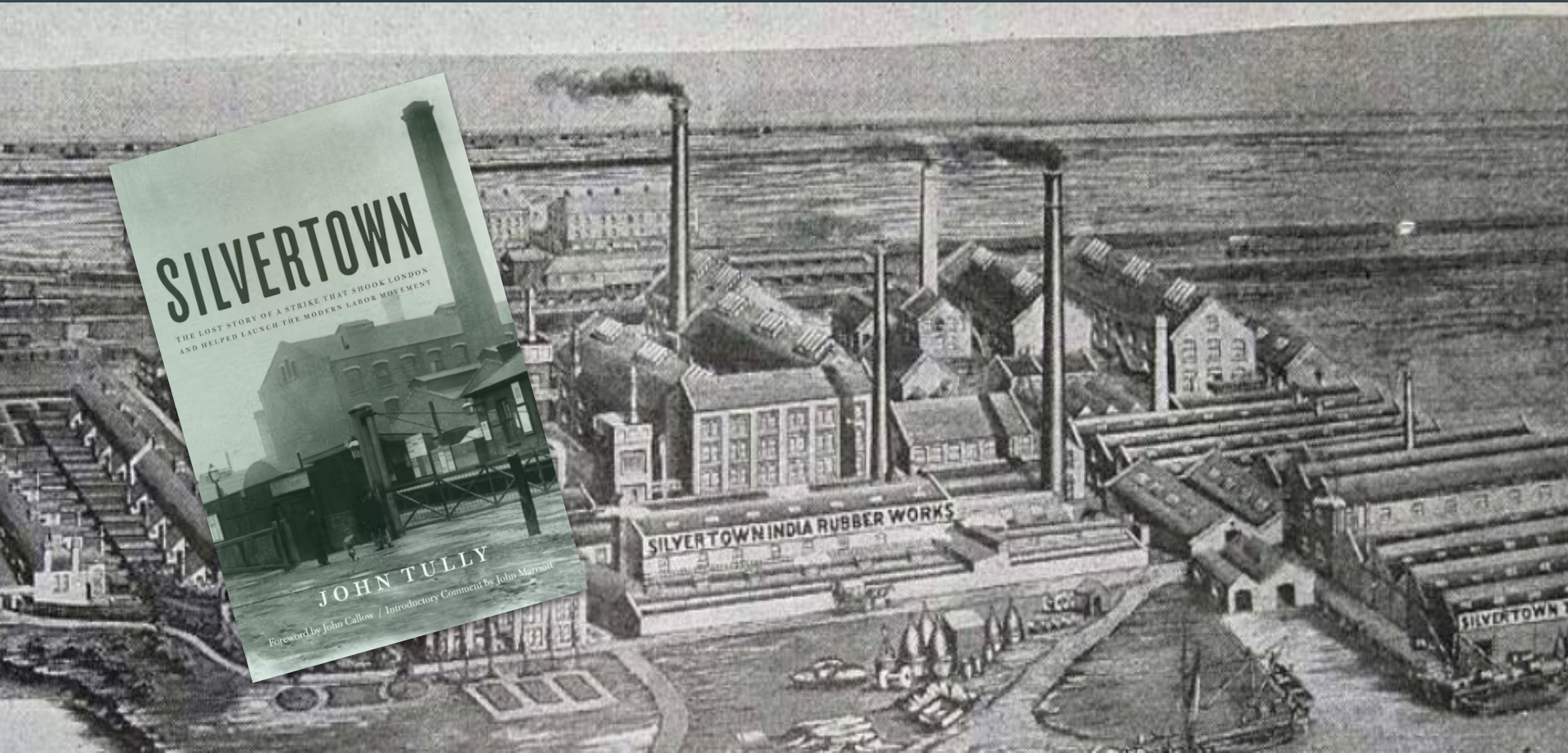
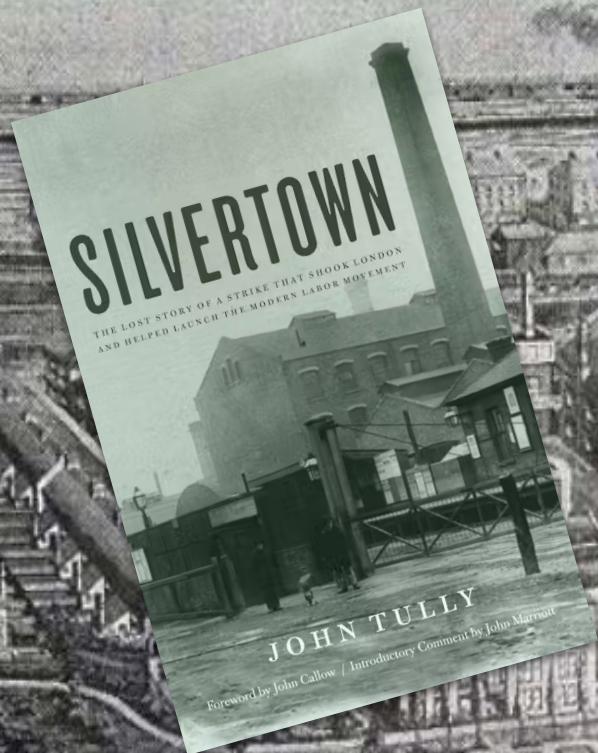
CARBON BISULPHIDE POISONING PHYSICIANS ANXIOUS TO GET

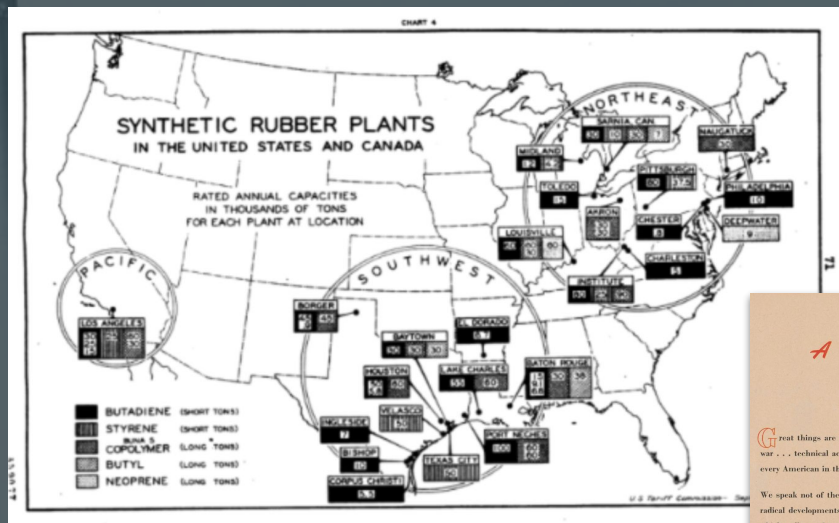
GENERAL SYMPTOM OF DISEASE STOP BEST PROBABLE TREATMENT

1933 MAR 11 PM 11 17

MINUTES IN TRANSIT
FULL RATE DAY LETTER

Source: Alice Hamilton Collection, Linda Lear Archives, Conn College; Blanc, 2006 (Yale Press).





...awaiting “honorable discharge” to “serve a world at peace...”

[illegible]

Source: US Tariff Commission, Dow, 1944 via the Science History Institute.

Source: U.S. Tariff Comm: Rubber, War Changes in Industry, 1945