

THE HOUSE OF THE BUTTERFLIES

Lead Poisoning among Workers and Consumers

Throughout world history, industry managers and laborers alike understood that work was dangerous. But it was not until the beginning of the twentieth century that reformers began a concerted effort to ameliorate the worst aspects of industrial civilization. The growing concern over safety and health issues for American workers developed during the first decade of the twentieth century in the wake of revolutionary social and economic changes.¹ In little more than three decades Americans had witnessed an unprecedented population explosion in its cities and manufacturing centers. Work for most laborers had become so dangerous that some newspapers and magazines published exposés of “the Death Roll of Industry,” which sent “to the hospital or the graveyard one worker every minute of the year.”²

Accidents took the lives of thousands of workers who built the skyscrapers and railroads, who worked in mines and tunneled through the rock underneath and around America’s cities to build subways and water tunnels. Indeed, in the late nineteenth and early twentieth centuries, America’s industrial accident rates were among the worst in the world. Less apparent were the diseases that afflicted those working with new toxins. In the early twentieth century, practices within the steel, rubber, textile, and chemical industries ultimately forced Americans to confront the huge costs in health that we traded for industrial dominance.

While much attention was paid to industrial accidents that took an immediate toll, a few industrial toxins like lead, mercury, and phosphorus, which caused acute symptoms as well as chronic disability, also became the focus of intense reform efforts. In 1908, the occupational physician Alice Hamilton noted that lead had endangered workers as far back as “the first half century after Christ.” She pointed out that “lead is a most potent

producer of abortion, and it is very rare that a woman lead worker bears a healthy child at term.”³ Throughout her distinguished career, Hamilton was deeply involved in uncovering the relationship between lead and disease in the American workforce. She first worked among poor families as a member of the famous Hull House Settlement in Chicago and did most of her pioneering work on lead poisoning while living there. By investigating systematically, she and others found that workers in the battery, painting, plumbing, ceramics, pottery, and other industries were at high risk for death and disease. Because of her continuing involvement in protecting the dispossessed—the poor, the immigrants, the factory workers—she was able to observe the special dangers lead posed to the unborn. For many decades she advocated protectionist regulations for women at work, particularly in lead-using industries.⁴

Such efforts in the United States to protect workers were part of a broader effort to “preserve the race” in the face of the massive dislocations of urbanization and mass production. In England in 1911, Thomas Oliver wrote an article titled “Lead Poisoning and the Race” in which he focused on the corrupting effect of lead: “Lead poisoning develops insidiously; the metal acts upon the cells of particular organs of the body, deranging their function and structure, so that life is gradually brought to a close by the intervention of disease of organs, such as the kidney or nervous system, years after it may be the person has been near lead.”⁵ Not only were women and men workers at risk, but also children were seen as especially susceptible to lead’s deleterious effects. In a 1912 monograph, Thomas Legge, another English authority on occupational hazards, observed that “young persons are regarded as more liable to lead poisoning than adults.”⁶ At the First National Conference on Industrial Diseases, held in Chicago in 1910, Alice Hamilton presented results from her landmark studies of lead poisoning in Illinois industries. She noted that lead was a hazard in lead smelting and the making of white lead and that the “painting trades yield the largest number of victims, especially if we add to ordinary painters the so called mechanical artists who use white lead for retouching advertisements.” She noted that painters “have not so far been helped by improvements in their trade.”⁷ Her studies appeared in popular as well as medical journals such as the *Journal of the American Medical Association*.⁸ Also in 1910 she went directly to the largest lead company in the country, National Lead, and delivered a speech on the need for protection against lead poisoning in Europe and America. She made the important point that “the study of the past thirty years has shown that lead enters the body through inhalation and swallowing, not through the skin.”⁹ In a summary

of her surveys of twenty-two of the twenty-five factories in the United States that manufactured white lead, Hamilton gave specific suggestions for the improvement of conditions in each of the plants, but her overall assessment pointed to the self-evident nature of the problem: "What is especially needed is intelligent control of the work—control based upon knowledge of the dangers inherent in handling white lead."¹⁰

In 1913 Hamilton told the International Congress of Master Painters that she was "against the use of white lead in interior work."¹¹ She supported a report by a committee of union painters urging "the enactment of a law similar to the Pure Food and Drug Act, compelling manufacturers of coatings to label all cans as to their contents so that the painter may know when he is using dangerous ingredients."¹² In her classic 1913 report, *Hygiene of the Painters' Trade*, which she conducted for the U.S. Bureau of Labor Statistics, Hamilton asserted that "the danger from the use of lead paints comes from paint dust in the air and from paint smeared on the hands which may be carried into the mouth with food or tobacco."¹³ She concluded, "The total prohibition of lead paint for use in interior work would do more than anything else to improve conditions in the painting trade."¹⁴

There was wide acknowledgment that painters were at special risk from white lead. At a hearing sponsored by the House Committee on Interstate and Foreign Commerce in 1910, members considered a bill that would have prohibited "the introduction into any state . . . of any white lead or mixed paint containing white lead which is not labeled with a skull and crossbones and the words 'Poison; white lead.'"¹⁵ (White lead is the paint pigment composed of lead carbonate or, less frequently, lead sulfate. See chapter 2.) By the second decade of the twentieth century, popular as well as medical and public health journals noted the dangers of lead poisoning among a variety of industries, especially among painters.¹⁶ *Everybody's*, a mass distribution magazine, called lead "an industrial poison as deadly for many as the gangster's black-jack."¹⁷ *The Survey* magazine remarked, "One of the most striking facts to be gleaned from the [New York Factory Investigating Commission] Report is the ignorance and indifference which were manifested by foremen and company officials, as well as workmen, with regard to the dangers incident to the handling of the various forms of lead and the precautions which should be taken."¹⁸

By the end of the second decade of the century, Alice Hamilton could summarize the extent of industrial lead poisoning this way: "The manufacture of white lead has been regarded in every land as one of the most dangerous of the lead trades, if not the most dangerous. In the United

States it was even more dangerous than in Europe. . . . Painting is, of course, the most notorious of the lead trades and in almost every hospital and dispensary painters make up the large majority of the cases of lead poisoning."¹⁹

In 1912, perhaps as a result of Hamilton's influence, National Lead Company reported to its stockholders that the company was making serious efforts to protect workers. "In the manufacture of the various products of Lead, there are two sources of danger to the health of workmen therein employed; viz., the fumes arising from the smelting or melting of metallic lead, and the dust arising in the processes of making white lead and lead oxides."²⁰ The workmen at National Lead, the report maintained, were given respirators to protect them from the dust. The company laundered their clothes free of charge, and they were encouraged to wash their hands and faces with soap and warm water before eating. After work they took "shower baths." No women were employed in the factory "except in such occasional capacity as messenger, helper, etc." No children were employed. These were all part of the company's "contribution to the improvement of the Safety and Health of Workmen engaged in the various Lead industries."²¹ Another industry representative agreed that "the cardinal principle of lead-works hygiene . . . is to prevent the lead salt, in any form, from entering the nose or mouth."²²

By this time, no one disputed that white lead was a poison. In 1914, the director of the scientific section of the Paint Manufacturers' Association noted approvingly the development of "sanitary leadless" paints and predicted that, as a result of the growing use of such alternatives, "lead poisoning will be done away with almost entirely." He went so far as to claim that "the use of flatted lead has been largely abandoned for wall and ceiling decoration and its place has been taken by the more sanitary lead-less flat paints."²³ By 1919, industry officials such as George B. Heckel, the editor of *Drugs, Oils and Paint*, a trade journal, were heralding the relative safety of zinc oxides as an alternative to lead pigments. The son of a country doctor, Heckel himself had contracted lead poisoning while helping his father renovate his house in the 1880s. "As a special favor I was allowed [as a young boy] to climb the scaffolding and help paint the cornice on one of the gables. . . . Before I finished I had contracted not only wrist-drop, but leg-drop and back-drop, together with a firm resolution not to be a painter."²⁴

In 1923 the Provincial Board of Health in Ontario published a 300-page report, "Lead Poisoning," which described the "intensive investigations" conducted in France, Austria, Holland, and England regarding the substitution of nonlead pigments: "The present tendency of opinion is towards the

belief that for interior painting which is not exposed to the weather, zinc paints are as good, if not better, than white lead paints, not only from the hygienic point of view, which was known, but from the commercial."²⁵ The vitality of the European labor movements, not to mention their greater willingness to become involved in political struggles (by contrast with the American Federation of Labor), helped push the issue of interior paints onto the public-policy agenda outside the United States.

A number of countries banned or restricted the use of white lead for interior painting. These included France,²⁶ Belgium, and Austria in 1909; Tunisia and Greece in 1922; Czechoslovakia in 1924; Great Britain, Sweden, and Belgium in 1926; Poland in 1927; Spain and Yugoslavia in 1931; and Cuba in 1934.²⁷ In 1922 the Third International Labor Conference of the League of Nations recommended the banning of white lead for interior use,²⁸ ultimately deciding "that white lead be prohibited entirely for paints for interiors; that women and children under 16 years of age be not employed where white lead was used in the manufacture of paint, and that countries now using white lead have six years . . . to comply with these regulations." The conference also decided that in outdoor paint, "white lead be limited to 2%."²⁹

Even in the United States, which refused to sign the International Labour Office (ILO) ban, growing awareness about the lead threat to painters was prompting calls to limit its use in indoor painting. Much as in 2001, when those outside the government demanded attention to global warming despite the refusal of the Bush administration to sign the Kyoto Protocol, those outside the administration of Warren G. Harding pushed for controls over painters' exposure to lead. The Painters District Council in Chicago suggested that among the measures useful in preventing lead poisoning would be the "prohibition of white lead in interior painting."³⁰ The Brotherhood of Painters, Decorators, and Paperhangers of America, an organization representing 125,000 members, predominantly house painters, stated that "the use of white lead is a grave menace to the health and lives of painters and should be forbidden."³¹ The Workers Health Bureau, a labor advocacy group, proposed a labeling law in New York state for poisonous paint materials.³² One such bill was introduced in February 1924.³³ In Massachusetts, the Legislature considered and ultimately rejected a code that would have limited the exposure of painters to "dangerous poisons such as lead" and would have prohibited the use of lead "in all interior painting of public buildings."³⁴

By 1929, the Committee on Lead Poisoning of the Industrial Hygiene Section of the American Public Health Association remarked on "the

improvement in substitute paint bases, such as lithopone," noting that they were now "essentially as acceptable as white lead or other lead compounds" with the added benefit of potentially lowering the incidence "of severe or fatal lead poisoning."³⁵ By the early thirties, lithopone, titanium and zinc oxides were capturing an increasing percentage of the market and were being marketed as "nonpoisonous," in contrast to "poisonous" lead pigments.³⁶

But just as industrial hygienists, managers, and physicians were beginning to take meaningful steps to protect the workforce from lead in the paint industry in the 1920s, a more devastating threat was arising: tetraethyl lead was being added to gasoline to increase engine power in automobiles.

In the early 1920s General Motors found itself on the verge of bankruptcy. Ford's Models A and T had simply proven so durable—nearly indestructible—that people were not buying cars from GM. The company decided to try to save itself with a new marketing strategy. To compete with the unchanging Tin Lizzie, GM offered increasingly powerful cars whose styling and features were changed yearly in the hope that consumers would be seduced by a desire for newer cars. Owners of a four-year-old car would be faced with a spiffier and more powerful automobile. By building obsolescence into the vehicles, GM guaranteed itself a steady market. GM's fortunes turned around, and by 1927 Ford abandoned the Model T and joined in the automotive "arms race" of ever-changing exteriors and ever-increasing power.

Historian William Kovarik points out that in the early twentieth century a number of automobile fuels—gasoline, ethanol, alcohol, and various blends of these and other fuels—were competing in a wide-open market. Most early automobiles, like Ford's Model T, had low compression engines, and central to the creation of powerful, large automobiles was the development of a more efficient fuel that could drive cars at greater speed. Kovarik argues that alcohol and ethanol blends were the first fuels capable of providing power to the new engines, which demanded high octane, a measure of gasoline's power. The advantage of these fuels was that they were renewable and nonpolluting.³⁷

But these very advantages worked against their adaptation as a motor fuel, since General Motors, with its interlocking directorate relationship with the DuPont Company and the petrochemical industry, sought to develop a fuel it could patent and profit from.³⁸ Tetraethyl lead, developed in 1922 by Thomas Midgley Jr. ("the Father of Ethyl Gas") at the General

Motors Research Laboratory in Dayton, Ohio, promised to raise the compression at which gasoline burned, thus eliminating the "engine knock" that decreased power. General Motors quickly contracted with DuPont and Standard Oil of New Jersey to produce tetraethyl lead. Ethyl, the brand name for "leaded gas" (that is, gasoline containing the additive tetraethyl lead), was placed on sale in test markets on February 1, 1923. In 1924, DuPont and GM created the Ethyl Gasoline Corporation to produce and market it.³⁹

In the very year that Midgley and his co-workers at General Motors Research Corporation heralded the discovery of this anti-knock compound, scientists in and outside of government warned that tetraethyl lead might be a potent threat to public health. William Mansfield Clark, a professor of chemistry, wrote to A. M. Stimson, assistant surgeon general at the Public Health Service, in October 1922 warning of "a serious menace to the public health." He noted that in the early production of tetraethyl lead "several very serious cases of lead poisoning have resulted." He worried that its use in gasoline would result in atmospheric pollution, for "on busy thoroughfares it is highly probable that the lead oxide dust will remain in the lower stratum."⁴⁰

Stimson advised that the Service "be provided with some experimental evidence tending to support this opinion" and suggested that it was in the province of the Division of Chemistry and Pharmacology to investigate the dangers.⁴¹ The director of that division felt that such an investigation would take "a considerable period of time, perhaps a year," and that the results would be of little "practical use since the trial of the material under ordinary conditions [of use] should show whether there is a risk to man." He recommended instead that the Public Health Service depend upon industry itself to provide relevant data.⁴²

A month later, H. S. Cumming, the surgeon general, respectfully asked Pierre S. DuPont, chairman of the board of General Motors, whether the public health effects of tetraethyl lead manufacturing and use had been taken into account. Thomas Midgley himself responded that the question "has been given very serious consideration . . . although no actual experimental data has been taken." Even without experimental data, GM and DuPont were confident that "the average street will probably be so free from lead that it will be impossible to detect it or its absorption."⁴³

DuPont and GM recognized that, given the general apprehension about the potential hazards of tetraethyl lead, a private, in-house study of its safety would be met with skepticism. Rather than conduct their own investigations, therefore, they arranged for the General Motors Research

Corporation to pay for an investigation by the U.S. Bureau of Mines at government facilities. The bureau was trusted by industry and often performed testing as a service to the mining and metal industries. GM, through prime negotiator Charles Kettering, requested one other proviso: that "the Bureau refrain from giving out the usual press and progress reports during the course of the work, as [Kettering] feels that the newspapers are apt to give scare headlines and false impressions before we definitely know what the influence of the material will be."⁴⁴ The concern about adverse publicity and leaks to newspapers was so great that the bureau insisted on using "Ethyl" instead of "lead," even in internal correspondence. Since the bureau had agreed to a blackout of information, one official asserted, "if it should happen to get some publicity accidentally, it would not be so bad if the word 'lead' were omitted as this term is apt to prejudice somewhat against its use."⁴⁵

The willingness of the Bureau of Mines to impose a gag on its own scientists and even to avoid accurate scientific terminology in favor of a trade name reflected the tentativeness with which the bureau (and the administration of President Calvin Coolidge) approached the giant corporations. This can be seen clearly in the subsequent agreements between this government agency and GM, DuPont, and the newly created Ethyl Gasoline Corporation while the critical research into the health effects of tetraethyl lead progressed. The first agreement, in September 1923 between the General Motors Research Corporation and the Bureau of Mines, allowed relative freedom for the bureau to report its final conclusions.⁴⁶ By June 1924, General Motors sought much greater control over the final product, demanding, in addition to the ban on all publicity in the popular press, that "all manuscripts, before publication, will be submitted to the Company for comment and criticism."⁴⁷ The bureau acquiesced, but in two months the Ethyl Corporation asked for still more modifications: that there be a dollar limit on the maximum expenses the company would incur and "that before publication of any papers or articles by your Bureau, they should be submitted to them [Ethyl] for comment, criticism, and *approval*" (emphasis added). These changes were incorporated into the new contract, which gave the Ethyl Gasoline Corporation, in effect, veto power over the research of the United States government.⁴⁸

Ironically, when it appeared that the preliminary research results pointed toward the safety of tetraethyl lead, GM, DuPont, and the government violated their own agreement to release no information until the study was complete. In July 1924, five months before the preliminary report was released, GM's director of research, Graham Edgar, wrote to

Dr. Paul Leech of the American Medical Association that the results of the Bureau of Mines' research would show "that there is no danger of acquiring lead poisoning through even prolonged exposure to exhaust gases of cars using Ethyl Gas." He further erroneously assured the AMA that "poisoning from carbon monoxide would arise long before the concentration of lead would reach a point where even cumulative [lead] poisoning is to be feared."⁴⁹

Many public health leaders and scientists saw the federal government as colluding with GM, DuPont, Standard Oil, and Ethyl to certify the safety of tetraethyl lead. Yandell Henderson of Yale University, a leading public health physiologist, wrote an angry letter to Royd R. Sayers, the coordinator of the government's activities as the bureau's chief surgeon and also as a surgeon in the U.S. Public Health Service, pointedly rejecting an offer to take part in the government's research. "As regards your suggestion that you might assign us [at Yale's Laboratory of Applied Physiology] a part in the investigation which you are carrying out for the General Motors on tetra-ethyl lead, I feel that I should want a greater degree of freedom of investigation and finding—in view of the immense public, sanitary, and industrial questions involved—than the subordinate relation which you suggest would allow. It seems to me extremely unfortunate that the experts of the United States government should be carrying out this investigation on a grant from the General Motors."⁵⁰ C. W. Deppe, the owner of a small car company, Deppe Motors, was much blunter: "May I be pardoned if I ask you frankly now, does the Bureau of Mines exist for the benefit of Ford and the G.M. Corporation and the Standard Oil Co. of New Jersey, and other oil companies parties to the distribution of the Ethyl Lead Dopes, or is the Bureau supposed to be for the public benefit and in protection of life and health?"⁵¹

The dangers posed by the widespread introduction of leaded gasoline were finally brought to the public's attention by newspaper reports of some odd goings-on at Standard Oil's Bayway labs in Elizabeth, New Jersey. Over the course of five days, five workers died and thirty-five others showed severe neurological symptoms of organic lead poisoning. In total, forty of forty-nine workers in the tetraethyl lead processing plant were severely poisoned.

Ernest Oelgert of Elizabeth, a laboratory worker, died strangely on Sunday, October 26, 1924. Witnesses declared that he had been hallucinating on Thursday, had become severely paranoid, and on Friday was running around the plant "in terror, shouting that there were 'three coming at me

at once." By Saturday, he had been forcibly restrained and taken to Reconstruction Hospital in New York City, where he died the next day. Although the company officials denied any responsibility, none of the other workers were surprised. They all knew that Oelgert worked in what they all called "the looney gas building," an experimental station secretly established the previous year. Only forty-five workers were employed in the laboratory, and their fellow laborers had already made them the object of "undertaker jokes and farewell greetings." Standard Oil officials suggested that "nothing ought to be said about this matter in the public interest."

The headlines of a front-page story in the *New York Times* the next day reported "Odd Gas Kills One, Makes Four Insane." The *Times* quoted one of the supervisors at the Bayway facility who said "these men probably went insane because they worked too hard." The father of the dead man, Ernest Oelgert, however, "was bitter in denunciation of conditions at this plant" and told reporters that "Ernest was told by the doctors at the plant that working in the laboratory wouldn't hurt him. Otherwise he would have quit. They said he'd have to get used to it."⁵²

By Monday, another worker had died and twelve others were hospitalized from what everyone at the plant called "insanity gas." Terror-stricken workers were being carted away to New York City in straitjackets, hallucinating, convulsing, and screaming about the visions appearing before their eyes. It soon became clear that the victims had been poisoned by a gasoline additive called tetraethyl lead. As the workers continued to be hospitalized and as the New York newspapers began to pick up the story, it became more and more difficult to deny its significance. By Friday, as the fifth victim of "looney gas" died—and as three quarters of the laboratory's workers lay in hospitals—the New York City Department of Health, the city of Philadelphia, and various municipalities in New Jersey had banned the sale of leaded gasoline. The *New York Times*, the *New York World*, and all the regional newspapers were blaring out front-page headlines such as "'Mad Gas' Claims Third Victim," "Bar Ethyl Gasoline as Fifth Victim Dies," and "Gas Madness Stalks Plant." These deaths stimulated renewed concern about the potential public health dangers from the exhaust produced by leaded gasoline, despite Standard Oil's assurance that no "perils existed in the use of this gas in automobiles."⁵³

In some ways this was an extreme example of a typical scenario overtaking workers all across America. In industry after industry—rubber, steel, petrochemical, and automobile—workers were coming in contact with new chemicals that were making them sick and even killing them. In the first two decades of the century, muckraking magazines had produced

dramatic headlines about phossy jaw among match makers, many of whom were children working with phosphorous, radium poisonings among the young women who painted watch dials in New Jersey, silicosis among granite cutters in Vermont, and lead poisoning among painters. *Everybody's*, *Charities and the Commons*, *World's Work*, and *The Outlook*, all widely circulated magazines, had exposés of "the work that kills" and "the lead menace."

But the crisis at Standard Oil's plant in Bayway, New Jersey, was different. Very quickly it became clear that more was at stake than the lives of a few workers. Public health officials and the public who read the daily accounts of dying workers understood that the gas that was killing the workers also could kill or harm ordinary citizens breathing air polluted by automobiles or who were pumping gas at the rapidly growing network of filling stations across the country. The horrendous experiences with poison gas in World War I less than a decade earlier had heightened public concern over the new substance, also called a "gas," that was making headlines in many major cities. With little distinction between the organic lead that was poisoning workers in the Standard Oil plant and the inorganic lead that would be spewing from the exhaust pipes of cars, newspapers fanned the fears that a toxic gas would soon be inhaled by millions of Americans. Industry leaders understood that if they could not contain the developing crisis, millions upon millions of dollars would be at risk. The questions: how to contain it, and what would containment mean?

On the one hand, the gasoline and lead industry had to develop a program to prevent dramatic outbreaks of "loony gas poisoning" within the plant if it were to quell public outrage generated by lurid headlines above photographs of sickened workers being taken to hospitals in straitjackets. On the other hand, industry had to convince the public that, far from being a generalized threat to their health, poisonings by industrial products could be solved, or at least confined behind the walls of a factory. Occupational health issues were exactly that: problems borne by the workforce but no threat to the public at large. This was part of a broader effort on the part of major corporations to improve their public image and undercut the popular suspicion that they were "soulless" entities that were "greedy and ruthless in their pursuit of profits."⁵⁴

Amid daily newspaper reports on health conditions at the plant,⁵⁵ the company continually denied management's responsibility for the tragedy. Thomas Midgley, Ethyl's second vice president and general manager, appeared at a press conference and said that true responsibility for the crisis rested with the workers, who, "regardless of warnings and provision for

their protection, had failed to appreciate the dangers of constant absorption of the fluid by their hands and arms." Midgley and other company representatives argued that the workers should have known from the precautions taken by the company that lead could be dangerous: "The rejection of many men as physically unfit to engage in the work at the Bayway plant, daily physical examinations, constant admonitions as to wearing rubber gloves and using gas masks and not wearing away from the plant clothing worn during work hours should have been sufficient indication to every man in the plant that he was engaged 'in a man's undertaking.'"⁵⁶

Many people outside the industry reached different conclusions. The prosecutor in Union County, New Jersey, asserted that he was "satisfied many of the workers did not know the danger they were running. I also believe some of the workers were not masked nor told to wear rubber gloves and rubber boots."⁵⁷ The New Jersey commissioner of labor said he had never been informed that the workers in the Bayway plant were potentially in danger. "Secrecy surrounding the experiments was responsible for the Labor Department's lack of knowledge of them," an official said.⁵⁸ Under the relentless pressure of daily revelations and investigations, Standard Oil acknowledged, after the fifth victim died, "that it was known that this gas had collected a previous toll of death and insanity before the forty-nine employees were exposed to it at the Elizabeth plant."⁵⁹

The day after the fifth victim died, and in the midst of growing public fear of this new chemical, the Bureau of Mines released its preliminary findings on the possible dangers of leaded gasoline to the general public. The *New York Times's* headline summed up the report: "NO PERIL TO PUBLIC SEEN IN ETHYL GAS/BUREAU OF MINES REPORTS AFTER LONG EXPERIMENTS WITH MOTOR EXHAUSTS/MORE DEATHS UNLIKELY." They also reported "the investigation carried out indicates the danger of sufficient lead accumulation in the streets through the discharging of scale from automobile motors to be seemingly remote." The report exonerated tetraethyl lead.⁶⁰

Yet, the circumstances of the workers' deaths put in doubt the credibility of the Bureau of Mines's findings. Scientists and labor activists found fault with the report. E. E. Free, editor of the prestigious journal *Scientific American*, was skeptical of R. R. Sayers's assurances that the Bureau of Mines could find no evidence of lead poisoning in the study animal subjects.⁶¹ Cecil K. Drinker, editor of the *Journal of Industrial Hygiene* and professor of public health at Harvard University, and Dr. David Edsall, dean of the Harvard Medical School, were also critical. In early January 1925, Drinker wrote Sayers a pointed critique that concluded: "As an investigation of an important problem in public health... [the report] is

inadequate."⁶² Occupational physician Alice Hamilton concurred with Drinker's position and noted the "desirability of having an investigation made by a public body which will be beyond suspicion."⁶³

This attack by scientists, public health experts, and labor activists on the quality and integrity of the report prompted those who championed the introduction of lead into gasoline to begin a counteroffensive. Dr. Emery Hayhurst, of the Ohio Department of Health, emerged as one of the key figures in the attempt to "sell" tetraethyl lead to the American public. Hayhurst is of special interest in this period because of his established reputation as a respected and independent industrial hygienist. But what was not known about Hayhurst was that at the same time when he was advising labor organizations such as the Workers' Health Bureau on industrial hygiene matters, he was also working for the Ethyl Corporation as a consultant.⁶⁴ Correspondence between Hayhurst and the Public Health Service indicates that Hayhurst was supplying advocates of tetraethyl lead with information regarding the tactics to be used by their opponents. Indeed, even before the Bureau of Mines issued its report, Hayhurst had decided that tetraethyl lead was not an environmental toxin and advised the Bureau of Mines to include a statement that "the finished product, Ethyl Gasoline, as marketed and used both pure or diluted in gasoline retains none of the poisonous characteristics of the ingredients concerned in its manufacture and blending."⁶⁵

Even more damning was that in another letter to R. R. Sayers of the Public Health Service, sent as the attacks on the report were mounting, Hayhurst secretly provided criticisms that the Workers' Health Bureau had developed so that the government could be prepared to reply. The Workers' Health Bureau had specifically refrained from sending these comments to the government; Hayhurst violated their trust.⁶⁶

Hayhurst and Sayers also worked together to build public and professional support for the position of the Bureau of Mines and the Ethyl Corporation that tetraethyl lead was not a public health danger. Sayers urged that Hayhurst counter the criticisms of Drinker and Edsall with a review or editorial of his own in support of the report. Hayhurst replied that he had prepared an editorial for the *American Journal of Public Health* and that the unsigned editorial proclaimed, "Observational evidence and reports to various health officials over the country . . . so far as we have been able to find out, corroborated the statement of 'complete safety' so far as the public health has been concerned."⁶⁷

Nonetheless, this back-channel effort was incapable of quelling the doubts about the safety of leaded gasoline or the integrity of the Bureau of

Mines report. The press kept the public's attention focused on collusion of the Bureau of Mines and private industry. It was soon reported that other workers had died handling tetraethyl lead at the DuPont chemical plant at Deepwater, New Jersey, and at the General Motors Research Corporation site in Dayton, Ohio. As the Workers' Health Bureau researchers catalogued the deaths and illnesses of workers, they found that since September 1923 at least two men had died at Dayton and four others at Deepwater.⁶⁸

The *New York Times*, in fact, published an article specifically about the difficulties that editors and reporters had in following the story; the article also noted that there was nothing in the *Record*, the local New Jersey paper, about the death of Frank W. "Happy" Durr, who had worked for DuPont for twenty-five years. Durr had literally given his life to the company. He began working at DuPont as a child of twelve and died, from exposure to tetraethyl lead, twenty-five years later. The editor of the *Record* told the *Times*: "I guess the reason we didn't print anything about Durr's death was because we couldn't get it. They [DuPont] suppress things about the lead plant at Deepwater. Whatever we print we pick up from the workers." The *Times* further described how it was almost impossible to get information from the local hospital about the source of the workers' problems, indicating the sway that DuPont held over medical staff. Nonetheless, the *Times* uncovered more than three hundred cases of lead poisoning among workers at the Deepwater plant during the previous two years. The workers knew that something was amiss there and had dubbed the plant "the House of the Butterflies" because so many of their colleagues had hallucinations of insects during their bouts of lead poisoning: "The victim pauses, perhaps while at work or in a rational conversation, gazes intently at space and snatches at something not there." The *Times* reported that "about 80% of all who worked in 'the House of the Butterflies,' or who went into it to make repairs were poisoned, some repeatedly."⁶⁹

As a result of the continuing public disquiet over the Bureau of Mines report, scientists and public health leaders expressed their concerns to Hugh Cumming, the surgeon general of the Public Health Service, who was contemplating calling a national conference to assess the tetraethyl lead situation. Haven Emerson, the eminent public health leader and professor of public health at Columbia University, spelled out in a frank letter to Cumming the concerns of public health officers. He suggested that the report was having "a widespread, and to my mind harmful, influence on public opinion and the action of public agencies." He believed that it would be

"well worthwhile to call those whom you intend to a conference promptly. . . . The impression is gaining way that the interests of those who may expect profit from the public sale of tetraethyl lead compounds have been influential in postponing such a meeting."⁷⁰

Despite some indication that R. R. Sayers opposed such a conference and may have delayed it,⁷¹ the surgeon general announced at the end of April 1925 that he was calling together experts from business, labor, and public health to assess the tetraethyl lead situation. Cumming stated that leaded gasoline "is a public health question of extreme seriousness . . . if this product is actually causing slow poisoning and serious effects of a cumulative character."⁷²

On May 20, 1925, the conference convened in Washington with every major party represented. In the words of one participant, the conference gathered together in one room "two diametrically opposed conceptions. The men engaged in industry, chemists, and engineers, take it as a matter of course that a little thing like industrial poisoning should not be allowed to stand in the way of a great industrial advance. On the other hand, the sanitary experts take it as a matter of course that the first consideration is the health of the people."⁷³

The conference opened with statements from General Motors, DuPont, Standard Oil, and the Ethyl Corporation outlining the history of the development of leaded gasoline and the reasons why they believed its continued production was essential. The companies made three points: that leaded gasoline was essential to the industrial progress of America; that any innovation entails certain risks; and that deaths and illnesses occurred at their plants because the men who worked with the materials were careless and failed to follow instructions.

While others stressed the importance of tetraethyl lead as a means of conserving motor fuel, Frank Howard, first vice president of Ethyl, provided the most complete rationale for the continued use of tetraethyl lead in gasoline. "You have but one problem," he remarked, attempting to characterize the position of his opponents. "Is this a public health hazard?" He countered by observing that "unfortunately, our problem is not that simple." Rather, he argued, automobiles and oil were central to the industrial progress of the nation, if not the world. "Our continued development of motor fuels is essential in our civilization," he proclaimed, and the development of tetraethyl lead, after a decade of research, was an "apparent gift of God." Howard, by casting the issue in this way, put his opponents on the defensive, making them appear to be reactionaries whose limited vision could permanently retard human progress and stunt the nation's economic

growth. "What is our duty under the circumstances?" he asked. "Should we say, 'No, we will not use a material [that is] a certain means of saving petroleum? Because some animals die and some do not die in some experiments, shall we give this thing up entirely?'"⁷⁴

Since tetraethyl lead was a key to the industrial future of the nation, the companies argued, some sacrifice would be required. Dr. H. C. Parmelee, editor of the trade journal *Chemical and Metallurgical Engineering*, stated, "The research and development that produced tetraethyl lead were conceived in a fine spirit of industrial progress looking toward the conservation of gasoline and increased efficiency of internal combustion motors." In the end, he said, "its casualties were negligible compared to human sacrifice in the development of many other industrial enterprises."⁷⁵

The final part of the industry's position was that it was workers, and not the companies, who were at fault for the tragedies at Bayway, Deepwater, and Dayton. Acknowledging that there were "certain dangers" inherent in the production of this essential industrial product, the Standard Oil Company asserted that "every precaution was taken" by the company to protect its workers. According to Thomas Midgley Jr., "the essential thing necessary to safely handle [tetraethyl lead] was careful discipline of our men. . . . [Tetraethyl lead] becomes dangerous due to carelessness of the men in handling it." In an earlier statement to the *New York World*, Midgley explained what this discipline consisted of: "The minute a man shows signs of exhilaration [a euphemism for acute lead poisoning] he is laid off. If he spills the stuff on himself he is fired. Because he doesn't want to lose his job, he doesn't spill it."

Midgley's own recklessness and inconsistency were revealed at a news conference in which he sought to downplay the toxicity of tetraethyl lead. When asked by a reporter if it was dangerous to spill the chemical on one's hands, Midgley dramatically requested that "an attendant bring in a quantity of pure tetraethyl." He "washed his hands thoroughly in the fluid and dried them on his handkerchief. 'I'm not taking any chance whatever,' he said. 'Nor would I take any chance doing that every day.'" He washed his hands with tetraethyl lead despite the fact that he had only a year before taken a prolonged vacation in Florida on account of his own symptoms of lead poisoning.⁷⁶

Those who opposed the introduction of leaded gasoline disagreed with every fundamental position of the industry representatives. First, they believed that it was wrong to accept that progress entails inevitable risks; rather, they believed, the federal government had to assume responsibility for protecting the health of the nation. Second, opponents pointed out that

what we would now call inorganic lead compounds were already known to be a slow, cumulative poison that should not be introduced into the general environment. Third, they rejected the notion that workers were responsible for their own poisoning. Fourth, and most important, because they believed that the public health should take precedence over the needs of industry, they argued that the burden of proof should be on the companies to prove tetraethyl lead was *safe* rather than on opponents to prove that tetraethyl lead was dangerous.

Dr. Yandell Henderson, a Yale physiologist, emerged as one of the strongest critics of the industry. He told the conference that lead was a public menace, as serious as the infectious diseases then affecting the nation's health. He was horrified at the thought that hundreds of thousands of pounds of lead would be deposited every year in the streets of every major city of America and that "the conditions will grow worse so gradually and the development of lead poisoning will come on so insidiously . . . that leaded gasoline will be in nearly universal use and large numbers of cars will have been sold . . . before the public and the government awaken to the situation."⁷⁷

Unlike industry spokespeople, who defined the problem narrowly—as an occupational hazard—and maintained that individual vigilance on the part of workers could solve the problem, Henderson believed that leaded gasoline was a public and environmental health issue that required federal action. Harriet Silverman of the Workers' Health Bureau underlined the absurdity of the industry's position: "I ask you gentlemen to consider the fact that you are asked to allow a man to be subjected to contact with a poison which is considered hazardous by the leading scientists of the country. And when you expose them to that poison out of which the manufacturers are making profits, the manufacturers penalize those men by making them forfeit a day's wage."⁷⁸

Opponents were extremely concerned that the industry equated the use of lead with industrial progress. Reacting to the Ethyl Gasoline Corporation representative's statement that tetraethyl lead was a "gift of God," Grace Burnham of the Workers' Health Bureau said it "was not a gift of God when those 11 men were killed or those 149 were poisoned." She angrily questioned the priorities of "this age of speed and rush and efficiency and mechanics" and said that "the thing we are interested in in the long run is not mechanics or machinery, but men." A. L. Berres, secretary of the Metal Trades Department of the American Federation of Labor (AFL), also rejected the prevalent notion that "the business of America was business." He told the conference that the AFL opposed the use of

tetraethyl lead. "We feel that where the health and general welfare of humanity is concerned, we ought to step slowly."⁷⁹

The country's foremost authority on lead, Dr. Alice Hamilton, agreed with those who believed there was no way to know how to regulate leaded gasoline so that it would be safe. Only a ban would suffice. "You may control conditions within a factory," she said, "but how are you going to control the whole country?"⁸⁰ In a more extended commentary on the conference and the issues that it raised, Hamilton stated, "I am not one of those who believe that the use of this leaded gasoline can ever be made safe. No lead industry has ever, even under the strictest control, lost all its dangers. Where there is lead some case of lead poisoning sooner or later develops, even under the strictest supervision."⁸¹

Most public health professionals did not agree with Henderson and Hamilton. For the vast majority of public health experts at the conference, the problem was how to reconcile the opposed views of advocates of industrial progress and those frightened by the potential for disaster. Although everyone hoped that science itself would provide an answer to this imponderable dilemma, the reality was that all evidence to this point was ambiguous. No one in the 1920s had a model for explaining the apparently idiosyncratic occurrence of lead poisoning.

Convinced by industry that oil supplies were limited and there was an extraordinary need to conserve fuel by making combustion more efficient, most public health workers believed that there must be overwhelming evidence that leaded gasoline actually harmed people before it should be banned. Industry advertisements compared tetraethyl lead to vitamins, suggesting that automobiles would run inefficiently without the additive.

Dr. Henry F. Vaughan, president of the American Public Health Association, said: "Certainly in a study of the statistics in our large cities there is nothing which would warrant a health commissioner in saying that you could not sell ethyl gasoline." He agreed that there should be further tests and studies of the problem but that "so far as the present situation is concerned, as a health administrator I feel that it is entirely negative." Dr. Emery Hayhurst of the Ohio Department of Health argued that the widespread use of leaded gasoline for twenty-seven months "should have sufficed to bring out some mishaps and poisonings suspected to have been caused by tetraethyl lead."⁸² Given that it didn't, he was prepared to declare leaded gas safe.

In private, however, Hayhurst and others admitted their private doubts. One investigator from Columbia University, Frederick Flinn, who had not spoken at the conference, expressed his fears in a personal communication



Ethyl
IS TO GASOLINE what
VITAMINS are to FOOD

DOCTORS SAY, "Give your children fruit. It adds needed vitamins to the nourishment they get from other foods."

Oil companies say, "Give your car Ethyl. It evens the explosions of gasoline inside the engine; delivers more of gasoline's energy to your motor as power, leaves less of it as waste heat."


But oil companies go one step farther. They add Ethyl to good gasoline—and sell you Ethyl Gasoline already mixed in the right proportion.

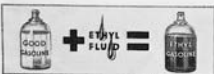
And this month, oil companies are

announcing an even higher standard of quality for Ethyl Gasoline—offering you still greater value for your gasoline money.

The new high compression cars, built by automobile companies to take advantage of Ethyl's universal distribution, require this better motor fuel. Older cars find Ethyl a real economy because it prevents harmful knock, overheating and power-loss.

Stop at the Ethyl pump tomorrow. You'll notice the difference immediately. Ethyl Gasoline gives you more power on hills, faster pick-up and less gear-shifting in traffic, a smoother, more responsive motor. It is the correct motor fuel for your car. Ethyl Gasoline Corporation, New York City.

Buy **ETHYL**

GASOLINE



Ethyl fuel contains lead. © N.M.C. 1934

1. Ethyl is to gasoline what vitamins are to food. In this advertisement, the Ethyl Corporation equates leaded gasoline to vitamins and links children, food, lead, and automobiles. Source: *Ladies' Home Journal* (June 1932), 55.



RAIN STORMS will play tricks on you. And so will an old motor—unless it has Ethyl.

But stop beside the pump that bears the Ethyl emblem every time you need gas and then you know what your car will do.

It will run its best all the time!

You don't always want top speed—or fueling pick-ups—or the extra power it takes to zoom over hills is high. But when you do, you want "oom." And when you're driving at moderate speed, Ethyl makes the difference between real grease and just going some place. It brings back the fun you used to get from your car.

Stop at an Ethyl pump and discover what millions of others know today: *The next best thing to*

a brand-new car is your present car with Ethyl. With all companies selling Ethyl at only 2¢ a gallon over the price of regular, you can't afford not to use it. The savings Ethyl makes in repairs and upkeep more than offset this new low price. Ethyl Gasoline Corporation, New York City.



NOW
 SOLD BY GAS COMPANIES AT
 ONLY **2¢** PER GALLON
 over "regular"

NEXT TIME STOP AT THE ETHYL PUMP

2. This car needs ethyl. The Ethyl Corporation promotes its lead gas additive, comparing it favorably to nonlead fuels. Source: *Saturday Evening Post* (1933).


The Verdict of the Jury

*... composed of millions of motorists
who have considered the evidence
for over two years...*

is that

**BLUE
SUNOCO**

is a high powered, knockless motor
fuel which gives excellent perform-
ance even in the highest com-
pression motors.



BLUE SUNOCO is a pure petroleum product, non-poisonous and harmless. Its high knockless qualities are obtained by exclusive methods of manufacture and not by the addition of foreign substances.

You save from 3¢ to 5¢ per gallon
—because BLUE SUNOCO sells at regular gas price

3. The verdict of the jury. After the controversy over tetraethyl lead, other gas companies promoted their nonleaded products as nonpoisonous and the choice of the people. (March 1929). Source: Hagley Museum. Acc. 84.247.5 po 90-251, 8-3.

to R. R. Sayers of the Public Health Service and the Bureau of Mines: "The more I work with the material [tetraethyl lead] the more I am confused as to whether it is a real public health hazard," he began. He felt that much depended upon the special conditions of exposure in industry and on the street, but in the end stated he was "convinced that there is some hazard—the extent of which must be studied around garages and filling stations over a period of time and by unprejudiced persons." As Flinn had performed studies for the Ethyl Corporation, it is not surprising that he ended his letter by saying that "of course you must understand that my remarks are confidential."⁸³

Emery Hayhurst was even more candid in his private correspondence to Sayers. He told Sayers that he had just received a letter from Dr. L. R.

Thompson of the Public Health Service saying that "lead has no business in the human body. . . . That everyone agrees lead is an undesirable hazard and the only way to control it is to stop its use by the general public." Hayhurst, however, acknowledged to Sayers that political and economic considerations influenced his scientific judgment. "Personally I can quite agree with Dr. Thompson's wholesome point of view, but still I am afraid human progress cannot go on under such restrictions and that where things can be handled safely by proper supervision and regulation they must be allowed to proceed if we are to survive among the nations. Dr. Thompson's arguments might also be applied to gasoline and to the thousand and one other poisons and hazards which characterize our modern civilization."⁸⁴ Despite the widespread ambivalence on the part of public health professionals and the opposition to any curbs on production on the part of industry spokespeople, the public suspicion aroused by the preceding year's events led to a significant victory for those who opposed the sale of leaded gasoline. At the end of the conference, the Ethyl Gasoline Corporation announced that it was suspending the production and distribution of leaded gasoline until the scientific and public health issues involved in its manufacture could be resolved. The conference called upon the surgeon general to organize a blue ribbon committee of the nation's foremost public health scientists to study leaded gasoline. Among those asked to participate were David Edsall, professor of clinical medicine at Harvard University; Julius Stieglitz, professor of chemistry at the University of Chicago; and C.-E. A. Winslow, professor of public health at Yale University.

For Alice Hamilton and other opponents of leaded gasoline, the conference appeared to have yielded a positive result, placing the power to decide the future of an important industrial poison in the hands of university scientists. "To anyone who has followed the course of industrial medicine for as much as ten years," Hamilton remarked one month after its conclusion, "this conference marks a great progress from the days when we used to meet the underlings of the great munitions makers [during World War I] and coax and plead with them to put in the precautionary measures. . . . This time it was possible to bring together in the office of the Surgeon General the foremost men in industrial medicine and public health and the men who are in real authority in industry and to have a blaze of publicity turned on their deliberations."⁸⁵

The initial euphoria over the apparent victory of "objective" science over political and economic self-interest was short-lived. The blue ribbon committee, under pressure to deliver an early decision, designed a short-term,

and thus very limited, study of garage and filling station attendants and chauffeurs. Researchers studied four groups of workers in Dayton and Cincinnati, totaling only 252 people. Of these, 36 were controls employed by the city of Dayton as chauffeurs of cars using gasoline without lead, while 77 were chauffeurs using leaded gasoline over a period of two years. Also, 21 others were controls employed as garage workers or filling station attendants where unleaded gasoline was used and 57 were engaged in similar work where tetraethyl gas was used. As another means of comparison, 61 men were tested in two industrial plants in which there was known to be persistent exposure to lead dust. In just seven months, the committee concluded their study, finding that "in its opinion there are at present no good grounds for prohibiting the use of ethyl gasoline . . . provided that its distribution and use are controlled by proper regulations." They suggested that the surgeon general formulate specific regulations to be enforced by the states.⁸⁶

Although it appears that the committee rushed to judgment, it must be pointed out that this group viewed their study as only interim, to be followed by longer follow-up studies in the coming years. In their final report to the surgeon general, the committee warned:

It remains possible that if the use of leaded gasoline becomes widespread conditions may arise very different from those studied by us which would render its use more of a hazard than would appear to be the case from this investigation. Longer experience may show that even such slight storage of lead as was observed in these studies may lead eventually in susceptible individuals to recognizable lead poisoning or to chronic degenerative diseases of a less obvious character.

Recognizing that their short-term retrospective investigation did not address the issue of long-term effects, the committee concluded that further study by the government was essential:

In view of such possibilities the committee feels that the investigation begun under their direction must not be allowed to lapse. . . . It should be possible to follow closely the outcome of a more extended use of this fuel and to determine whether or not it may constitute a menace to the health of the general public after prolonged use or other conditions not now foreseen. . . . The vast increase in the number of automobiles throughout the country makes the study of all such questions a matter of real importance from the standpoint of public health and the committee urges strongly that a suitable appropriation be requested from Congress for the continuance of these investigations under the supervision of the Surgeon General of the Public Health Service.⁸⁷

These suggestions were never carried out. For the next four decades, all studies of the use of tetraethyl lead were conducted by laboratories and scientists funded by the Ethyl Corporation and General Motors. In direct contradiction to the recommendations of the committee, Robert Kehoe, a physiologist who had originally helped formulate the industry's position, supervised the studies for Ethyl. He explained that since "it appeared from their investigation that there was no evidence of immediate danger to the public health, it was thought that these necessarily extensive studies should not be repeated at present, at public expense, but that they should be continued at the expense of the industry most concerned, subject, however, to the supervision of the Public Health Service." It should not be surprising that Kehoe concluded that his study "fails to show any evidence for the existence of such hazards," nor did the Public Health Service supervise his work.⁸⁸

Since there was no immediate danger that could justify the removal of this toxin, industry used this rationale to justify another sixty years of leaded gasoline. This is an unfortunate testament to the power of industry's conception that a valuable (profitable) product should continue to be used until it was proven to be hazardous to consumers. For most of the twentieth century, this need to prove danger prevailed over the public health community's traditional precautionary model that toxic materials should not be used unless they could be demonstrated not to present a health risk.

The industry was successful in defining the issue as an occupational problem that remained largely undetected outside of the industrial setting. And Kehoe, a professor of physiology at the University of Cincinnati College of Medicine, continued to have his industry-supported laboratories and emerged in the following decades as a virtual commissar of lead toxicology. He, more than anyone, was responsible for promulgating the view that it was "normal" for certain amounts of lead to be in all human beings and that people had natural mechanisms for eliminating it and controlling it as a threat. Until the 1960s, there was no challenge to this position.

Kehoe fought the environmental model of lead poisoning. Yet, he saw that children were being lead poisoned as a result of ingesting lead-based paint. Ironically, while he was a staunch defender of the Ethyl Corporation and its use of lead in gasoline, he became part of a reconceptualization of risk and responsibility of industry as it related to childhood lead poisoning from paint, a movement that ultimately opened the door to a critique of environmental lead poisoning in general. This, in turn, resulted in the end of tetraethyl lead as the premier additive in gasoline.