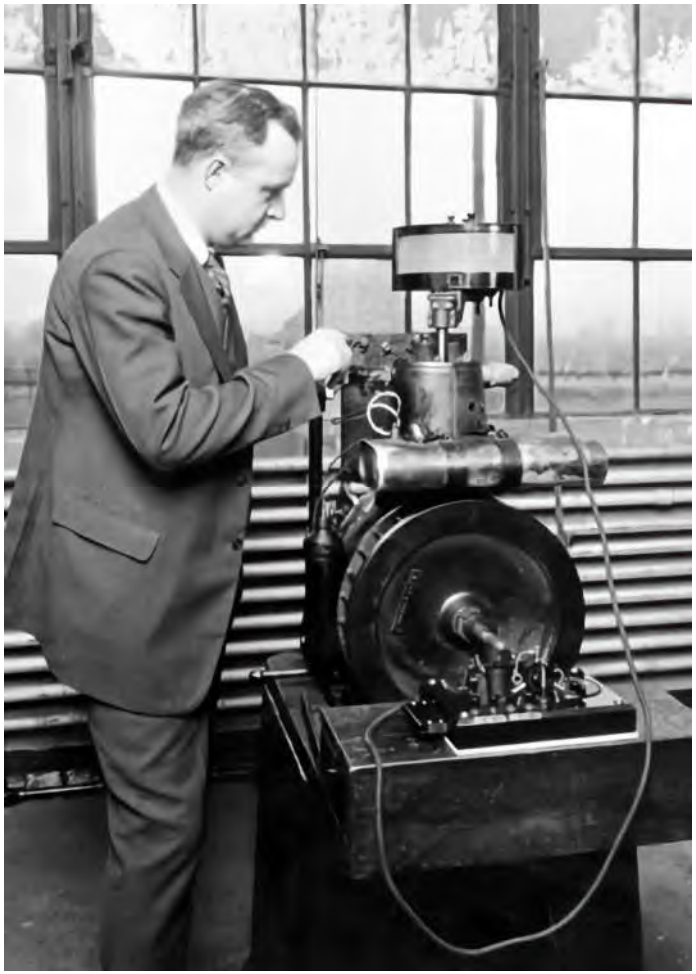
MJPHD

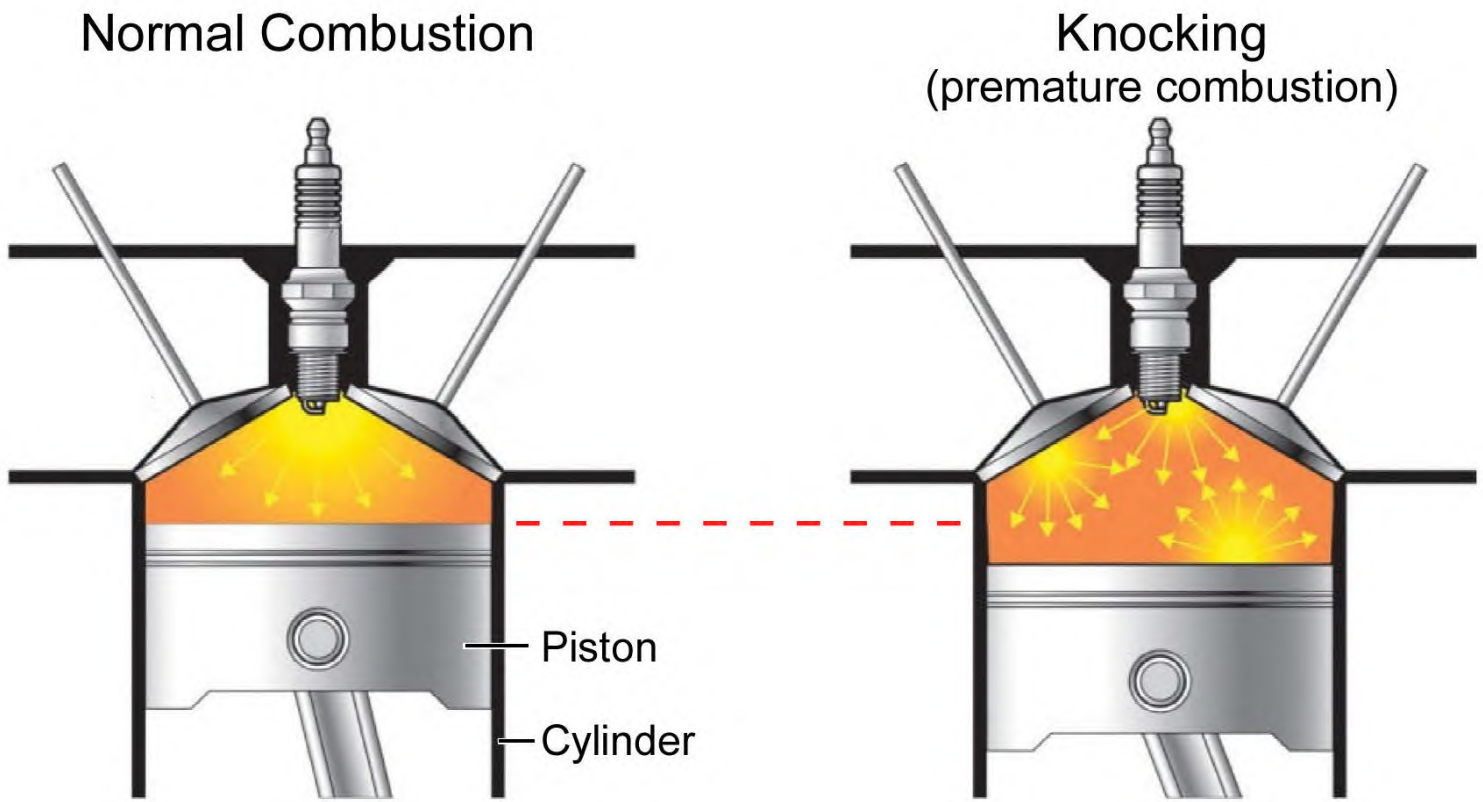
TRADEOFFS ON THE ROAD TO MORE SUSTAINABLE

MARK JONES
CREATIVE DIRECTOR
MJPHD, LLC

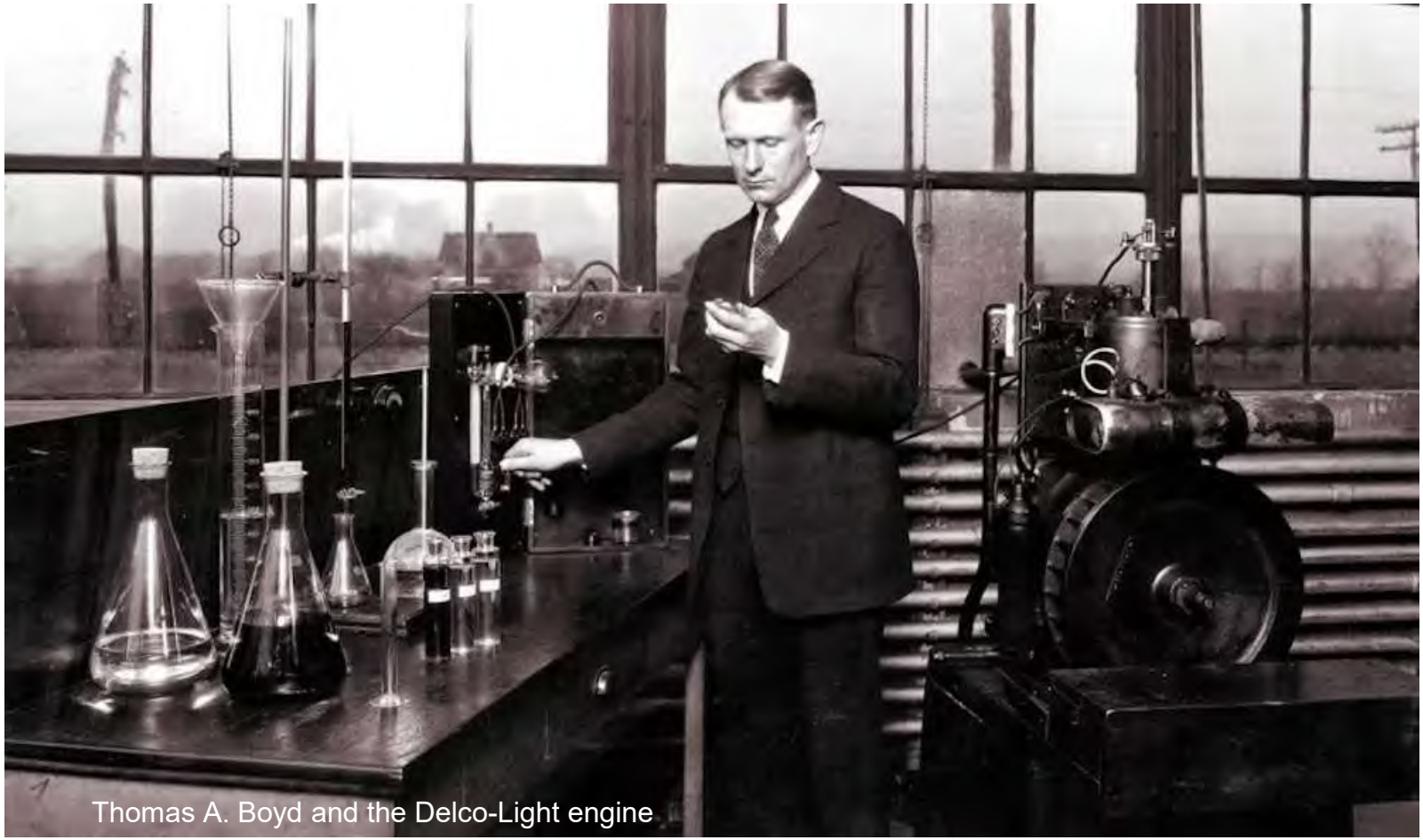
30 September 2022



KNOCKING


Normal Combustion
Knocking
(premature combustion)
Piston
Cylinder


3X
THE BOOST
LUCAS
OIL PRODUCTS INC.
A REAL
OCTANE BOOSTER
RACING FORMULA
TESTED - Increases Octane Rating by 3 Full Numbers
STOPS PINGING
DANGER: COMBUSTIBLE. Harmful or fatal if swallowed. Read carefully DIRECTIONS and DANGER on side panel.
5.25 fl oz. U.S. Made in USA 155 mL



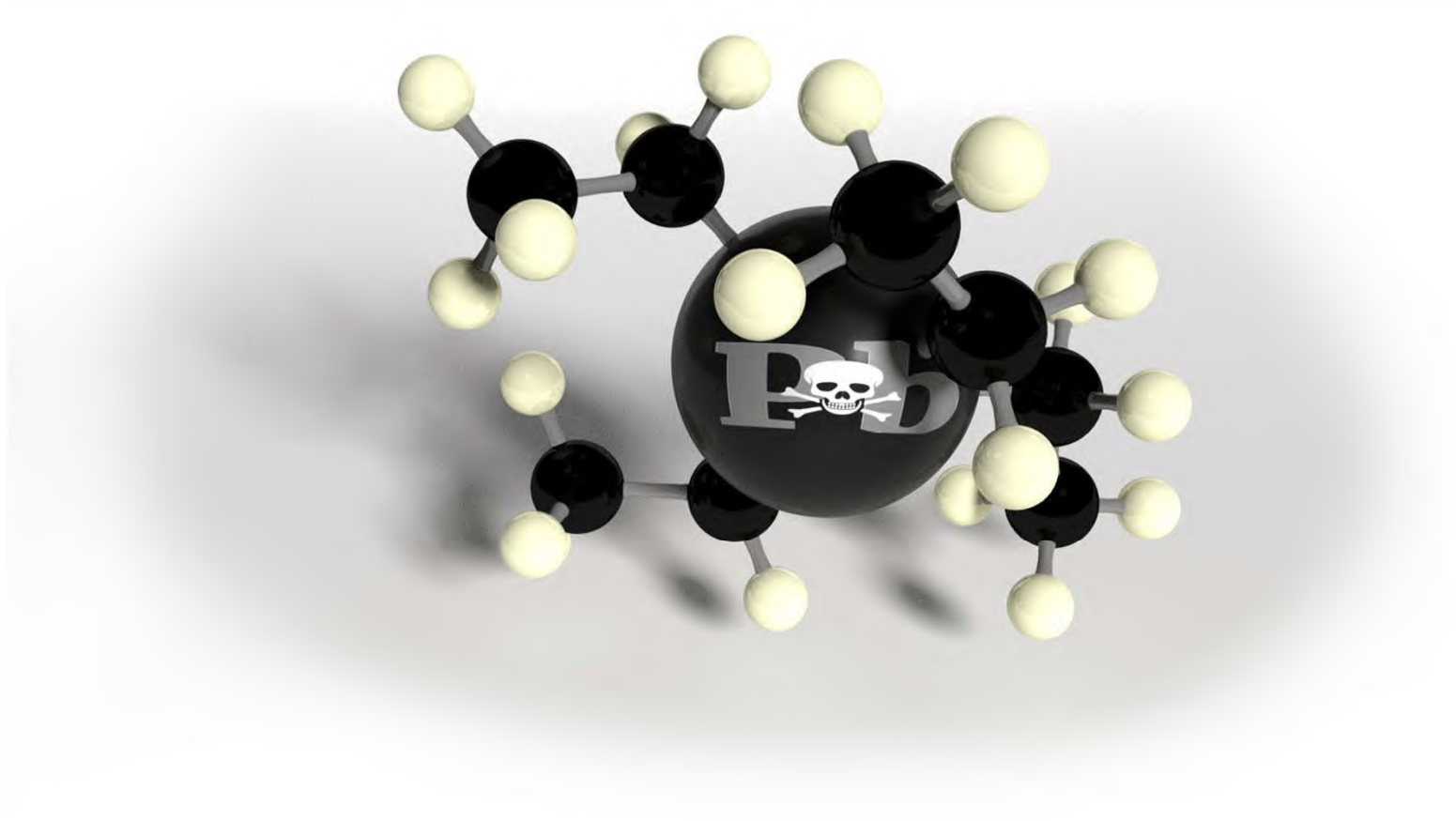
Thomas A. Boyd and the Delco-Light engine

Table 1. Relative Antiknock Effectiveness of Various Compounds[a]

tetraethyllead	118	tetraethyltin	4
tetraphenyllead	73	triphenylarsine	1.6
iron pentacarbonyl	50	xylidine	1.6
nickel carbonyl	35	diphenylamine	1.5
diethyl telluride	27	*N*-methylaniline	1.4
triethylbismuth	24	dimethylcadmium	1.2
diethyl selenide	7	aniline	1.0
stannic chloride	4.1	ethanol	0.1

[a] Vs aniline = 1 on a mole basis. From ref 1e, by permission of Springer-Verlag and Ethyl Corp.

TETRAETHYL LEAD



Patented Feb. 23, 1926. 1,573,846

UNITED STATES PATENT OFFICE.

THOMAS MIDGLEY, JR., OF DAYTON, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL MOTORS CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF DELAWARE.

METHOD AND MEANS FOR USING MOTOR FUELS.

Application filed April 15, 1922. Serial No. 553,270.

To all whom it may concern:

Be it known that I, THOMAS MIDGLEY, Jr., a citizen of the United States of America, residing at Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Methods and Means for Using Motor Fuels, of which the following is a full, clear, and exact description.

This invention relates to fuels, such, for example as kerosene and gasoline, employed in the operation of internal-combustion engines and to the art of burning the fuels in an engine. The present tendency is to produce lower grades of gasoline in order to obtain a sufficient output for the increasing demand for motor fuels and to reduce the compressions of the engines so that these lower grades of fuel may be used without knocking. As the lowering of engine compression reduces the efficiency of the engine, a still greater output of fuel is required to meet the increase in fuel required to operate larger and less efficient engines. The principal objects of the present invention are to overcome these difficulties and to provide a means for using either low or high grades of motor fuel more efficiently and so reduce the quantity of fuel used.

The present application is a continuation

duced, the engine heats rapidly, the efficiency of the engine is reduced and, if the initial pressure is very high, engine parts may be injured. The highest pressure at which a mixture may be burned in a cylinder without producing a fuel knock varies with the different fuels and, to some extent, with the temperature, position of spark plugs and other conditions within the engine. This pressure I term the "critical compression pressure" of the fuel.

The average critical compression pressure of kerosene is about 50 pounds, of the proper grades of gasoline about 75 pounds and of the better grades of gasoline about 125 pounds. The latter grade of gasoline is produced in limited quantities and is not available universally to the consumer. The commoner grades of fuel, such as kerosene and gasoline, having critical compression pressures below 75 pounds are used generally, and in internal-combustion engines for house lighting systems, trucks, tractors, and automobiles are designed to operate on these kinds of fuel.

I have found that the critical compression pressure of a fuel of the type mentioned above is increased by incorporating therewith any one of a large number of compounds containing metallic elements, i. e.,

Tetraethyl Lead Poison Hazards[1]

By Thomas Midgley, Jr.

Ethyl Gasoline Corp., New York, N. Y.

LAST fall in a semi-work's production plant manufacturing tetraethyl lead by a newly developed process there occurred an accidental poisoning which cost the lives of five men. The newspaper publicity engendered by this accident gave rise to a variety of opinions and opened an attack upon the general proposition of using tetraethyl lead in gasoline.

Although these opinions were in almost every case the result of assumptions as to the facts, rather than knowledge, it is believed that the best interest of the public will be served by a clear statement as to the actual hazards involved in carrying out the ethyl gasoline program.

It is not the purpose of this paper to enlarge upon the benefits of the use of tetraethyl lead in gasoline. It may not be amiss, however, to mention broadly the advantages to the public which will follow upon its general use. These are (1) conservation of petroleum due to the increased mileage obtainable by using a nonknocking gasoline in a high-compression motor, (2) reduction of carbon monoxide contamination of the atmosphere due to increased efficiency of combus-

they may in time contract poisoning if there is any possible chance of exposure to it. This has been the history of practically every individual who has suffered from tetraethyl lead.

As the result of experience, which, however costly, seems nevertheless to have been the only possible teacher, tetraethyl lead poisoning can now be detected by a well-informed physician before the slightest danger develops. In this connection it will be well to mention the difference between tetraethyl lead poisoning and the ordinary type of lead poisoning familiar in the lead industry. Ordinary or chronic lead poisoning is denoted by the following symptoms: stippling of the blood cells, lead line at the base of the teeth, stomach cramp (commonly called painter's colic), paralysis (most commonly wrist drop), and in extreme cases spasms and death. None of these symptoms are observed in poisoning due wholly to tetraethyl lead, in which case the symptoms are, in the order of their appearance, drop of blood pressure, drop of body temperature, reduced pulse, sleeplessness, loss of weight, sometimes nausea, sometimes tremor, and, in the most serious cases, delirium tremens. The first three

Tetraethyl lead alone formed problematic deposits in engines. Midgley's solution was to add organohalides to purposely form volatile lead compounds. Halogenated organics, like 1,2-dibromoethane and 1,2-dichloroethane, became part of the additive package. Lead would be swept out of the engine, out of the tailpipe. Midgley compounded the bad idea of placing lead into gasoline by ensuring it would be dispersed into the atmosphere. He clearly knew of the chronic impacts of lead but must have believed "the solution to pollution is dilution."


THE REFINERS OIL CO.
ETHYL GAS
ANTI-KNOCK
GASOLINE

Tetraethyl lead . . . THE REASON WHY AMERICA'S CARS ARE BEING TUNED UP . . . NOT DOWN !

DO YOU KNOW that if it weren't for the universal availability of high anti-knock gasoline every modern auto engine would have to be tuned-*down* . . . the spark *retarded* to eliminate "knock" or "ping"?

But today oil refiners have a way of making vast quantities of high anti-knock gasoline economically. By just adding a small amount of anti-knock fluids containing *tetraethyl lead* to each gallon of gasoline they can produce fuels that actually permit motor service men to tune-*up* a car . . . advance the spark to give better performance and mileage.

Since the oil industry has made this "leaded" gasoline generally available to the motorist, there have been two important results:

1. Automobile engineers in designing new cars can take advantage of the inherent advantages of high-compression engines requiring high anti-knock fuels . . . for they know that such fuels can be purchased anywhere in the United States and Canada.

2. Cars now on the road can be tuned-up for greater power and economy.

So, from the standpoint of both present and future needs, it is easy to see why it has been said that "Tetraethyl lead is almost as important as gasoline itself!"

* * *

THIS MONDAY NIGHT TUNE IN ON "TUNE-UP TIME" featuring Arthur Godfrey and his Orchestra, Tony Marvin as Master of Ceremonies, Kay Thompson and her Rhythm Singers. Columbia Broadcasting System, 8:30, E.S.T.

ETHYL GASOLINE CORPORATION, *manufacturer of anti-knock fluids used by oil companies to improve gasoline*

MAKING THE FARMER'S IRON HORSE WORK HARDER...

...tetraethyl lead!

ONLY FOUR YEARS AGO there were no high-compression tractors in the United States. Until then tractors were built with low compression engines in order to burn the poorest grade of fuel sold. Most farmers thought that this was the way to "economize."

But in 1933 oil refiners made "leaded" regular gasoline generally available . . . that is, gasoline which has been improved by the addition of anti-knock fluids containing tetraethyl lead.

So tractor engineers began to experiment with high compression engines designed to take advantage of this new, better fuel. They ran practical tests on farms and tractor proving grounds. They discovered that Farmer Jones, with a high compression tractor, could pull three plows instead of two, that he could operate in a higher gear and get more work done in the same time, or that he could pull the same equipment on four gallons of fuel instead of five.

Today twelve tractor manufacturers sell high compression tractors designed to use "leaded" gasoline. Thousands of these tractors are now in use. And a recent national survey indicated that nearly three out of every four farmers who are planning to buy a new tractor will buy a high compression tractor.

Tetraethyl lead has helped the farmer's iron horse work harder . . . just as it has the automobile owner to get greater power and economy from his car.

Ethyl Gasoline Corporation

manufacturer of anti-knock fluids used by oil companies to improve gasoline

THIS MONDAY NIGHT tune in on "Tune-Up Time" *Columbia Broadcasting System, 7 p.m., E.S.T.; 6 p.m., C.S.T.;—9 p.m., M.S.T.; 8 p.m., P.S.T.*

Even the man in the moon wouldn't know for certain when the war is going to end. But one thing you can be sure of—as long as American soldiers, sailors and airmen are in action, the best gasoline America can produce will be with them in the fight.

Today, the manufacture of combat gasoline is taking the cream of the U.S. petroleum industry's production, plus most of the Ethyl fluid manufactured. That's why gasoline at home must still be limited both as to quantity and quality.

But when final Victory is achieved, you can look forward to getting unlimited quantities of top-quality Ethyl gasoline again—Ethyl that will bring out the best performance of any car.

Ethyl CORPORATION

Chrysler Building, New York 17, N. Y.

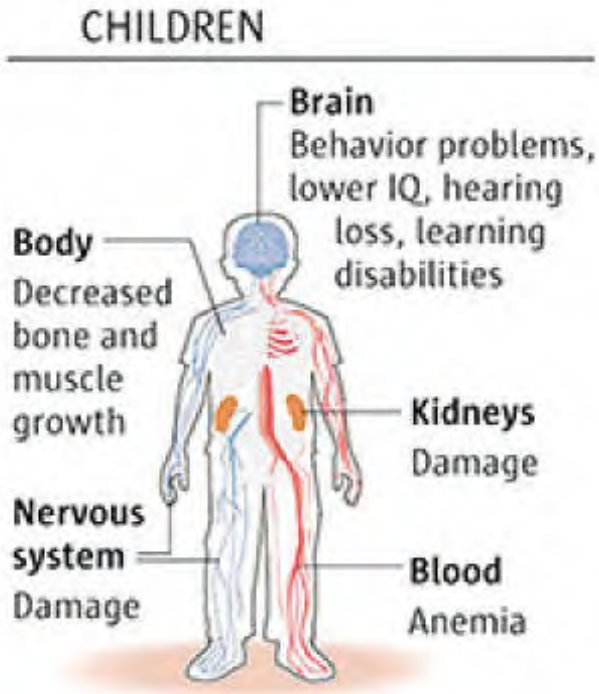
ETHYL IS A TRADE MARK NAME

Thomas Midgley, Jr

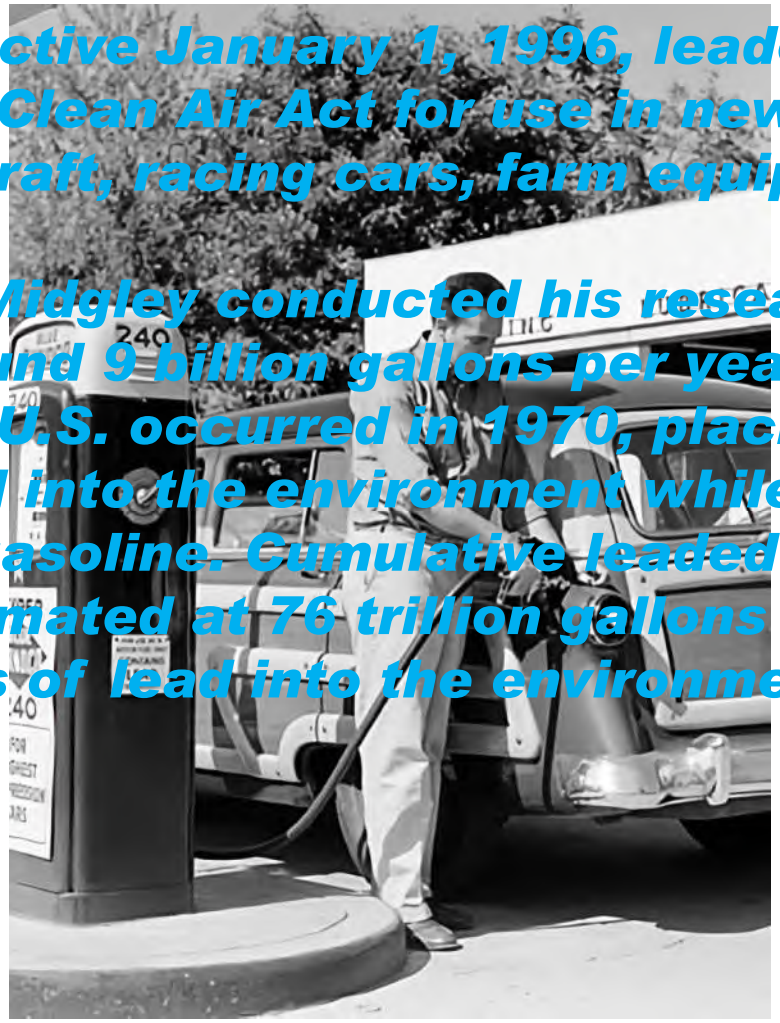
Roast Mortem Cast

When you think of the world's most dangerous person, who do you think of? Genghis Khan? Stalin? Hitler?! Try a gas-huffing, pseudo-chemist that gave an entire generation lead poisoning and singlehandedly melted a hole in the atmosphere. Midgley created an ecological Frankenstein's monster

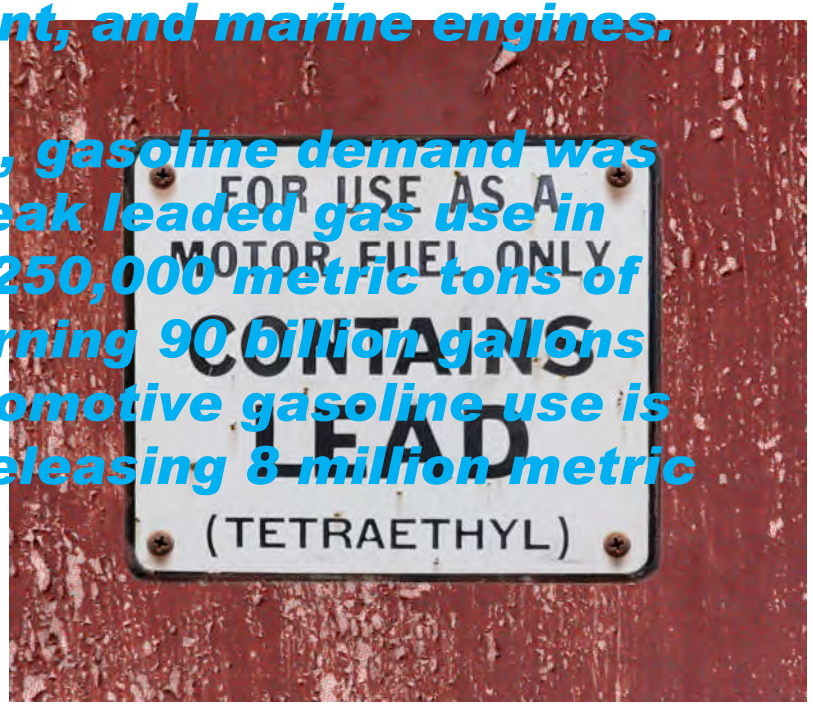

THE TOXIC EFFECTS OF LEAD
BRAIN & NERVE DAMAGE
DECREASED MENTAL ABILITY & LEARNING DIFFICULTIES
SPEECH, LANGUAGE & BEHAVIOUR PROBLEMS
HEARING PROBLEMS
ANAEMIA
HIGH BLOOD PRESSURE
REDUCED GROWTH
KIDNEY DAMAGE
REPRODUCTIVE PROBLEMS (ADULTS)
DIGESTIVE PROBLEMS
World Health Organization


CHILDREN
Brain
Behavior problems, lower IQ, hearing loss, learning disabilities
Body
Decreased bone and muscle growth
Kidneys
Damage
Nervous system
Damage
Blood
Anemia

Effective January 1, 1996, leaded gasoline was banned by the Clean Air Act for use in new vehicles other than aircraft, racing cars, farm equipment, and marine engines.



As Midgley conducted his research, gasoline demand was around 9 billion gallons per year. Peak leaded gas use in the U.S. occurred in 1970, placing 250,000 metric tons of lead into the environment while burning 90 billion gallons of gasoline. Cumulative leaded automotive gasoline use is estimated at 76 trillion gallons — releasing 8 million metric tons of lead into the environment.



Full Calculations

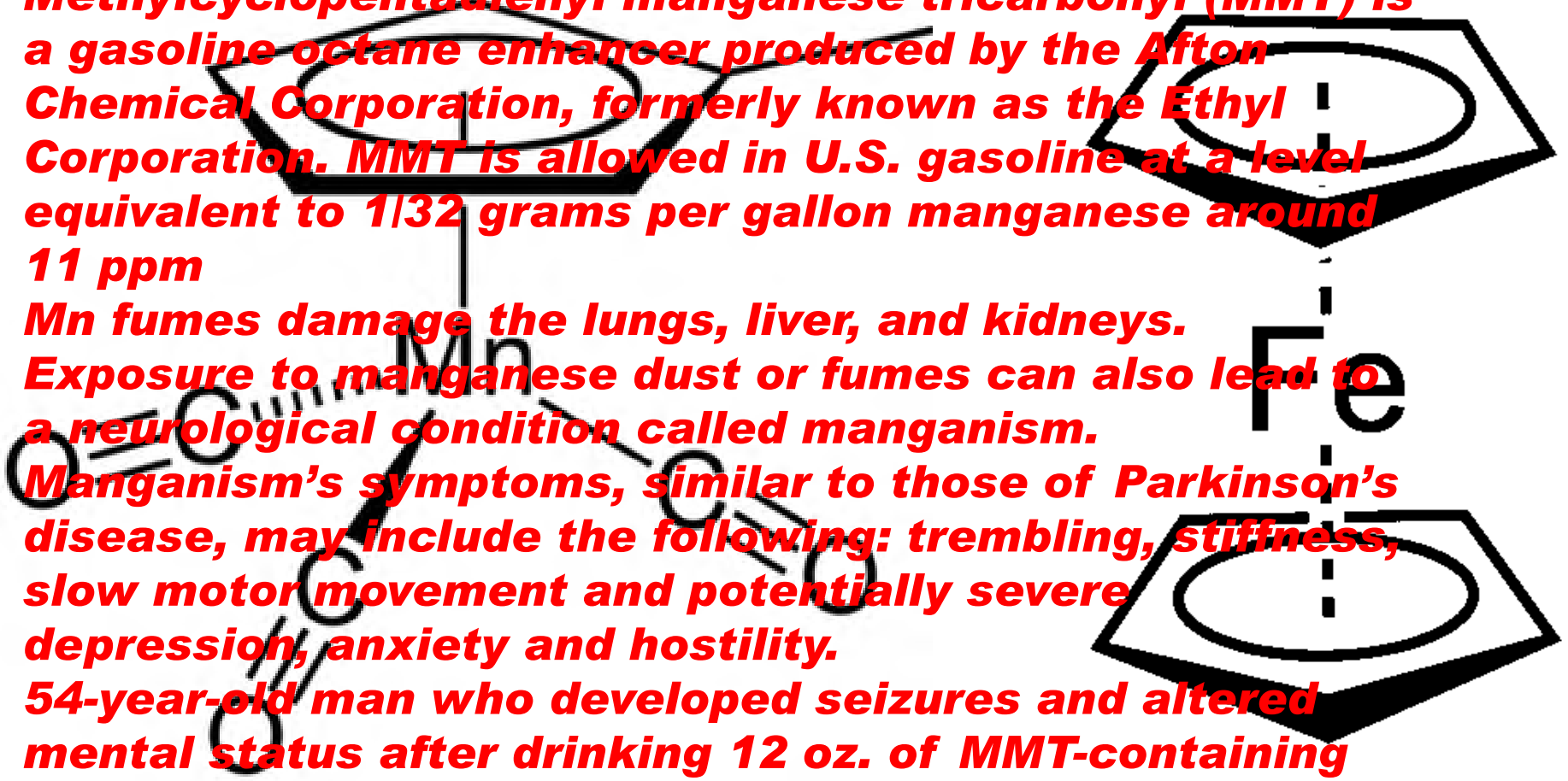

3X
THE BOOST
HI-PERFORMANCE
LUCAS
OIL PRODUCTS INC.
A REAL
OCTANE BOOSTER
RACING FORMULA
TESTED - Increases Octane Rating by 3 Full Numbers
STOPS PINGING
DANGER: COMBUSTIBLE. Harmful or fatal if swallowed. Read carefully DIRECTIONS and DANGER on side panel.
5.25 fl oz. U.S. Made in USA 155 mL

Methylcyclopentadienyl manganese tricarbonyl (MMT) is a gasoline octane enhancer produced by the Afton Chemical Corporation, formerly known as the Ethyl Corporation. MMT is allowed in U.S. gasoline at a level equivalent to 1/32 grams per gallon manganese around 11 ppm

Mn fumes damage the lungs, liver, and kidneys. Exposure to manganese dust or fumes can also lead to a neurological condition called manganism.

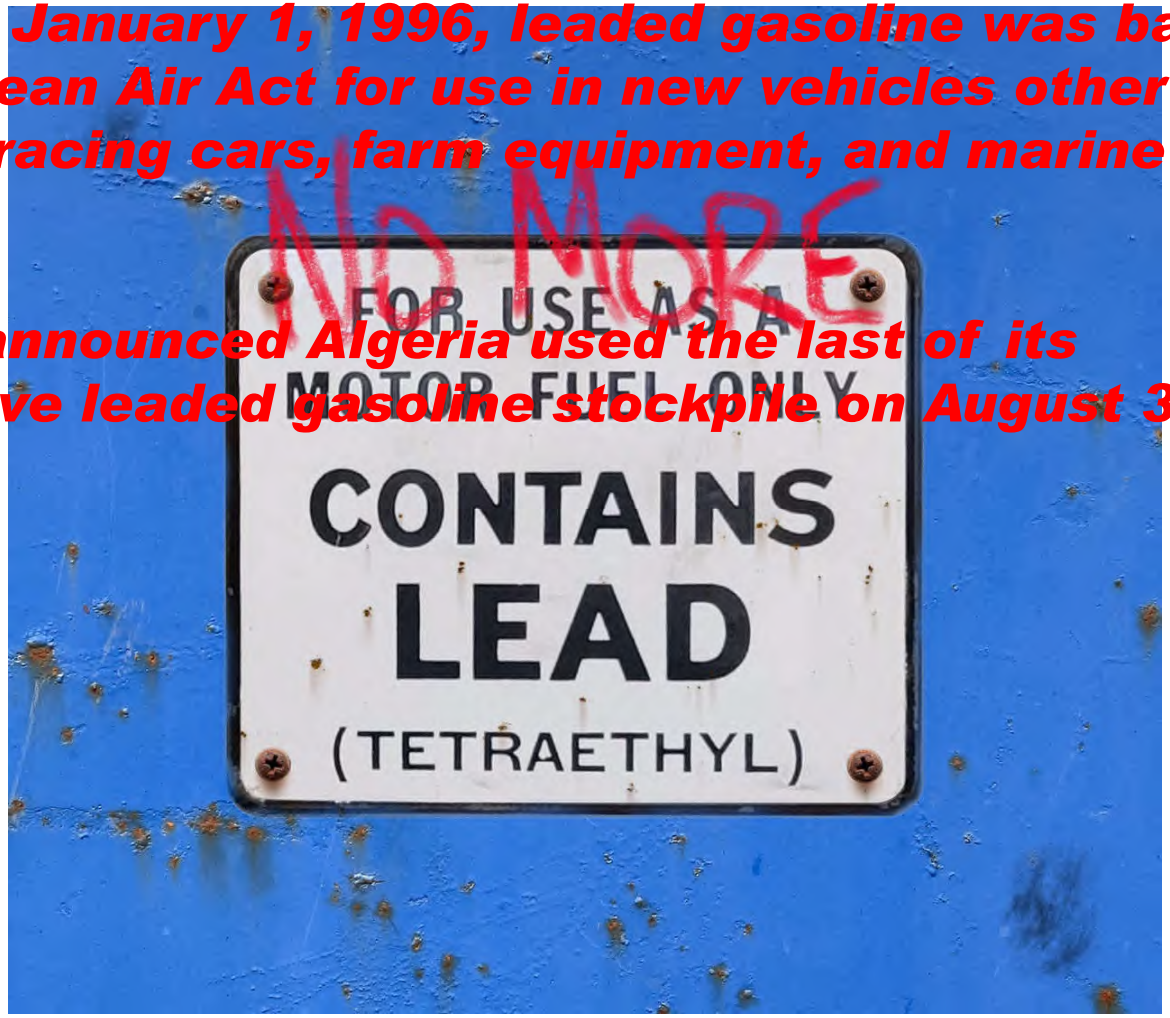
Manganism's symptoms, similar to those of Parkinson's disease, may include the following: trembling, stiffness, slow motor movement and potentially severe depression, anxiety and hostility.

54-year-old man who developed seizures and altered mental status after drinking 12 oz. of MMT-containing NOS Octane Booster Racing Formula.

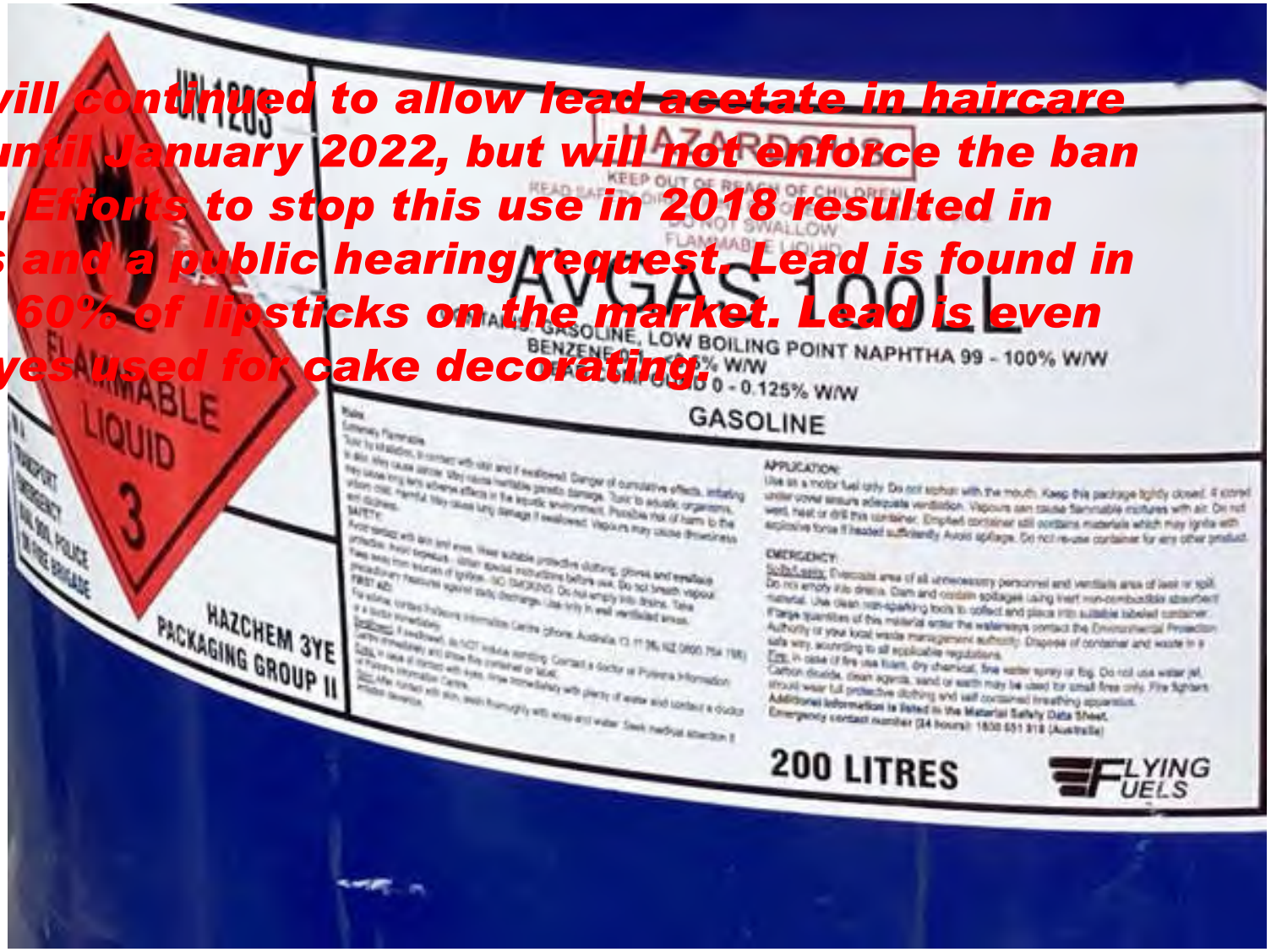


Effective January 1, 1996, leaded gasoline was banned by the Clean Air Act for use in new vehicles other than aircraft, racing cars, farm equipment, and marine engines.

The UN announced Algeria used the last of its automotive leaded gasoline stockpile on August 30, 2021.



The FDA will continued to allow lead acetate in haircare products until January 2022, but will not enforce the ban until 2023. Efforts to stop this use in 2018 resulted in objections and a public hearing request. Lead is found in more than 60% of lipsticks on the market. Lead is even found in dyes used for cake decorating.



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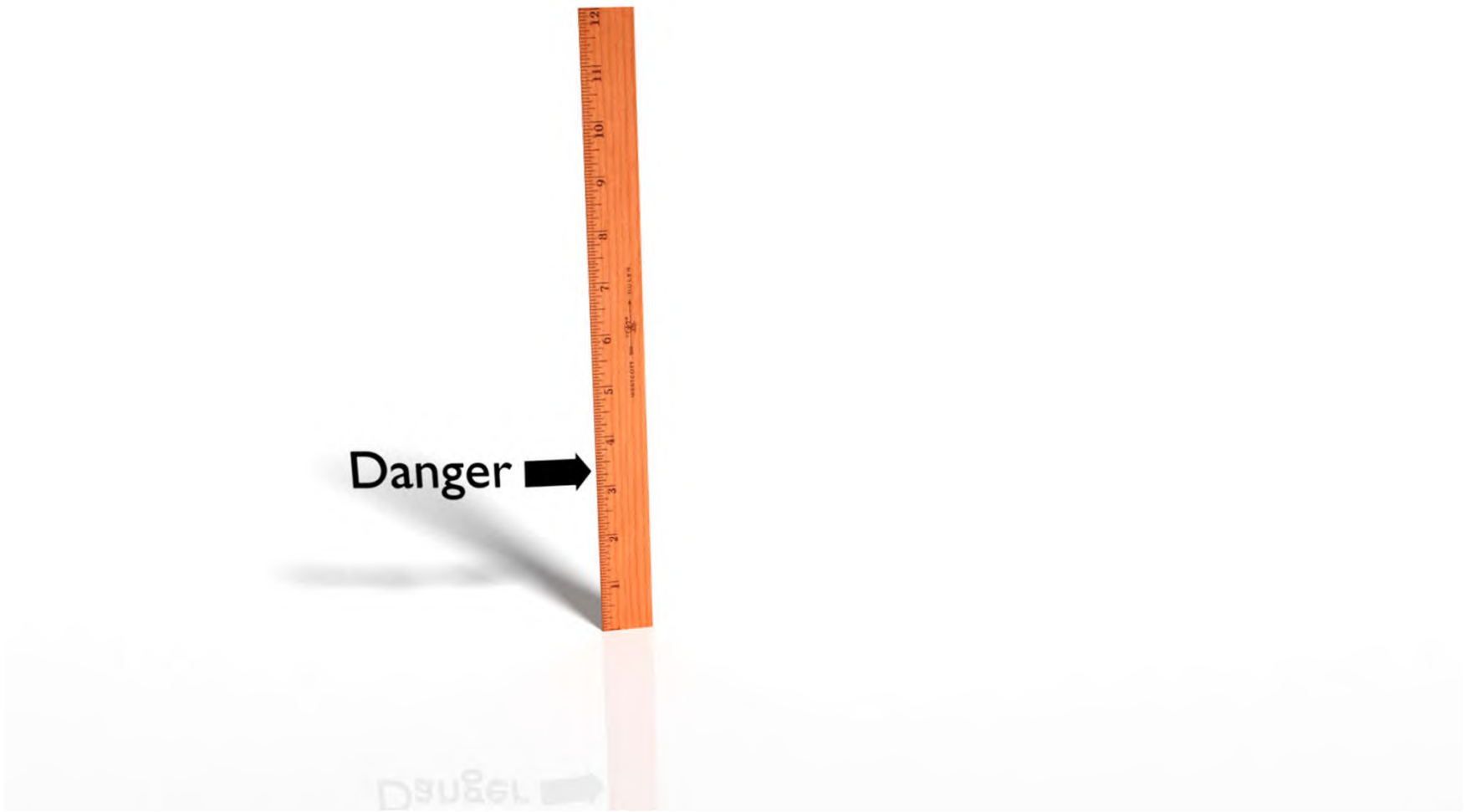
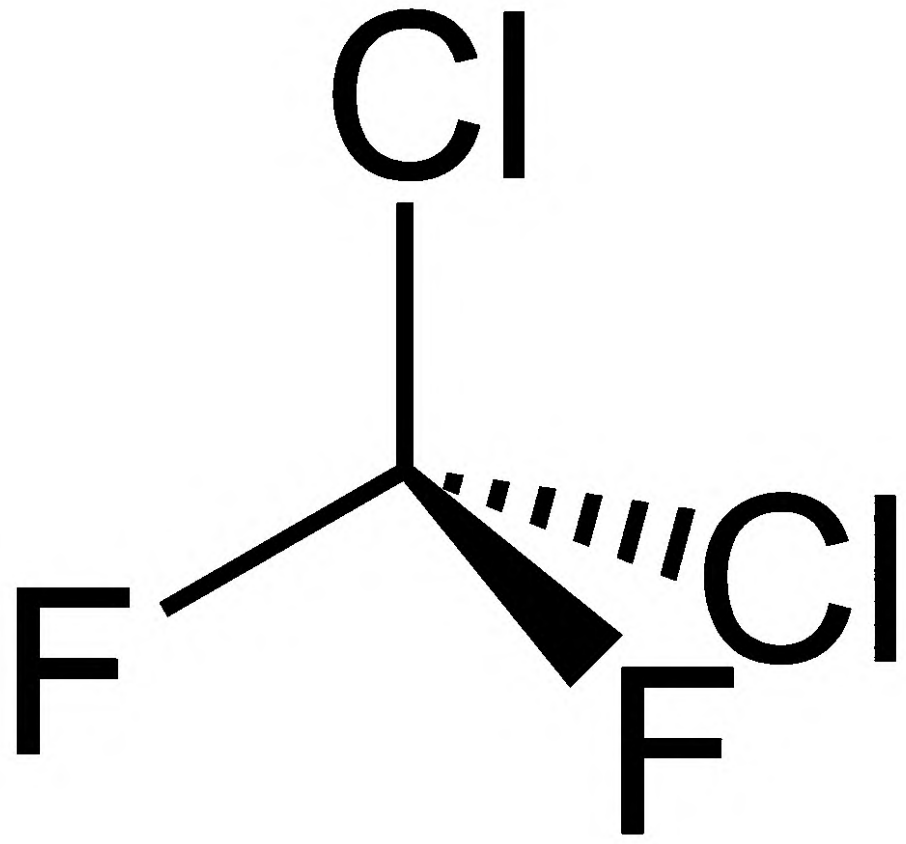

Danger


Danger
Risk
Tolerance


Risk
Tolerance
Danger
Benefit

Thomas Midgley, Jr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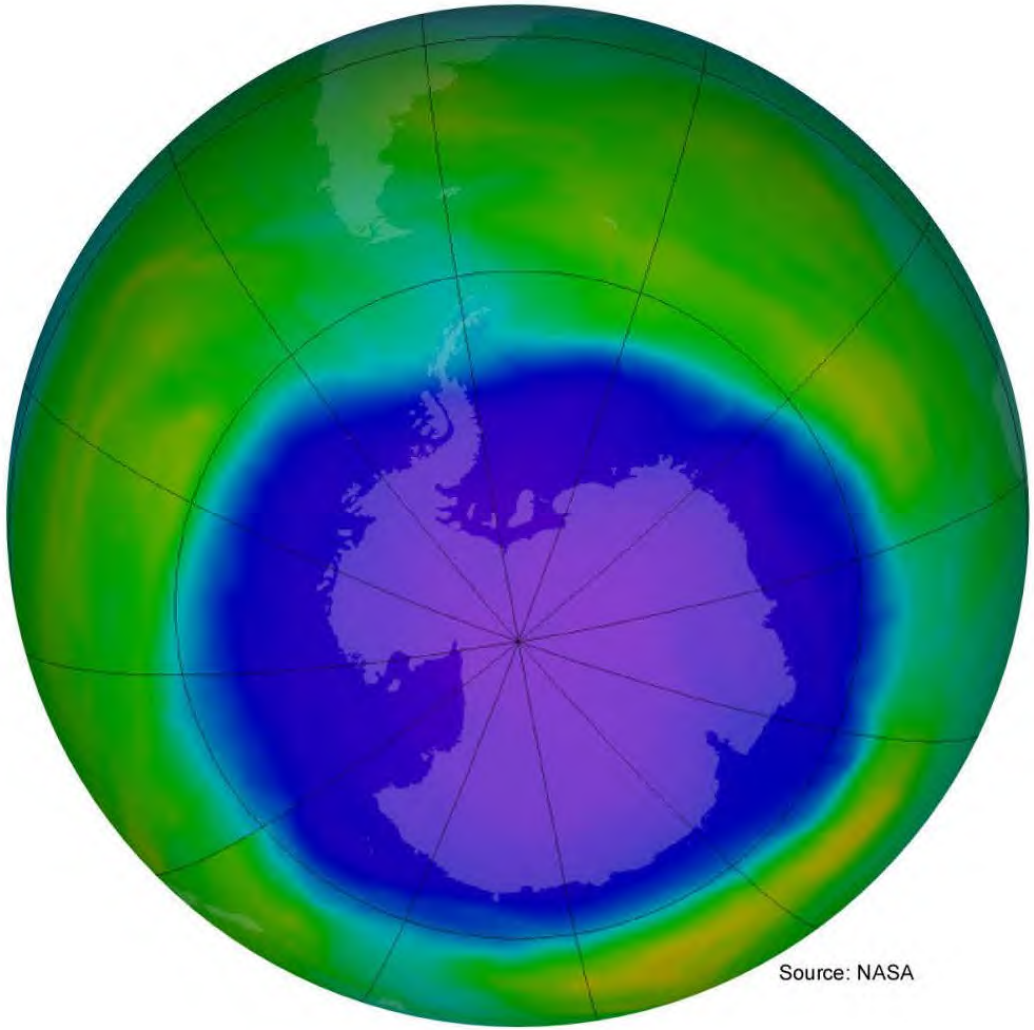
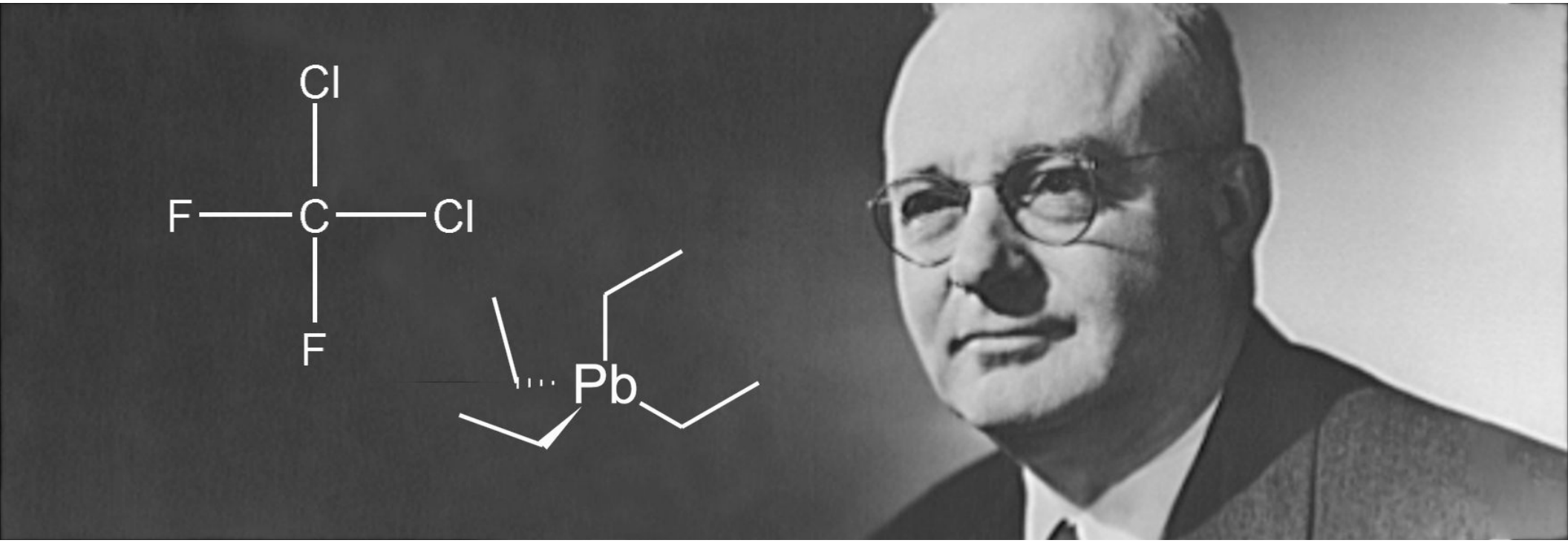


Source: NASA

My articles on Midgley:
- **ACS Industry Matters**
- **R&D World**

Full Midgley Bibliography



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