Public Health Then and Now

A 'Gift of God'?: The Public Health Controversy over Leaded Gasoline during the 1920s

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Introduction

A recent article in the *American Journal of Public Health* noted the high correlation between the lead content of soil in urban areas and the elevated blood-lead levels of children in these cities.[1] An editorial in the same issue of the Journal suggested that the "use of leaded gasoline and [high] traffic density" helped explain this observation.[2] For most public health experts, the controversy over the possible adverse effects of leaded gasoline began in the 1970s. What we intend to show in this paper is that as early as the 1920s public health experts, government officials, scientists, corporate leaders, labor, and the public were acutely aware of the dangers posed by the introduction of lead into gasoline. The depth of concern was manifested by the fact that leaded gasoline was banned in New York City for over three years and in many states and other municipalities for shorter periods of time. In 1925, the production of leaded gasoline was halted for over nine months.

During the 1920s, the petrochemical and automobile industries emerged as the corporate backbone of the United States. Because the acceptance or rejection of leaded gasoline had profound implications for these industries, a spirited and often heated controversy arose. Public health professionals found themselves under intense pressure to sanction and minimize the hazards associated with the manufacture and use of this new potentially toxic substance and the pages of the *American Journal of Public Health* were compromised during the months and years when the fate of leaded gasoline was being decided. The debates of that era centered on issues of health and public policy that remain current today. Numerous questions arose regarding the evaluation of health hazards associated with new and potentially harmful substances, including: How can scientists evaluate the relative importance of acute and chronic effects of toxic substances? What should constitute adequate proof of safety or harm? What business, professional, or government agencies should be responsible for evaluating possibly dangerous substances? How does one study potentially toxic substances while protecting the right to health of human subjects? Does industry have to prove a new substance safe or do public health experts have to prove it dangerous? In the face of scientific uncertainty concerning the safety or dangers posed by leaded gasoline, and the perceived need for this substance by the automobile industry, the broader question became: What was the level of acceptable risk that society should be willing to assume for industrial progress? By examining this controversy, we will illustrate how, at every stage of the debate, the political, economic, and scientific issues were inextricably intertwined.

Leaded Gasoline Developed

Before the 1920s, the automobile industry was expanding and highly competitive. In addition to national manufacturers such as Ford, General Motors, and Studebaker, there were local companies, sometimes arising out of former bicycle manufacturers, that competed for special markets. Ford dominated the pre-1920 market, however, producing nearly half of all the cars bought by Americans. Its Model T, small and cheaply produced, was the standard for the industry. In the 1920s, General Motors developed a number of marketing and stylistic innovations that allowed it to replace Ford as the number one producer by the end of that decade. Alfred Sloan, president of General Motors, explained that their strategy called for creating demand "not for basic transportation, but for progress in new cars for comfort, convenience, power and style." Central to the creation of powerful and large automobiles was the development of a more efficient fuel capable of driving cars at greater speed. In 1922, Thomas Midgley and co-workers at the General Motors Research Laboratory in Dayton, Ohio discovered that adding tetraethyl lead to gasoline raised the compression and hence, speed, by eliminating the engine "knock". This allowed for the development of the "modern" automobile produced over the next 50 years.[3]

General Motors, which had an interlocking directorship with the DuPont Chemical Company, quickly contracted with DuPont and Standard Oil of New Jersey to produce tetraethyl lead. Leaded gasoline was placed on sale in selected markets on February 1, 1923. In 1924, DuPont and General Motors created the Ethyl Corporation to market and produce its final product. This was done in spite of the fact that industrial hygienists such as Alice Hamilton had long since identified lead as an industrial toxin.[4-7]

Scientists Question Safety

In the very year that Midgley and his co-workers at General Motors Research Corporation heralded the discovery of this powerful anti-knock compound, scientists in and outside of government warned that tetraethyl lead might be a potent threat to the public's health. William Mansfield Clark, a professor of chemistry, wrote to A. M. Stimson, Assistant Surgeon General at the Public Health Service, in October of 1922 warning of "a serious menace to the public health." He

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Editor's Note: See also related editorial p 338 this issue.

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noted that in the early production of tetraethyl lead, "several very serious cases of lead poisoning have resulted." He feared that its use in gasoline would result in environmental pollution, theorizing that "on busy thoroughfares it is highly probable that the lead oxide dust will remain in the lower stratum."[8,9]

Stimson believed that "the possibilities of a real health menace do exist in the use of such a fuel and it is deemed advisable that the Service be provided with some experimental evidence tending to support this opinion." He suggested that it was in the province of the Division of Chemistry and Pharmacology to conduct investigations of the dangers.[10,11] The director of that division opposed this suggestion because 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 them with relevant data.[12]

One month later, H. S. Cumming, the Surgeon General, wrote to P. S. DuPont, Chairman of the Board of the DuPont Company, asking whether the public health effects of tetraethyl lead manufacturing and use had been taken into account. He was answered by Thomas Midgley himself who allowed that although the question "had been given very serious consideration . . . no actual experimental data has been taken." Despite the lack of 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."[13,14]

DuPont and General Motors recognized that, in view of the apprehension about the potential health hazards of tetraethyl lead, a purely private in-house study of its safety would be met by skepticism and rejection. Therefore, rather than conduct its own investigations, it worked out an agreement with the US Bureau of Mines. The agreement called for the General Motors Research Corporation to provide funding for an investigation of the dangers of tetraethyl lead and for the Bureau of Mines to provide the facilities and the imprimatur of the US Government on the results of such an investigation. GM, through its 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 [GM] 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."[15]

Corporate Veto and Censorship

It was clear to many that this was a politically explosive inquiry. For example, the chief chemist, S. C. Lind, wrote to the superintendent of the Pittsburgh Bureau of Mines Field Station where the investigation was being carried out objecting to the government's use of the trade name "ethyl" when referring to tetraethyl lead gasoline, saying, "Of course their [GM's] object in doing so are fairly clear, and among other things they are not particularly desirous of having the name 'lead' appear in this case. That is alright from the standpoint of the General Motors Company but it is quite a question in my mind as to whether the Bureau of Mines would be justified in adopting this name so early in the game before it has had the support of popular usage." The superintendent replied that the avoidance of "the use of 'lead' in the interbureau correspondence" was intentional because of leaks to the newspapers. Since the Bureau had agreed to a blackout of information, he asserted that "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."[16,17]

The willingness of the Bureau of Mines to avoid publicity and even accurate scientific terminology in favor of a trade name reflected the Bureau's weak position vis-a-vis the giant corporations, GM and DuPont. This was further evident in the subsequent agreements developed between the government, GM, DuPont, and the newly created Ethyl Gasoline Corporation. The first agreement in September 1923 between the General Motors Research Corporation and the Bureau allowed relative freedom for the Bureau to report its final conclusions.[18] However, by June 1924, General Motors sought much greater control over the final product. Not only had the corporation demanded that no publicity concerning the research be given to the popular press, it now added to the contract the stipulation that "all manuscripts, before publication, will be submitted to the Company for comment and criticism."[19] Two months after the Bureau acquiesced to this new stipulation, the newly created Ethyl Corporation asked that their proposed contract be modified so that "before publication of any papers or articles by your Bureau, they should be submitted to them [Ethyl] for comment, criticism, and approval." These changes were incorporated into the new contract giving the Ethyl Corporation veto power over the research of the United States Government.[20]

Despite the insistence of GM, DuPont, and the US Government that no information should be released before completion of the study, it is clear from the unpublished correspondence that this agreement was violated when it appeared that the preliminary results pointed toward a vindication of the companies' faith in tetraethyl lead. In July 1924—two years after leaded gasoline was first put on the market in the mid-west and the east coast and five months before the preliminary report was released—the GM 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 assured the AMA that "poisoning from carbon monoxide would arise long before the concentration of lead would reach a point where even cumulative poisoning is to be feared."[21]

Oil Company Disaster

The industry's assurances of the safety of leaded gasoline were undermined by a horrifying disaster that occurred in the Standard Oil Company's experimental laboratories in Elizabeth, New Jersey. Between October 26 and October 30, 1924, five workers died and 35 others experienced severe palsies, tremors, hallucinations, and other serious neurological symptoms of organic lead poisoning. Thus, of 49 workers in the tetraethyl lead processing plant, over 80 per cent died or were severely poisoned. On the first day, the *New York Times* quoted the company doctor who suggested that "nothing ought to be said about this matter in the public interest," and 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, however,

"was bitter in denunciation of conditions at the 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."[22,23]

After this initial revelation, every major newspaper in New York began to report on conditions at the plant. Day after day, the *Times*, the *New York World*, and other newspapers revealed deaths and occupationally related insanity due to what the newspapers called "looney gas".[24] The company continually sought to deny management's responsibility for the tragedy. At a press conference, Thomas Midgley asserted that true responsibility for the crisis rested with the workers. He said that at another plant "the men, 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."[25] Despite Standard Oil's attempt to shift blame to workers, others were reaching different conclusions. The Union County (New Jersey) prosecutor 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."[26,27] 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.[28]

These deaths and the continuing controversy 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," New York City, New York State, Philadelphia, and many other municipalities and states banned the sale of leaded gasoline.[29]

Bureau of Mines Report Issued

On the day after the fifth and last victim died, and in the midst of growing public skepticism about 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* 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."**

The *Times* 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." In short, the report exonerated tetraethyl lead.[30] Despite the desire of the manufacturers to use the report to reassure the public, the circumstances of the workers' deaths only served to undermine the credibility of the Bureau of Mines' findings. Specific criticisms came from a number of different sources. Scientists and labor activists alike found fault with the report. E. E. Free, editor of the prestigious *Scientific American* magazine, was skeptical of R. R. Sayers' assurances that the Bureau of Mines could find no evidence of lead poisoning in experimental animals.[31,32] Cecil K. Drinker, editor of the *Journal of Industrial Hygiene* and professor of public health at Harvard, and Dr. David Edsall, Dean of the Harvard Medical School, were also critical. In early January 1925, Drinker wrote a pointed letter to Sayers in which he concluded, "As an investigation of an important problem in public health upon which a great deal of inexact data has already appeared, the report is inadequate."[33–35] 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."[36]

National Library of Medicine

National Archives

Dr. Alice Hamilton, (left) one of the country's foremost authorities on lead, opposed tetraethyl lead in gasoline, while R. R. Sayers (right), who headed the Bureau of Mines, issued the preliminary report exonerating tetraethyl lead as a hazard to the public.

Perhaps the strongest criticism of the Bureau of Mines' report came from the Workers' Health Bureau and one of its chief scientific advisors, Yandell Henderson, Professor of Applied Physiology at Yale University. Even before the report was issued, the Workers' Health Bureau—an organization of pro-labor activitists devoted to investigating and organizing around occupational safety and health issues—called for a united stand to oppose lead in gasoline. They pointed out that the crisis at Bayway indicated that both workers and the general public were in danger of lead poisoning, if lead were allowed to remain in gasoline.[37,38] Henderson, upon whom the Workers' Health Bureau depended for much of their information about the dangers of tetraethyl lead, voiced the public health profession's nagging fear regarding the fact that "this investigation is financed by the Ethyl Gas Corporation" and that in spite of many protests "the investigators in the Bureau of Mines have used experimental conditions which are fundamentally unsuited to afford information on the real issues."[39] In addition, he said, "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." He felt "very strongly that there is the most urgent need for an absolutely unbiased investigation."[40] C. W. Deppe, owner of a competing motor car company, was much more blunt in his criticism of the government's relationship to GM, saying: "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?"[41]

Propaganda Efforts

This attack by scientists, public health experts, and activists on the quality and integrity of the report forced those who favored the introduction of lead into gasoline to begin a counter offensive. Emery Hayhurst, a noted industrial hygienist with the Ohio Department of Health, emerges as one of the key figures in the attempt to "sell" tetraethyl lead

to the American public. Hayhurst was important in the following months and years because of his established reputation as a respected and independent industrial hygienist. But what was not known about Dr. Hayhurst during the months of struggle around this issue was the dual role he played in the controversy; at the same time he was advising organizations like the Workers' Health Bureau about industrial hygiene matters, he was also working as a consultant for the Ethyl Corporation.[42] It is also evident from correspondence between Hayhurst and the Public Health Service 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 had issued its report, Hayhurst had decided that tetraethyl lead was not an environmental toxin. He had 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."[42,43] Even more damning evidence is found in another letter to Sayers—when the attacks on the report were mounting—wherein Hayhurst secretly sent to the Public Health Service copies of the criticisms that the Workers' Health Bureau had developed, so that the federal government could be prepared to reply. Although the Workers' Health Bureau had specifically refrained from sending these comments to the government, Hayhurst violated their trust.[44–47] Hayhurst and Sayers also worked together to build public and professional support for the Bureau of Mines' and the Ethyl Corporation's position that tetraethyl lead was not a public health danger. Sayers urged[45] that Hayhurst counter the criticisms of Drinker and Edsall with a review or editorial of his own in support of the report. Hayhurst replied[48] that he had prepared an editorial for the *American Journal of Public Health** that 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."[49] Printed as an unsigned editorial, it gave *Journal* readers the impression that public health professionals had determined that leaded gasoline posed no threat to the public's health.

Nevertheless, this propaganda effort did not quell the doubts about the safety of leaded gasoline or the integrity of the Bureau of Mines' report. It also became apparent that the companies were engaging in a cover-up of other deaths and illnesses among their workers in other plants. In light of the publicity over Bayway, it was soon reported that other workers had died handling tetraethyl lead at both the DuPont chemical plant at Deepwater, New Jersey and the General Motors research division site in Dayton, Ohio. The Workers' Health Bureau, for example, began to catalogue the deaths and illnesses of workers at these plants showing that, since September 1923, at least two men had died at Dayton and four others at Deepwater.[28,47] The *Times* later reported that editors and reporters had difficulties in following up on the story. For example, the *Times* noted that there was nothing in the local paper about the death of Frank W. (Happy) Durr who had worked for DuPont for 25 years. Durr had literally given his life to the company; he had begun working for DuPont as a 12-year-old child and died from exposure to tetraethyl lead at the age of 37. 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* went on to describe the control that DuPont exercised over the local hospital to which its poisoned workers were sent, indicating that it was almost impossible to get information from the hospital about the source of the workers' problems. Despite this, the *Times* was able to uncover the fact that there had been over 300 cases of lead poisoning among workers at the Deepwater plant during the past two years. Workers at the DuPont facility, knowing something was amiss, 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 'the House of the Butterflies,' or who went into it to make repairs were poisoned, some repeatedly."[50]

*He was a member of the Journal's Editorial Committee at the time.

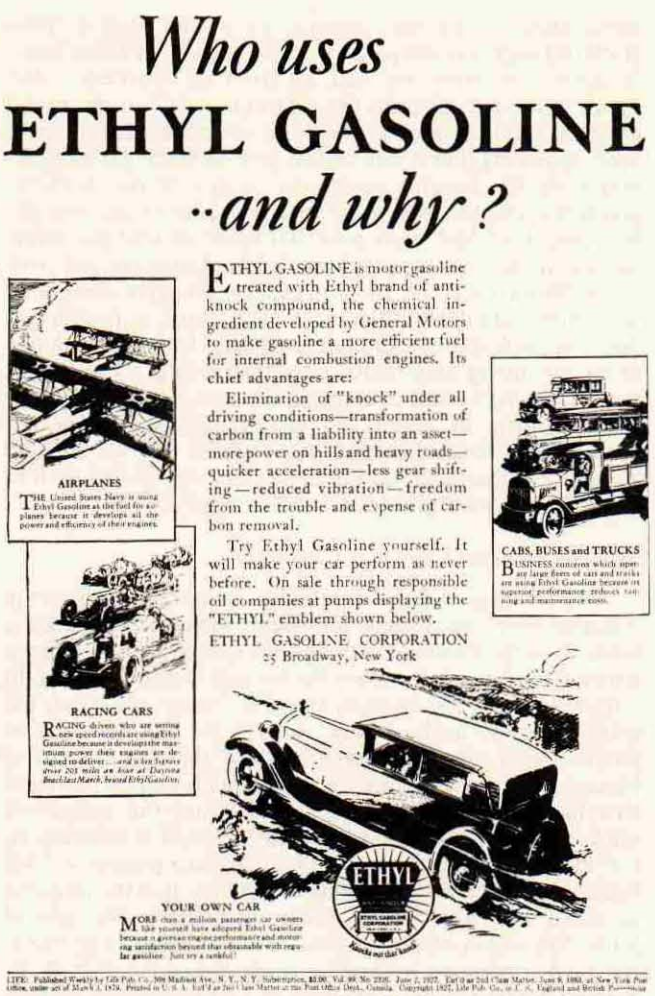
Surgeon General Convenes Conference

As a result of these continuing revelations and public disquiet over the Bureau of Mines report, the Surgeon General of the Public Health Service contemplated calling a national conference to assess the tetraethyl lead situation. In a frank letter to the Surgeon General, Haven Emerson, the eminent public health leader, spelled out the concerns of public health officers. Emerson stated that the Bureau of Mines' report was having "a widespread, and to my mind harmful, influence on public opinion and the actions of public agencies" and that it would be "well worthwhile to call those whom you intend to a conference promptly." He feared that there was a growing impression 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.[51] Despite some indication that R. R. Sayers opposed such a conference and may have delayed it,[52] 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.[53]

The conference convened on May 20, 1925 in Washington, DC, with every major party represented. At the conference, the ideologies of the different participants were clearly and repeatedly laid out, thus providing an important forum by which we can evaluate the scientific, political, economic, and intellectual issues surrounding this controversy. 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."[54]

'Industrial Progress' Invoked

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. Three themes emerge as central arguments by the companies. First, the manufacturers maintained that leaded gasoline was essential to the industrial progress of America. Second, they maintained that any innovation entails certain risks. Third, they stated that the major reason



This ad, appearing in a 1927 issue of *Life* magazine, never mentions lead.
Photo credit: The Ohio Historical Society

that deaths and illnesses occurred at their plants was that the men who worked with the materials were careless and did not follow instructions.

C. F. Kettering, of GM and Ethyl, and Robert Kehoe, scientific consultant to the industry, both stressed the importance of tetraethyl lead as a means of conserving motor fuel. But Frank Howard, representing the Ethyl Gasoline Corporation, provided the most complete rationale for the continued use of tetraethyl lead in gasoline. He noted that it was not possible to abstract the questions of public health from broader economic and political issues. "You have but one problem," he remarked rhetorically, "Is this a public health hazard?" He answered that "unfortunately, our problem is not that simple." Rather he posited that 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. Noting that at least a decade of research had gone into the effort to identify tetraethyl lead, he called its discovery an "apparent gift of God." By casting the issue in this way, Howard put the opposition on the defensive, making them appear to be reactionaries whose limited vision of the country's future could permanently retard progress and harm future generations. "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?"[55,56]

The stark portrayal of tetraethyl lead as a key to the industrial future of the nation led naturally into industry's second argument that any great advance required some sacrifice. Dr. H. C. Parmelee, editor of *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." Parmelee believed that the companies did their best to safeguard the workers. In the end, he said, "its casualties were negligible compared to human sacrifice in the development of many other industrial enterprises."[57-59]

Companies Say Workers at Fault

The final part of the industries' position was that workers, rather than the companies, 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 their workers. Thomas Midgley, Jr., vice president of General Motors and known as "the Father of Ethyl Gas," was more pointed at the conference. He said that the lesson that the companies had learned out of this whole experience was that "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 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 was 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 "had an attendant bring in a quantity of pure tetraethyl" with which he "washed his hands thoroughly in the fluid and dried them on his hankerchief. 'I'm not taking any chance whatever,' he said. 'Nor would I take any chance doing that every day.' " He did this act in spite of the fact that only a year before he had taken a prolonged vacation in Florida in order to cure himself of lead poisoning.[58,60,61]

A Public Health/Environmental Issue

Those who opposed the introduction of leaded gasoline disagreed with every fundamental position of industry representatives. First, opponents pointed out that what we would now denote as inorganic lead compounds were already known to be a slow, cumulative poison that should not be introduced into the general environment. Second, they believed because of industry's reckless disregard for workers' and the public's health the federal government had to assume responsibility for protecting the health of the nation. Third, they rejected the notion that the workers were the ones responsible for their own poisoning. Fourth, and most importantly, because they believed that the public's 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, Yale physiologist, was the strongest and most authoritative critic of industry. He told

the conference that lead was a serious public health menace that could be equated to the serious infectious diseases then affecting the nation's health. Unlike industry spokespeople who defined the problem as one of occupational health and maintained that individual vigilance on the part of workers could solve the problem, Henderson believed that leaded gasoline was a public health and environmental health issue that required federal action. He expressed horror at the thought that hundreds of thousands of pounds of lead would be deposited in the streets of every major city in America. His warning to the conference of the long-term dangers proved to be an accurate prediction: "conditions would 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."[62-64]

To meet such a public health menace, Henderson and other critics believed that it was essential for the federal government to take an active role in controlling leaded gasoline. Harriet Silverman of the Workers' Health Bureau attacked the idea put forth by industry that the workers were responsible for their own poisoning, saying "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 the poison out of which the manufacturers are making profits, the manufacturers penalize those men by making them forfeit a day's wage."[65-67]

Opponents were most concerned, however, about the industry propaganda that equated the use of lead with industrial progress, and the survival of our civilization itself. Reacting to the Ethyl 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 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 conception of the 1920s that "the business of America was business." He told the conference that the AFL opposed the use of tetraethyl lead, saying, "We feel that where the health and general welfare of humanity is concerned, we ought to step slowly." But it was Yandell Henderson who summarized the opponents' position and delineated the course for future policy makers. In a private letter to R. R. Sayers of the Bureau of Mines, he said, "In the past, the position taken by the authorities has been that nothing could be prohibited until it was proved to have killed a number of people. I trust that in the future, especially in a matter of this sort, the position will be that a substance like tetraethyl lead can not be introduced for general use until it is proved harmless."[68,64]

For the vast majority of public health experts at the conference, the problem was how to reconcile the opposing 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. One major problem was that, in the 1920s, no one had a model for explaining the apparently idiosyncratic occurrence of lead poisoning. Even the medical director of Reconstruction Hospital in New York, probably the only facility at that time devoted exclusively to the study and treatment of occupational disease and accidents, could not explain the strange manifestations of chronic tetraethyl lead poisoning. Of the 39 patients he treated after the Bayway disaster, he said, "some of these individuals gave no physical evidence and no symptoms or any evidence that could be found by a physical examination that would indicate that they were ill, but at the same time showed lead in the stools." He concluded that "perhaps a man may be poisoned from the tetraethyl lead without showing clinical evidence and that therefore, there may be a considerable number of individuals so poisoned who have not come under observation." The policy implications for him were that leaded gasoline "should be withheld from public consumption until it is conclusively shown that it is not poisonous."[69]

Dr. Alice Hamilton, one of the country's foremost authorities on lead, agreed with those opposed to tetraethyl lead. At the conference she expressed her belief that the environmental health issues were far more important than the occupational health and safety issues, adding that she doubted that any effective measures could be implemented to protect the general public from the hazards of widepsread use of leaded gasoline. "You may control conditions within a factory," she said, "but how are you going to control the whole country?" In an extended commentary after the conference on 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."[70-72]

Further Tests, Studies Urged

Most public health professionals did not agree with Henderson and Hamilton, however. Many took the position that it was unfair to ban this new gasoline additive until definitive proof existed that it was a real danger. In the face of industry arguments that oil supplies were limited and that there was an extraordinary need to conserve fuel by making combustion more efficient, most public health workers believed that there should be overwhelming evidence that leaded gasoline actually harmed people before it was banned. Dr. Henry F. Vaughan, president of the American Public Health Association, said that such evidence did not exist. "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 pointed out. Vaughan acknowledged 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." Emery Hayhurst also argued this point at the Surgeon General's Conference, maintaining that the widespread use of leaded gasoline for 27 months "should have sufficed to bring out some mishaps and poisonings, suspected to have been caused by tetraethyl lead."[73-75]

While Hayhurst and other experts publicly supported the use of leaded gasoline, many of them voiced serious doubts in private. One investigator from Columbia University, Frederick Flinn, articulated his fears in a personal communication to R. R. Sayers of the United States Public Health Service and the Bureau of Mines, saying "The more I work with the material [tetraethyl lead] the more I am

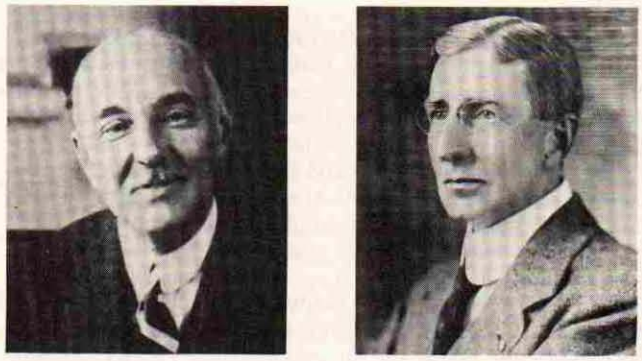
confused as to whether it is a real public health hazard." He felt that much depended upon the special conditions of exposure in industry and on the street but in the end stated he was "convinced that there is some hazard—the extent of which must be studied around garages and filling stations over a period of time and by unprejudiced persons." Given the fact that Flinn did his study for the Ethyl Corporation, it is not surprising that he ended his letter by saying, "of course, you must understand that my remarks are confidential." Emery Hayhurst was even more candid in his private correspondence to Sayers. He told Sayers of a letter he received from Dr. 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 acknowledged to Sayers, however, 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."[76,77]

Company Suspends Manufacture, Sales

Blue Ribbon Committee to Investigate

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 suspicions 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 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 also called upon the Surgeon General to organize a blue ribbon committee of the nation's foremost public health scientists to conduct an investigation of leaded gasoline. Among those asked to participate were David Edsall of Harvard University, Julius Steiglitz of the University of Chicago, C.-E. A. Winslow of Yale University and the American Public Health Association. For Alice Hamilton and other opponents of leaded gasoline, the conference appeared to be a major victory for it wrested from industry the power to decide on the future of an important industrial poison, and placed it in the hands of university scientists. "To anyone who had followed the course of industrial medicine for as much as ten years," Alice Hamilton remarked one month after the conference, "this conference marks a great progress from the days when we used to meet the underlings of the great munition 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."[71]

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



C.-E. A. Winslow (left) served on Blue Ribbon Panel appointed by Surgeon General Hugh Smith Cumming (right) to conduct investigation of leaded gasoline. ***Photo credit: National Library of Medicine***

very limited, study of garage and filling station attendants and chauffeurs in Dayton and Cincinnati. The study consisted of four groups of workers, 252 people in all. Of these, 36 men 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 known to have serious exposure to lead dust. As a result of their study, the committee concluded seven months after the conference 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 with enforcement by the states.[78–80] Although it appears that the committee rushed to judgment in only seven months, it must be pointed out that this group saw their study as only an interim report, to be followed by longer range follow-up studies in ensuing 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 or to chronic degenerative diseases of a less obvious character."

Recognizing that their short-term investigation was incapable of detecting such danger, 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."[81–84]

These suggestions were never carried out and subsequent studies of the use of tetraethyl lead were conducted by the Ethyl Corporation and scientists employed by them.[85,86] In direct contradiction to the recommendations of the committee, Robert Kehoe who carried out the studies for Ethyl, wrote: "as 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."[87]

What Went Wrong?

Today, looking back at the controversy of the 1920s, we may be tempted to look askance at public health professionals of the period who put their faith in the ability of scientific investigations to settle this thorny political and economic issue. After all, those like Alice Hamilton and Yandell Henderson who fought the introduction of lead into gasoline were the strongest advocates of governmentally sponsored scientific study to determine the safety or dangers of tetraethyl lead. What went wrong? Why is tetraethyl lead still a prime source of lead in the environment? Of course, there were those who had such an ideological commitment to industrial progress that they were willing to put their science aside to meet the demands of corporate greed. But, more importantly, we should look at those who considered themselves to be objective scientific investigators. Ultimately, it was impossible to separate their "science" from the demands of an economy and society that was being built around the automobile. How else, then, do we explain public health scientists' willingness to conduct a short-term study that could not resolve the long-term health issues. By agreeing to provide quick answers they guaranteed that this vital industry would not be disrupted. The symptoms of lead accumulation due to exhaust emissions would be unlike anything they had previously encountered in industrial populations. In the long run, those most affected would not be adults, but children, slowly accumulating lead. Their suffering speaks more to the interlocking relationships between science and society than to the absence of a link between lead and disease.

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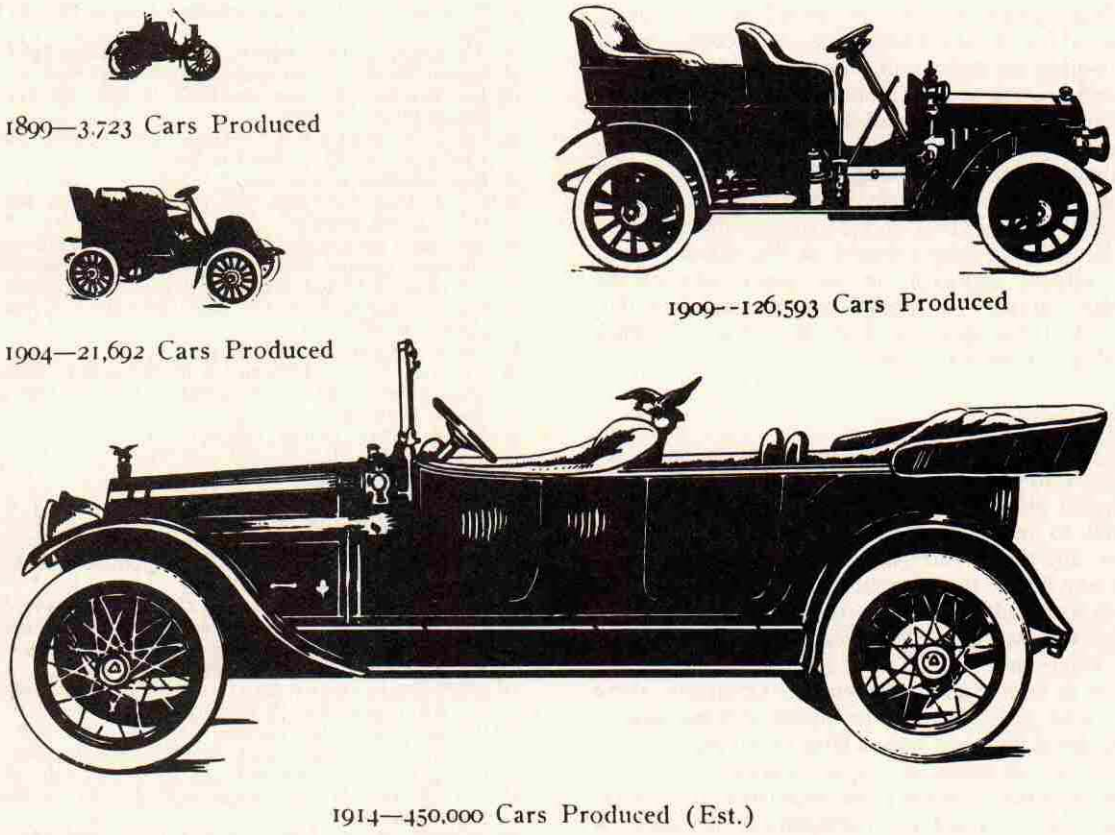

FIGURE 2—Graphic Illustration of Fifteen-year Growth of Automobile Industry in the United States, 1899–1914. ***Photo credit: National Archives***

chemists come to have for dangerous work with which they are familiar."]
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ACKNOWLEDGMENTS

We would like to thank David Kotelchuck, Tony Bale, Blanche Cook Lorin Kerr, Barbara Rosenkrantz, and Ruth Heifetz for their very helpful suggestions and comments on earlier drafts of this article. William Graebner was especially helpful in sharing his own research and ideas with us. We would also like to acknowledge the support of a PSC-CUNY Grant, and of the National Endowment of the Humanities and the Hastings Center which provided support for the academic year 1982–83.