Burning Questions

A history of the gas industry's campaign to manufacture controversy over the health risks of gas stove emissions

Climate Investigations Center
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Executive Summary

Since the early 1970s, the gas industry has successfully employed Big Tobacco's tactics to manufacture and magnify controversy over links between gas stove emissions and respiratory illness, obscuring science and undermining public health.

The gas industry funded its own studies in the 1970s and 1980s using the same laboratories, management consultants, and statisticians as its tobacco counterparts - and was advised by the same public relations company that masterminded the tobacco strategy, Hill & Knowlton. The gas industry's tactics influenced regulatory decision-making at the Environmental Protection Agency and Consumer Product Safety Commission and have continued up to the present day.

As new scientific findings reawaken long-standing concerns about the health impacts of indoor gas cooking, the gas industry has launched a barrage of attacks, casting doubt by making spurious complaints against academic studies, framing discussion of the issue as "reckless," and hiring influencers to push back against the latest evidence.

Evidence uncovered by the Climate Investigations Center reveals that:

- **The gas industry was aware of its 'NOx problem" at least at early as 1970.** According to the minutes of a government advisory panel composed entirely of high-level gas and utility company executives, the gas industry was requested to "take a look" at its NOx (nitrogen oxides) problem in September 1970.

- **That same year, EPA researchers launched the first epidemiological studies into the health effects of indoor nitrogen dioxide (NO_2) exposure from gas stoves.** These studies, which indicated that people who lived in homes with gas stoves were more susceptible to respiratory ailments, would soon attract national attention, threatening to create a potential health scandal for the gas industry.

- **Emulating the tobacco industry's response to growing concerns over the health impacts of smoking, the American Gas Association (AGA) funded its own health effects research program.** In 1972, AGA began sponsoring epidemiological studies into the health effects of gas stove emissions at Battelle Laboratories – a private lab which had a history of working for individual cigarette manufacturers as well as the Council for Tobacco Research. Battelle also had a proven track record of publishing information "consistent with the Sponsor's interests and wishes."

- **AGA-funded studies found no association between gas stoves and respiratory illness despite a growing body of independent, non-industry-affiliated research identifying a positive association between nitrogen dioxide emissions from gas stoves and respiratory problems.** The AGA-funded studies were used by industry to push back against escalating calls for regulatory action on indoor air pollution.

- **AGA funding of this research was not disclosed in independent journals** like *Environmental Research*, a fact that remains true for one of the most influential of the studies – Keller et al. – which is still cited in papers to this day.

- **During this time, the gas industry received advice from Hill & Knowlton - the same public relations company that masterminded the tobacco strategy** - specifically from the same

Hill & Knowlton executives who had been responsible for managing the firm's tobacco account. These executives told the gas industry that it needed to stay ahead of its "critics" by mounting "massive, consistent, long-range public relations programs" to cope with its problems, and recommended tactics similar to those the PR firm had deployed on behalf of the tobacco industry. "Continuing research … must be part of your daily activities," advised Hill & Knowlton.

- **In the 1980s the gas industry funded attacks on existing science through the Gas Research Institute (GRI),** hiring paid-for consultants to criticize the scientific literature, and using these critiques to influence public opinion and advocate against regulatory action. The GRI also funded a further epidemiological study.

- **The gas industry's influence campaign successfully manufactured a "controversy" over NO_2 and health that obstructed legislative and regulatory action**. As part of a wider mission to portray gas as clean, the gas industry's efforts influenced independent research and regulatory proceedings. For forty years, the Consumer Product Safety Commission (CPSC) and Environmental Protection Agency (EPA) have deferred stronger action. Their standards for NO_2 pollution still stop at people's front doors today.

The gas industry's scientific attacks continue to the present day. AGA and its member gas utilities continue to fund research and literature reviews using private consulting firms like Gradient Corporation, which has a long history of defending industry clients against public health research. Recently, AGA referenced the studies it sponsored at Battelle Laboratories in the 1970s (without disclosing this sponsorship) to maintain its position that there is no definitive evidence that NO_2 from gas stoves causes respiratory problems.

The Climate Investigations Center sent detailed questions to the American Gas Association about its sponsored epidemiological research into the health effects of gas stove emissions, the disclosure of funding the studies, contracts with Battelle, and the relationship between Hill & Knowlton. AGA ignored most of the questions. It sent the following statement from President and CEO Karen Harbert:

"*If there is one thing that is clear about the natural gas industry, we do not stand in place. The natural gas industry has collaborated with subject matter experts and research to develop analysis and scientific studies to inform and educate regulators about the safety of gas cooking appliances and ways to help reduce cooking process emissions, regardless of heating source, from impacting indoor air quality. Our focus is on the facts and independent analysis. The available body of scientific research, including high-quality research and consensus health reviews conducted independently of industry, does not provide sufficient or consistent evidence demonstrating chronic health hazards from natural gas ranges.*"

1. Introduction - The 'Controversy' Over NO2 And Health

Summary: In the early 1970s, studies linking gas stove emissions with respiratory problems and other health conditions attracted national attention, prompting discussions on the possible federal regulation of indoor air. It was bad timing for the gas industry which was lobbying for a widespread expansion of U.S. domestic gas reserves and rolling out gas-based infrastructure and household appliances. To better defend itself against public criticism and the prospect of regulation, the gas industry first funded its own research into gas stove emissions, then publicly amplified the findings from industry-friendly consultants to promote doubt and emphasize uncertainty.

"There are many unanswered questions regarding the indoor NO_2 health issue," declared Dr. H. Daniel Roth, a mathematician and statistician, at the 1981 International Gas Research Conference in Los Angeles, California, an event jointly sponsored by the Gas Research Institute, American Gas Association (AGA), and the U.S. Department of Energy.

Presenting his paper, "The Controversy Over NO_2 and Health," Roth attacked the credibility of epidemiological studies linking NO_2 emissions from gas stoves with respiratory problems. "Findings must be questioned," Roth informed his audience of delegates from 18 countries at Los Angeles' Bonaventure Hotel. According to Roth, while a number of gas range studies appeared to indicate that NO_2 might be a problem, the results of these studies were "ambiguous because of many shortcomings." "Study findings are questionable," argued Roth, criticizing each study in detail before claiming that their "results were inconclusive" and that "additional NO_2 epidemiological data" were needed.

Based on the literature reviewed for this report, Roth appears to be the first to publicly apply the label "controversy" to the subject of gas stove emissions and respiratory conditions. He would not be the last.

Roth's paper did **not** mention that he was under contract with the gas industry, specifically the Gas Research Institute – as revealed by documents reviewed by the Climate Investigations Center.

Nor was Roth alone. Other documents reveal that Roth was only one link in a much wider chain of gas industry executives, PR advisors, scientists, and consultants whose role in creating and maintaining a "controversy over NO_2 and health," started almost a decade before Roth's speech, in the early 1970s.

Alarm Bells

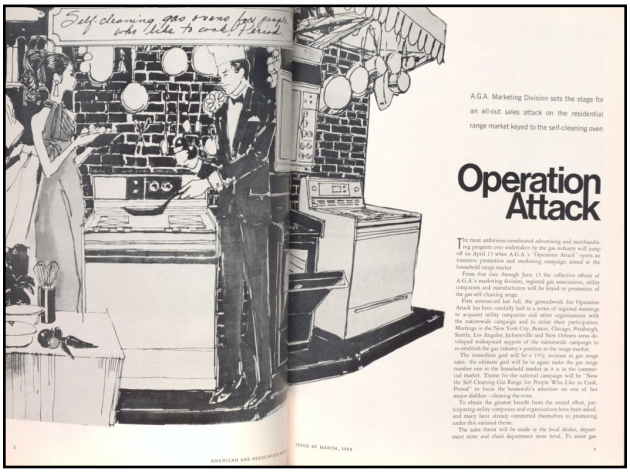
Alarm bells sounded for the gas industry in 1970 when a study in Chattanooga, Tennessee, identified a link between outdoor NO_2 exposure and respiratory problems in schoolchildren. Conducted by the government's National Air Pollution Control Administration, the study found that "ventilatory performance of second-grade schoolchildren in the High-NO_2 area was significantly lower than the performance of children in the Control areas." Although the study focused exclusively on outdoor exposures, the data suggested that high concentrations of NO_2 adversely affected "ventilatory performance" – in other words, breathing.

The Chattanooga study was one of the first in the United States that identified a link between NO_2 pollution and children's health.

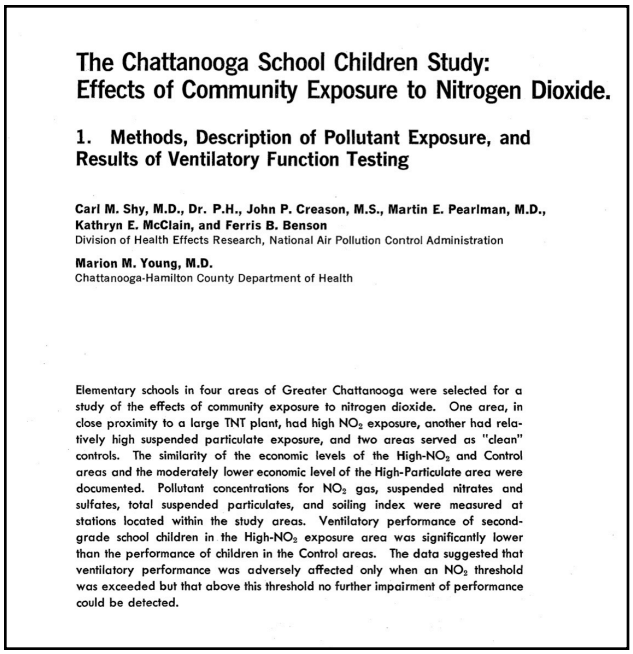
Two months later, U.S. Environmental Protection Agency (EPA) researchers launched the first official epidemiological investigations into the health effects of indoor NO_2 exposure from gas stoves.

From the gas industry's point of view, the timing was terrible. During this period, the gas industry was lobbying and advertising for a widespread expansion of U.S. domestic gas reserves, along with the rapid rollout of in-home domestic gas appliances and supposedly "clean-burning" gas-fired power plants to replace ones that burned coal.

In 1969, AGA, the gas utility industry's trade association (which had approximately 345 gas company members at this time), launched "Operation Attack," a million-dollar nationwide campaign intended to boost the sale of gas ranges over electric ones via "the most ambitious advertising and marketing program ever undertaken by the gas industry." The campaign deployed television commercials and advertisements in *Life*, *Reader's Digest*, *Better Homes and Garden*, *NAHB [National Association of Home Builders] Homebuilding Journal*, and many more. Any spotlight on gas's pollution problems could have complicated that sales push.



AGA's "Operation Attack" was a nationwide campaign that began in 1969 intended to boost the sale of gas ranges over electric ones.



The Chattanooga School Children Study: Effects of Community Exposure to Nitrogen Dioxide.

1. Methods, Description of Pollutant Exposure, and Results of Ventilatory Function Testing

Carl M. Shy, M.D., Dr. P.H., John P. Creason, M.S., Martin E. Pearlman, M.D., Kathryn E. McClain, and Ferris B. Benson
Division of Health Effects Research, National Air Pollution Control Administration
Marion M. Young, M.D.
Chattanooga-Hamilton County Department of Health

Elementary schools in four areas of Greater Chattanooga were selected for a study of the effects of community exposure to nitrogen dioxide. One area, in close proximity to a large TNT plant, had high NO_2 exposure, another had relatively high suspended particulate exposure, and two areas served as "clean" controls. The similarity of the economic levels of the High-NO_2 and Control areas and the moderately lower economic level of the High-Particulate area were documented. Pollutant concentrations for NO_2 gas, suspended nitrates and sulfates, total suspended particulates, and soiling index were measured at stations located within the study areas. Ventilatory performance of second-grade school children in the High-NO_2 exposure area was significantly lower than the performance of children in the Control areas. The data suggested that ventilatory performance was adversely affected only when an NO_2 threshold was exceeded but that above this threshold no further impairment of performance could be detected.

The Chattanooga School Children Study: Effects of Community Exposure to Nitrogen Dioxide from 1970 identified a link between NO_2 exposure and respiratory problems in schoolchildren.

It had long been known that burning fossil fuels releases nitrogen oxides. Throughout the 1950s and 1960s, research into NO_2 pollution had been conducted largely in relation to outdoor emissions from automobiles.

These new studies in the 1970s, however, focused specifically on gas-induced NO_2 pollution.

According to an AGA paper presented a decade later at the 1981 International Symposium on Indoor Air Pollution, Health and Energy Conservation, the gas industry had been "concerned" by the findings of this Chattanooga study, which prompted AGA to sponsor "a series of indoor air quality studies" to "examine the gas range in more detail."

"*EPA Studies performed in the early 1970s in Chattanooga, Tenn by Dr C. M. Shy and his co-workers noted that increases in respiratory illnesses were due to higher than normal NO_2, SO_2 and other pollutants. The gas industry was concerned with these*

findings because the combustion of all fossil fuels, including natural gas, produces some nitrogen oxides. Therefore the gas industry undertook a series of indoor air quality studies under the sponsorship of the American Gas Association to examine the gas range in more detail."

Minutes from a 1970 meeting of the National Industrial Pollution Control Council (NIPCC), a government advisory committee made up exclusively of top-level gas and utilities company executives, illustrate the gas industry's awareness of its "NOx problem." A draft report, produced in 1972 by AGA at the request of the NIPCC, shows that by January 1972, the industry was already conducting research into "Indoor Air Quality Control." The industry's research was intended to assist with the development of "prototype devices" that could limit "the levels of carbon monoxide and nitrogen oxides in household air," and collect "environmental control data" at "test homes in Canton, Ohio."

Minutes from a 1974 meeting of the Institute of Gas Technology board of trustees make clear that the industry was not only concerned about NOx emissions from industrial burners but also recognized the need to lower pollution emissions inside the home. By 1974, AGA Laboratories scientists had developed "a prototype range top" that reduced "NOx emissions."

AGA laboratories in Cleveland, OH, 1960s.

The industry, however, does not appear to have shared the details of its initial findings on gas stove emissions with the public or with the newly-formed EPA, based on an 81-page EPA literature review on indoor-outdoor air pollution relationships, published in August 1972, which stated that while it seemed "reasonable to assume that gas stoves" were "a significant source of indoor nitrogen dioxide" pollution, "no data were found from which the magnitude of this effect could be evaluated."

Nevertheless, separate studies soon provided more information on NO_2 emissions from household gas stoves. The first of these appears to have been an EPA study published in late 1972 that showed peak indoor NO_2 concentrations of 1 ppm (1000 ppb) - almost twenty times higher than the 1971 outdoor NO_2 standard of 0.053ppm (53 ppb).

Outside the industry, researchers had also been building a body of evidence that linked outdoor and laboratory NO_2 exposure to respiratory problems and increased infections. Since at least 1962, a wide range of chronic illnesses, including bronchitis and asthma, had been anecdotally identified by the physician and allergist, Theron G. Randolph, as resulting from indoor "hydrocarbon exposures."

Very little, however, had been published on the possible epidemiological connection between respiratory problems and indoor NO_2 exposure. But this changed in January 1973 with the publication of a study carried out by EPA scientists in Long Island, New York.

A New Threat

The 1973 EPA study, "*Exposure to Indoor Nitrogen Dioxide from Gas Stoves*," assessed the effect of indoor exposure to NO_2 from gas stoves among middle-class families living in Riverhead, Long Island, "a suburban fringe community where ambient pollutant exposure was low." With the exception of preschool children, subjects living in homes using natural gas cooking reported "significantly higher acute lower respiratory

illness" than those living in electric-cooking homes. Indoor NO_2 exposures were related to "gas flow rate, duration of burning, and distance from the stove."

With many American families reliant on gas stoves, the findings were newsworthy, and the *New York Times* reported on the study.

"Studies made by the EPA have yielded "preliminary" indications that people who live in homes with gas stoves are more susceptible to respiratory ailments than people who use other cooking devices," reported Gladwin Hill, the Times's environmental correspondent on March 8, 1973. According to the study's authors, wrote Hill, gas stoves often produced Nitrogen Dioxide – "a major pollutant" – in concentrations 20 times over the Federal Air quality limit.

Hill related that the incidence of "acute lower respiratory illness" was 32% higher in the mothers of families with gas stoves than among mothers in families with other types of stoves.

The lack of a higher incidence of respiratory illness in preschool children from gas stove households was tentatively explained by existing evidence showing that very young children have "either atypical resistance to low respiratory infections, or atypical susceptibility that statistically masked any difference between the two groups of families."

As the first study of its kind, the authors cautioned that their findings were "preliminary," and that yearly variation in the prevalence of respiratory pathogens necessitated that the data "be verified by studies in other years and other communities."

Even so, the study and its accompanying press coverage raised national concerns about the health impacts of using gas stoves. A month later, in April 1973, the *Yale Law Journal* published an op-ed portraying indoor pollution as a "menace" that required "comprehensive federal legislation." While

AGA advertisement from AGA Monthly, April 1973.

the op-ed identified tobacco smoke as the primary source of indoor air pollution, it stated that "the second major source of indoor air pollution is cooking, notably with gas stoves."

If the 1970 Chattanooga study had sounded an alarm for the gas industry indicating that it might have a public problem on its hands caused by NO_2 emissions from gas stoves, the combination of the 1973 Long Island study, the *New York Times* coverage and the *Yale Law Journal's* call for legislative action escalated the threat of regulation to a new level.

From this point on, the gas industry first funded studies investigating the health impacts of gas stove emissions, and then publicly amplified the industry-friendly findings of these studies in order to influence public opinion and prevent "comprehensive federal legislation."

2. Reassurance Of The Public

Summary: In the early 1970s, the PR firm Hill & Knowlton advised the gas industry on what should be its "consistent, long-range, public relations programs." Two top Hill & Knowlton executives, Richard Darrow and Carl Thompson, formerly assigned to the firm's tobacco account, presented advice to the gas industry, which mirrored the firm's earlier recommendations to the tobacco industry. "Continuing research … must be a part of your daily activities," Darrow told gas industry representatives in 1972, emphasizing that they must "explain as fully as possible what the situation is …. before the critics take the floor." Hill & Knowlton's advice also echoed recommendations it had made to the gas industry in the mid-1950s for a "long-range information program," including the sponsorship of research at "leading universities or research institutions" in order "to question the accuracy of facts and interpretations about the industry from government and outside sources." This element was a key component of the Hill & Knowlton formula devised to assist some of the most powerful corporations in America in dealing with controversies over their products. While the extent of Hill & Knowlton's services for the American Gas Association and its members in the early 1970s is not clear, elements of Hill & Knowlton's 'tobacco' formula are visible within the gas industry's actions during this period and beyond based on documents detailed in this report.

> "*In the past, industry has given little twists to the facts of science, to convert them into sales propaganda, without much risk. The cigarette industry has indeed been doing this for years. We can therefore readily understand its assumptions that the same technique will work now, in devising propaganda.*"
>
> -Forwarding Memo from Hill & Knowlton to the Members of the Planning Committee, December 15, 1953

One of the first memos sent by the public relations firm Hill & Knowlton to the "Planning Committee," which would become the Tobacco Industry Research Committee (TIRC), advised its members to *"Start screening and planning a scientific research program.*" In a separate memo on December 24, 1953, Hill & Knowlton told its tobacco clients that *"the underlying purpose of any activity at this stage should be reassurance of the public through wider communication of facts."* They argued that if the TIRC could communicate "the existence of weighty scientific views which hold there is no proof that cigarette smoking is a cause of lung cancer," the industry could gain the "reassurance of the public."

When the gas industry faced public concerns about its product in the early 1970s, it would similarly fund external studies to obtain "weighty scientific views" of its own that it would use to reassure the public. During this time, the gas industry was advised by Hill & Knowlton on what should be its "consistent, long-range, public relations programs."

As demonstrated by the Center for International Environmental Law's 2017 "*Smoke & Fumes*" report, the fossil fuel industry had strategically funded research in the 1940s with the aim of preventing the "hasty passage" of laws to limit smog caused by automobile exhaust in Los Angeles. A few years later, this tactic would be successfully deployed to a far greater extent by Hill & Knowlton on behalf of the tobacco industry. And, in 1972, based on this success, the same tactic would be recommended by Hill & Knowlton to a different sector of the fossil fuel industry: gas.

Recommending that an industry fund its own scientific research was only one aspect of Hill & Knowlton's PR formula, as summarized by the Climate Investigations Center below. Perfected in the course of its work for the chemical, tobacco and gas industries in the 1950s, the formula itself was simple but effective (see the appendix for further details and links to primary source documents):

- **Establish a "Research Committee" or "Institute**" to carry out public relations activities, creating an appearance of independence from individual corporate interests. .
- **Gather as much information as possible** pertaining to the industry or problem in question via public opinion surveys and background research.
- **Publicize any information showing the industry in a positive light** such as how much the industry is spending on finding solutions to the problem, meanwhile, underscoring the industry's importance to the economy and, if possible, national security.
- **Get ahead of "critics" and take control of the narrative** by facilitating industry sponsorship of existing or new research to build public confidence by enhancing positives. This can also be done by refuting or casting doubt on evidence linking the industry to harmful environmental or health impacts. Where possible, recruit established scientists and experts to carry out this research or to speak on the industry's behalf.
- **Adopt a skeptical stance, arguing that more research is needed.** Describe scientific findings as controversial and emphasize that "other factors" need to be properly evaluated.
- **Publicize the results of industry-sponsored research efforts through every possible channel**, targeting relevant lawmakers, regulators, and opinion leaders, including newspaper editors, writers, radio and television broadcasters, celebrities, medics, health professionals, nutritionists, leaders of women's groups, teachers, and others.
- **Once a company or industry averts any immediate crisis, continue with the formula over the long term** and stay attuned to potential threats while adjusting research programs accordingly.

Best known for its deployment by the tobacco industry, records show that Hill & Knowlton offered the same playbook to the gas industry in 1972 and that the gas industry deployed it.

Richard Darrow, Hill & Knowlton president. Photo from a 1969 speech to Ohio Wesleyan University.

Editions of the AGA's in-house magazine, *AGA Monthly*, reveal that two top Hill & Knowlton executives advised the gas industry in the early 1970s on its public relations strategy in ways that mirror the PR firm's recommendations to its tobacco clients. Richard Darrow, Hill & Knowlton's president and chairman of the board, and Carl Thompson, the head of Hill & Knowlton's Department of Environmental and Consumer Affairs, had been integral to Hill & Knowlton's tobacco account - responsible for both the Tobacco Industry Research Committee (TIRC), renamed the Council for Tobacco Research (CTR) in 1964; and the Tobacco Institute, created by Hill & Knowlton in 1958, which took over the TIRC's lobbying and PR activities.

In a 1975 interview, John Hill, founder of Hill & Knowlton and mastermind of the tobacco strategy, revealed that the agency's work for tobacco, particularly its "valuable library," had proved useful not only to tobacco but also to the PR firm's other clients — "especially in the area of environmental health problems."

Photo of John Hill, founder of Hill & Knowlton.

The Influence of Hill & Knowlton

In 1972, Hill & Knowlton was the biggest and most profitable PR firm in the U.S. While the firm had separated itself from the Council for Tobacco Research (CTR) in 1969 due to increasing conflict with CTR's lawyers over its research program, Hill & Knowlton continued to deploy tobacco-type tactics for its other industry clients facing controversies over their products, such as lead in 1971, polyvinyl chloride in 1974, and saccharin for the Calorie Control Council in 1977.

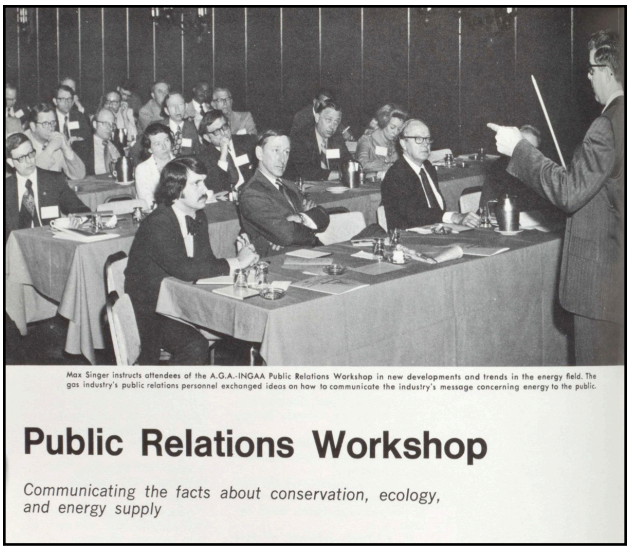
Throughout the 1970s, the Hill & Knowlton playbook, which had been successful for tobacco, would be adopted by other PR firms and deployed on behalf of multiple industries. For example, by 1980, Burson-Marsteller, one of Hill & Knowlton's closest competitors, would gain the Tobacco Institute account. A 1979 "long-range communication plan" for the Tobacco Institute, developed with the assistance of Burson-Marsteller, illustrates in detail how Burson-Marsteller advocated for tactics from the playbook developed by John Hill and his Hill & Knowlton executives.

It's not clear from currently available records which PR firms were employed by AGA at which points in the 1970s. O'Dwyers PR Directory states that in 1971, Burson-Marsteller represented AGA. But no listing for AGA appears for the year 1972 or thereafter for the rest of the 1970s. Editions of *AGA Monthly* from this period, however, show that senior executives from both Hill & Knowlton and Burson-Marsteller appeared at AGA events between 1971 and 1975.

For example, an *AGA Monthly* article reveals that at the opening session of the April 1972 Public Relations Workshop hosted by AGA and the Interstate Natural Gas Association of America (INGAA) at Disney World in Florida, Hill & Knowlton's president, Richard Darrow, offered the gas industry several solutions to the challenges posed by "the energy gap, pollution and consumer concerns."

Massive, consistent, long-range public relations programs

While the *AGA Monthly* article contains only fragments of Darrow's 1972 address, the full version was printed in a 1975 book comprised of Hill & Knowlton executive speeches. Stating that he'd been asked to look at a "recent survey of consumer attitudes conducted for the American Gas Association (AGA) and to suggest some ways to cope" with problems related to "the energy gap, pollution and consumer concerns," Darrow told the gas industry it needed to mount "massive, consistent, long-range public relations programs."



Attendees at the 1973 AGA-INGAA public relations workshop.

"Continuing research, continuing action, continuing planning on the issues that affect your business must be part of your daily activities," Darrow stated at the conference.

Saying that he had been "a consultant" for the gas and oil industry "for many years," Darrow told his audience that getting ahead of bad news was vital. "When a crisis hits, it is usually too late to do the kind of background work and planning that is fundamental to a strong communications effort," he explained.

> "*If you don't help inform them, they'll get all their information from your critics.*"
>
> - Hill & Knowlton's Carl Thompson address to the 1973 AGA Public Relations Workshop

Instead, it was essential for industry to "explain as fully as possible what the situation is" and, if possible, to "do this before the critics take the floor."

Under a subheading labelled "*Environmental Issues - Real and Contrived*," Darrow referred to a recently published report that had identified "gas appliances" as "major indoor polluters," pointing out how such criticisms could become a problem for the industry.

Offering a potential solution aimed at "quieting" consumer fears, Darrow asked: "Do we know enough about pollution within the home? And can we say something useful about this problem?"

To make its "voice heard," Darrow advised the gas industry to enter the "arena armed with viable and convincing practical solutions." He explained, "In today's climate there is no place for the American businessman to hide. But there is an opportunity to become involved in the ferment and hopefully to play a significant role in shaping the decisions that will affect the future course of the nation – and, not so incidentally, the ability of business to keep on making fair profits."

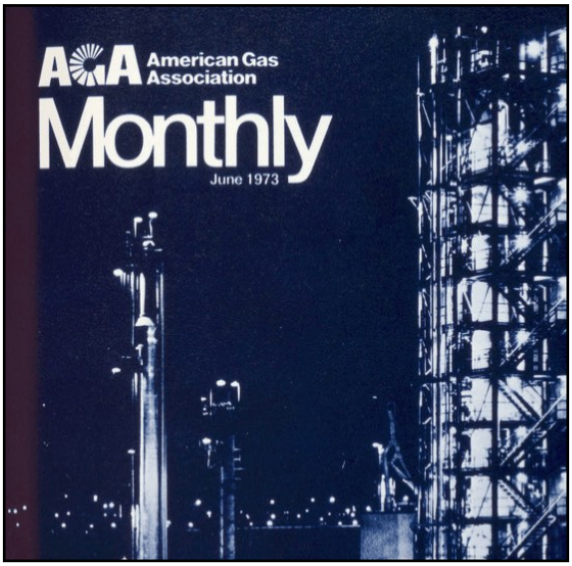
Speaking at the Workshop's opening session with Darrow was John W. Morton, chairman of INGAA. Morton was also president and CEO of Cities Service Company (now known as CITGO), a long-standing Hill & Knowlton client that was a large gas supplier for gas and electric utilities. By 1972, Hill & Knowlton also represented El Paso Natural Gas, Lone Star Gas, Continental Oil, Marathon Oil, R. J. Reynolds Industries (the tobacco giant which also owned the American Independent Oil Company), the Pennsylvania Electric Association, and the American Petroleum Institute (the powerful trade association that was the principal representative of the major U.S. oil and gas companies).

The following year, both Elias Buchwald (president of Burson-Marsteller) and Carl Thompson (head of Hill & Knowlton's Department of Environment and Consumer Affairs) addressed AGA's 1973 Public Relations Workshop in New Orleans.

Elias Buchwald's speech, printed in full in the October 1973 edition of *AGA Monthly*, illustrates how elements of the Hill & Knowlton formula were already being promoted by Burson-Marsteller. Listing gas

industry PR priorities, Buchwald urged that "immediate and very serious attention" be given to "third-party endorsement" (Hill & Knowlton's "weighty scientific views"). In the face of environmental challenges, Buchwald also advocated another key Hill & Knowlton tenet - constant vigilance. There was a "continuing need," said Buchwald, for the industry to "remain alert and address ourselves to newly emerging environmental challenges such as that which was recently brought into question the health effects of **carbon monoxide pollution in homes**." (emphasis added)

Meanwhile, Hill & Knowlton's Carl Thompson participated in "an intense panel discussion on energy and the environment." Like Darrow, Thompson had been central to Hill & Knowlton's tobacco account and was "regarded as the principal contact or informational source" at the Tobacco Institute.



Cover of AGA Monthly, June 1973

Echoing Darrow's advice from the previous year, Thompson declared, "The energy industry must work harder at face-to-face communication with the public in order to let them know what the situation is."

"If you don't help inform them," Thompson told the gas industry's PR men, "they'll get all of their information from your critics.'"

Documents in the John W. Hill papers at the Wisconsin Historical Society Archives show that these presentations weren't the first time Hill & Knowlton executives provided recommendations to the gas industry.

In 1954, Hill & Knowlton had conducted a $1.7 million crisis campaign for the oil and gas industry's Natural Gas and Oil Resources Committee (NGORC) – an ad hoc committee consisting of the major U.S. oil and gas producers mobilized to fight government regulation of natural gas prices. Hoping to capitalize on this campaign, a team of Hill & Knowlton's top executives pitched the idea of a continuing, long-range PR program to the gas producers.

While historians have extensively covered this crisis campaign, Hill & Knowlton's pitch to gas producers for a long-range PR program has been largely overlooked.

Tucked inside Hill & Knowlton documents marked as "confidential" and produced specifically for the gas industry in 1955-6, the agency's top executives proposed a "long-range information program" that contained many elements of the PR firm's 'tobacco' strategy.

According to these documents, the head of Hill & Knowlton's tobacco account, Richard Darrow, was simultaneously a member of its early gas industry team, which told gas industry leaders in 1955 that "in any long-range program ... facts should be gathered on a regular basis" to "support industry claims and counteract misinformation" and recommended the same strategy of sponsoring research at "leading universities or research institutions" to "question the accuracy of facts and interpretations about the industry from government and outside sources." Hill & Knowlton promised that this "intensified research" would "have immediate usage in regular publicity releases."

These 1950s documents also reveal the PR firm offering the benefits of its "Washington

Service" to the gas industry, specifying that: "A major function of public relations service in Washington is to send important Congressmen and key governmental officials facts relating to the gas industry when needed for special reports, studies, speeches, etc."

While records suggest that gas producers did not pursue Hill & Knowlton's proposal for this long-range program in the 1950s, elements of this program and the 'tobacco' strategy it contained are strikingly visible in the actions taken by the gas industry in the 1970s. Indeed, documents show Darrow offered a revised version of his firm's tried-and-tested formula while onstage in 1972, adjusted to fit the new set of challenges the gas industry faced.

"It has been our experience that the critics come back again and again with new facts or alleged facts, with new allies and with new proposals for regulation and restrictions," Darrow told the assembled industry representatives in 1972.

Hence, he recommended that "continuing research" be a part of the gas industry's "daily activities." "When faced with problems that involve the public, we must be willing to explain as fully as possible what the situation is, how we are part of this problem, what we are doing about it, what it will cost us, what it will cost the public and what problems are presently beyond solution. And we should do this before the critics take the floor and demand it," concluded Darrow.

In line with this strategy of proactive yet defensive research, industry documents reveal that AGA began funding epidemiological studies investigating the possible health effects of NO_2 emissions from gas stoves at *Battelle Laboratories*.

It was an investment that would pay dividends. But why Battelle?

3. The Sponsor's Interests And Wishes

Summary: By June 1972, AGA was sponsoring epidemiological research at Battelle Laboratories, a private lab that had a history of working for both the Hill & Knowlton-founded Council for Tobacco Research and multiple cigarette manufacturers including Philip Morris, Lorillard, British American Tobacco and Brown & Williamson, as well as the oil and automobile industry. Battelle had a track record of publishing information "consistent with the Sponsor's interests and wishes," as evidenced by memos from the 1950s and 1960s. While a growing body of non-industry-funded, independent research increasingly identified a positive association between nitrogen dioxide emissions from gas stoves and respiratory illness throughout the 1970s, the AGA-funded studies reported no association between gas stoves and respiratory illness. Additionally, AGA-funded scientists did not disclose that funding in industry publications or in the independent journal *Environmental Research*, which published the studies in 1979; the online version still does not mention AGA funding today. These AGA-funded studies distorted and delayed the process of scientific research, prompting at least one group of researchers to question the results of their study and weighting the outcomes of literature reviews and statistical analyses in the industry's favor. They also delivered PR benefits, providing an appearance of 'independence' and allowing the gas industry to manufacture a 'controversy' over the harmful link between NO_2 emissions from gas stoves and respiratory illness.

> "*Historically, the joint industry funded smoking and health research programs have not been selected against specific scientific goals, but rather for various purposes such as public relations, political relations, position for litigation, etc.*"
>
> - 1974 Memo from Alexander Spears, Lorillard Tobacco Company's director of research and development

One of the fundamental services provided by Hill & Knowlton to its Big Tobacco clients was the recruitment of scientists for the Tobacco Industry Research Committee (TIRC), later renamed the Council for Tobacco Research (CTR), to provide the appearance of credible, apparently independent third-party endorsement of the industry's position. In the 1970s and 1980s, the gas industry similarly funded scientists who would provide the appearance of credible, apparently independent endorsement of the gas industry's position.

Original TIRC documents from the tobacco litigation legacy archive held at the University of California San Francisco's Industry Documents Library reveal that Hill & Knowlton helped the tobacco industry to select the TIRC's scientific director and hand-picked respected academics and researchers for its Scientific Advisory Board. That Scientific Advisory Board, in turn, approved grant requests from individual researchers meticulously screened by TIRC staff – overseen by Hill & Knowlton. As Harvard Professor Alan M. Brandt detailed in "*Inventing Conflicts of Interest: A History of Tobacco Industry Tactics*," Hill & Knowlton was "always on the lookout for skeptics (and, even better, skeptics who smoked)." These ostensibly independent third-parties were intended to validate the tobacco industry's asserted position, to reassure the public, and to encourage the perception of a controversy over the link between cigarettes and cancer.

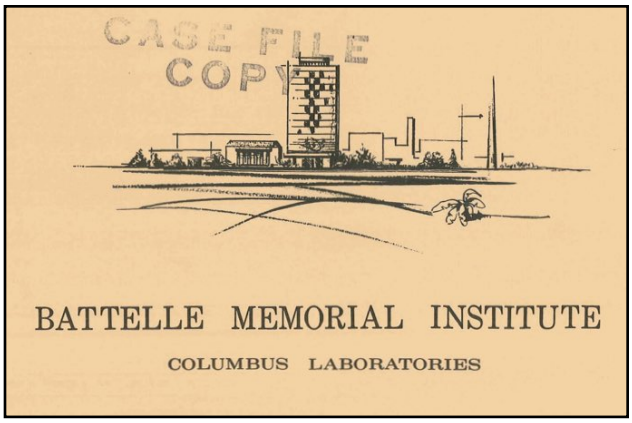


Image of a Battelle Memorial Institute research report, 1970.

Additionally, tobacco documents reveal that both the TIRC/CTR and individual tobacco companies also sponsored research at well-respected private laboratories, insisting on strict client confidentiality and, in some cases, the maintenance of a skeptical stance toward evidence correlating cigarette smoking with cancer and other diseases.

Battelle Laboratories had carried out research for individual tobacco companies Philip Morris, Lorillard, Brown & Williamson, and British American Tobacco as well as the CTR. It had also conducted research. funded by the American Petroleum Institute (API) and Automobile Manufacturers Association (AMA) in the 1960s and early '70s.

Communications between the American Gas Association and Battelle have not surfaced to date, but Battelle's correspondence with its tobacco clients from this period gives indications for why the gas industry might have chosen the laboratory as a suitable candidate to conduct its research.

A 1968 letter from Battelle's Chief of Physiology and Pharmacology, Dr. Joseph B. Boatman, to Brown & Williamson referred to an agreement made between the tobacco giant and Battelle that "all manuscripts" would be cleared by Brown & Williamson's office "prior to submission" and emphasized, "Battelle's view that **published information must be consistent with the Sponsor's interests and wishes.**" (emphasis added)

A project authorization letter authored by Battelle's Dr. Boatman in May 1969, signed by both Battelle and Brown & Williamson representatives, summarized Battelle's acceptance of the uncertainty of scientific studies associating cigarette smoke with human health impacts.

"In our opinion, the scientific literature has thus far established no definite evidence that there is correlation between such acute toxicity laboratory studies and the potential influences of tobacco smoke on human health," it read.

These types of agreements were typical. For example, a similar agreement was signed between Battelle and the TIRC in 1955, while another contract signed between Battelle and tobacco giant Philip Morris, dated October 20, 1970, stated: "BATTELLE-COLUMBUS agrees not to publish or make known to others the results obtained from PROJECT, as embodied in reports and other correspondence transmitted to SPONSOR, without approval in writing from SPONSOR." (original emphasis)

Battelle's work in the 1970s for its fossil fuel industry clients, the American Petroleum Institute (API) and Automobile Manufacturers Association (AMA), operated under similar terms. API and AMA records show that between 1970 and 1975, Battelle had contracts with API and AMA worth hundreds of thousands of dollars. In 1972, API and AMA had contracted Battelle on at least four separate projects involving the investigation of pollutant emissions. These projects happened as part of API and AMA's membership in the Coordinating Research Council (CRC) in cooperation with the EPA. Under the CRC's agreement with the EPA all progress and final reports would be submitted "for review, acceptability of content" and judgement as to whether reports would be made "available to public."

Records indicate that Battelle may have also similarly embraced uncertainty in its work for the CRC. A 1973 CRC Annual Report

(discovered in the U.S. National Archives) states that Battelle's study on particulates formed part of a wider series aimed at placing "automobile related particulates in proper perspective" and would assess the influence of "five" other "environmental variables." And, although the Battelle studies on "*Haze Formation*" and "*The Fate of Nitrogen Oxides*" ultimately identified fossil fuel emissions as the main cause of both haze and elevated levels of nitrogen oxides, Battelle's authors advocated a skeptical stance, recommending that "continued investigations" into haze formation were required; and warning that any generalization of findings showing a "negligible" contribution to nitrogen oxides by non-automobile sources should be "regarded with some degree of skepticism."

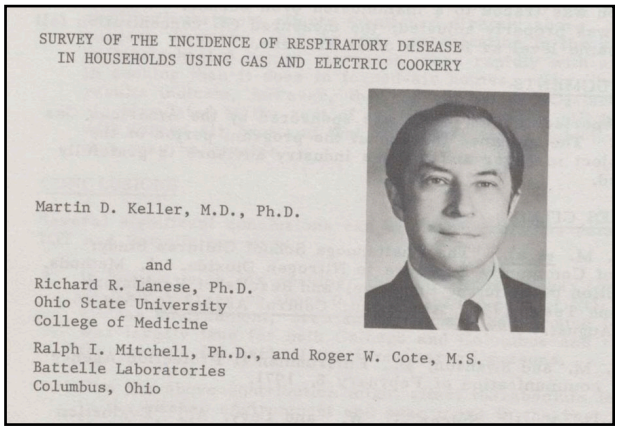
While correspondence and contracts between AGA and Battelle have not surfaced from this era, the tobacco and CRC documents from the same period suggest, firstly, that Battelle might also have taken a similarly skeptical stance when researching the relationship between NO_2 emissions from gas stoves and respiratory illness; and, secondly, given that the AGA-funded Battelle studies consistently reached conclusions amenable to the gas industry, that the laboratory may have maintained a similar contractual stipulation "that published information must be consistent with the Sponsor's interests and wishes."

The Research Team

Members of the AGA-funded research team may also have been selected for reasons beyond their scientific competence.

Tobacco legacy documents show that Ralph I. Mitchell, one of the two Battelle researchers recruited for the AGA's epidemiological studies, had conducted research for Philip Morris in 1959 and requested further sponsorship from Philip Morris in 1964 and the Cigar Research Council in 1972 – the same year the AGA began funding its epidemiological research at Battelle. Mitchell's letter to the Cigar Research Council suggested a potentially diversionary avenue of scientific investigation previously favored by the TIRC. Mitchell had also worked on the CRC-sponsored Battelle particulate pollution study, intended to place "automobile related particulates in proper perspective," from June 1971 to June 1972. Mitchell, therefore, moved straight from a project funded by API/AMA onto a project funded by AGA.

Two researchers from the Ohio State University College of Medicine, Dr. Martin Keller and Dr. Richard Lanese, also joined the Battelle scientists on the epidemiological studies – a move that would have given the AGA-funded research a greater appearance of independence and increased credibility.


SURVEY OF THE INCIDENCE OF RESPIRATORY DISEASE
IN HOUSEHOLDS USING GAS AND ELECTRIC COOKERY

Martin D. Keller, M.D., Ph.D.

and

Richard R. Lanese, Ph.D.
Ohio State University
College of Medicine

Ralph I. Mitchell, Ph.D., and Roger W. Cote, M.S.
Battelle Laboratories
Columbus, Ohio

Dr. Martin Keller joined Battelle scientists on epidemiological studies, 1972.

Records show that the Tobacco Institute tracked both Keller and Lanese. For example, tobacco documents show that a 1969 study on the prevention of coronary heart disease by Keller included a hand-written note from an employee at Philip Morris on the "Behavioral potential involved in study," while a copy of the same study found in the Tobacco Institute's library was marked "FILE Keller," likely indicating that the Tobacco Institute maintained a file under his name. Studies such as Keller's, which attributed disease at least partly to human "behavioral" (or lifestyle) factors, rather than the inherent effects of pollutants, were attractive to the tobacco industry since they deflected attention away from cigarette smoking to other factors as a cause of illness.

Another study published in 1972 by Keller and Lanese was separately on file in the Tobacco Institute library, marked "FILE AUTHORS YOUTH," illustrating that the Tobacco Institute also likely maintained a file under Lanese's name. This second study applied a "multivariate conceptual approach" to the analysis of smoking behavior in teenagers – a particular statistical approach adopted by the tobacco industry to potentially attribute blame for cancer caused by smoking to "other relevant factors." This statistical approach was actively sponsored and developed by the tobacco industry under the watch of Hill & Knowlton.

Keller and Lanese would have checked many of the necessary boxes for a gas industry searching for suitable candidates to conduct its sponsored research. Both were scientists from a prestigious institution who had published research in numerous peer-reviewed journals. Keller's 1968 CV shows that he had been listed in *American Men of Science*, 1965. Additionally, Keller's later writings on behalf of AGA reveal his conservative attitude to the setting of official air pollution standards, coupled with a demand for a high burden of proof that may also have made him an attractive candidate for the gas industry.

Additionally, Ohio State University conducted research for the Coordinating Research Council in partnership with EPA between 1971 and 1973 into the effects of carbon monoxide on drivers. (Keller and Lanese were not involved.) A 1973 document shows the total contribution by API and AMA of $154,303.

"No Significant Difference"

The AGA-funded epidemiological research program began in June 1972, jointly conducted by Ralph I. Mitchell and Roger W. Cote (of Battelle Laboratories) and Martin D. Keller and Richard R. Lanese (of the Ohio State University College of Medicine). By the spring of 1974, the first of these studies, "*Survey of the Incidence of Respiratory Disease in Households using Gas and Electric Cookery*," was presented at an industry conference hosted by the Institute of Gas Technology and the American Gas Association in Dallas, Texas. The study, which listed Mitchell as the lead author, identified peak NO_2 levels in the gas cooking households that "were generally eight times higher than the 24-hour average."

Table 3 — NO_x Monitoring

Type	Range (pphm) NO_2	Range (pphm) NO	Average (pphm) NO_2	Average (pphm) NO
Gas homes	0.5-11	1-41	5	11
Electric homes	0- 6	0-34	2	7
Outdoors	1.5- 5	0.5-22	3	4

Survey of the Incidence of Respiratory Disease in Households Using Gas and Electric Cookery, from 1974, identified peak NO_2 levels in the gas cooking households that "were generally eight times higher than the 24-hour average."

Despite this, the authors found "no significant difference in reported respiratory illness between the members of households cooking with gas and those cooking with electricity."

In June 1974, an almost identical paper, listing Keller as its lead author, was presented to the public at the 67th Annual Meeting of the Air Pollution Control Association in Denver, Colorado.

The Mitchell et al. and Keller et al. studies contained methodological problems that may have affected their results. Firstly, the studies were based on a relatively small volunteer sample, and, more seriously, parental smoking was not included as a variable for children.

In addition to analyzing data collected from its studies of households in Ohio, the AGA-funded study specifically targeted the EPA's Long Island study, obtaining this data from the EPA and reanalyzing it. Where the EPA researchers had found an increased incidence of respiratory problems in gas stove households from the data collected from the Long Island community, the AGA-funded researchers' reanalysis found "*no significant difference*."

This type of 'data capture' appears to have been pioneered by the tobacco industry on the advice of Hill & Knowlton, which paid its own statisticians to analyze data on smoking and various diseases obtained from leading medical establishments and research institutions – a practice that had proved to be an effective weapon against health effects research.

Automatic Interaction Detector

The Mitchell et al. paper (1974) describes how the AGA-funded researchers applied a new and controversial statistical technique to analyze both their results and those of the EPA researchers. Known as the *"Automatic Interaction Detector"* method (or A.I.D.), the authors argued that this method allowed the combined effects and interaction of a large number of variables to be examined, freeing their analysis from the "stringent assumptions" of traditional analytical methods. Mitchell et al. used A.I.D. to analyse the data collected for mothers and fathers. Traditional multiple regression analysis was used for data pertaining to children. According to the study's authors, "the expense of A.I.D. analysis was not warranted."

While the AGA-funded researchers were applying this A.I.D. technique, other scientists were raising concerns about its accuracy, including A.I.D. 's own developers who cautioned against its application to data sets smaller than a thousand - such as those analyzed by the AGA-funded authors. According to one professor, A.I.D. was "commonly misused and misinterpreted."

Nevertheless, in 1979, the AGA-funded authors published their results obtained via A.I.D. in the *Journal of Environmental Research* – this time with Martin D. Keller listed as the lead author. Keller et al.'s *"Respiratory Illness in Households Using Gas and Electricity for Cooking, I. Survey of Incidence"* reported that the authors had found "no evidence to suggest that cooking with gas is associated with an increase in respiratory disease or a decrease in pulmonary function."

Keller published a second study in the same edition of Environmental Research. The second study, "Respiratory Illness in Households Using Gas and Electricity for Cooking, II Symptoms and Objective Findings," claimed to validate the findings of the 1974 Mitchell et al. data and again reported "no significant difference" in "acute respiratory illness incidence between gas- and electric-cooking households."

Funding Not Disclosed

Evidence shows that the gas industry funding of these epidemiological studies was not uniformly disclosed.

For example, unlike other authors in the same volume, Keller et al. do not refer to their AGA funding in *Environmental Research*, which published the two Keller et al. studies (*I. Survey of Incidence* and *II. Symptoms and Objective Findings*) in 1979; AGA funding is still not disclosed in today's online versions of this journal. By contrast, disclosures of external support from both government and commercial sources are made by authors of other studies published in the same volume of *Environmental Research*.

Additionally, Keller et al.'s industry affiliation is not detailed in the official program listing the authors' presentations of their work at the Air Pollution Control Association's Annual Meetings in 1974 or 1975, despite AGA funding of other types of research being disclosed elsewhere in the program. Nor is any disclosure found in the Proceedings of the Third Conference on Natural Gas Research and Technology, which published the Mitchell et al. study in 1974 (likewise, AGA support for another study is disclosed in those proceedings). Nor is it disclosed in the ERDA Energy Research Abstracts for 1977.

In 1981 and 1982, AGA paid Dr. Keller to review the existing epidemiological evidence in two articles published in the AGA's official magazine, the *AGA Monthly*. Although AGA stated that its Coordinating Group for Environmental Affairs had paid Keller to write the AGA Monthly articles, neither AGA

nor the authors disclosed AGA's original funding of the Mitchell et al. (1974) and Keller et al. (1979) studies. Without mentioning that AGA had funded them, Keller cited both these studies in his AGA Monthly articles as evidence that gas cooking had not been proven a "health hazard."

Furthermore, AGA failed to disclose its funding of the Mitchell et al. (1974) and Keller et al. (1979) studies as recently as March 2023. Responding to questions related to a March 2023 Climate Investigations Center article for DeSmog, AGA replied, "AGA supported a 1982 review of the available research that found no causative link between gas stoves and asthma, a conclusion shared by regulatory agencies." AGA provided DeSmog with a copy of this "1982 review," which was Keller's 1982 *AGA Monthly* article. However, despite using the review to undermine health effects science associating gas stove emissions with asthma, the AGA did not disclose its funding of the Mitchell et al. (1974) and Keller et al. (1979) studies cited within Keller's "1982 review."

by Keller et al. to determine the gas range's potential to affect public health." Published in *AGA Monthly* in 1982, the footnotes of this paper reveal that these "epidemiological studies sponsored by AGA" refer to the studies by Mitchell et al. (1974) and by Keller et al. (1979).

AGA sponsorship of the Battelle / Ohio State epidemiological studies is also disclosed in a 1982 gas industry report on "Indoor Air Quality" published by the industry-funded Gas Research Institute. This "Indoor Air Quality" report states that: "Two studies conducted by Battelle-Columbus Laboratories in the early 1970s, with support from the American Gas Association (AGA) found no relationship between exposure to NO_2 and adverse health effects."

Putting Gas Range Emissions in Perspective

(Editor's Note: The following American Gas Association paper was presented at the International Symposium on Indoor Air Pollution, Health and Energy Conservation, held Oct. 16, 1981 at the University of Massachusetts.)

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The AGA paper, "*Putting Gas Range Emissions in Perspective*," was presented at a Symposium of Indoor Air Pollution held at the University of Massachusetts in 1981.

The Papertrail

The Climate Investigations Center has, nevertheless, identified evidence of industry funding of the Mitchell et al. and Keller et al. epidemiological studies.

AGA funding is mentioned in the 1981 AGA paper, "*Putting Gas Range Emissions In Perspective*," presented by Robert W. Welch, Chairman of the AGA's Coordinating Group for Environmental Affairs, at a Symposium on Indoor Air Pollution held at the University of Massachusetts. In the paper, Welch refers to "two epidemiological studies sponsored by AGA" and mentions Keller by name, stating that, in order to validate the results of the first study, "AGA sponsored a second study

PR Benefits and Scientific Impact

"If you don't help inform them, they'll get all their information from your critics," Carl Thompson (Hill & Knowlton) to the gas industry, 1973

PR Benefits: AGA and other industry groups used the AGA-sponsored studies, carried out by seemingly 'independent' third parties, to lend credibility to the gas industry's efforts to counter studies that NO_2 emissions from gas stoves are linked to respiratory problems.

As early as May 1974, the AGA-funded authors presented their work at the Annual

Meeting of the Air Pollution Control Association (APCA) during the first-ever APCA session concerned explicitly with "residential type emissions." Named as the lead author, Dr. Martin Keller stated that "the overall outcome of the analyses employed in the present study indicate no significant difference in reported respiratory illness between the members of households cooking with gas and those cooking with electricity." The session chairman, Stephen P. Cauley of the Mobil Oil Corporation (which itself owned significant gas assets), amplified the message, informing those present that "levels of gas combustion emissions within the residence environment are quite small and have not shown any contributory effects upon respiratory illness."

The AGA-funded authors continued to present their findings at air pollution, health, and industry conferences throughout the mid-1970s, allowing AGA and other gas industry groups to reassure key stakeholders and, ultimately, the public about gas stove emissions.

AGA representatives also exaggerated the implications of Keller et al.'s findings. In his presentation to the University of Massachusetts Symposium, AGA's Welch used Keller et al.'s findings to claim that the available epidemiological evidence was contradictory and uncertain. But he also went further, using this uncertainty as a stepping-stone for the much bolder claim that gas stove emissions were "not a source of respiratory illness in the indoor environment." A few months later, Welch's paper was printed in full in *AGA Monthly*.

As described above, AGA has used studies it funded in the 1970s as recently as 2023 as a reference when countering evidence of an association between NO_2 from gas stoves and respiratory illness – again without acknowledging its funding of these studies.

Scientific Impact: These AGA-funded studies likely contributed to delayed scientific understanding of the health effects of NO_2 emissions from gas stoves by countering what might otherwise have been an emerging scientific consensus during the 1970s and early 1980s. That happened through multiple mechanisms:

1. **Distorting independent scientific or government literature reviews and statistical analyses** – The inclusion of these industry studies in literature reviews of the existing evidence and statistical analyses of epidemiological data has weighted outcomes in the gas industry's favor by causing researchers reviewing or analyzing the balance of evidence to conclude that the results of studies conducted to date were "inconclusive" or that "further field studies" were needed, or that the degree of association between NO_2 and respiratory illness was weaker than it would otherwise have been. For example:

- EPA's 1976 report on indoor air pollution cited the Keller et al. studies before concluding that: "Further field studies to determine short-term NO_2 exposure and effects are required particularly in homes using gas-fired appliances;"

- National Academy of Sciences' report "Indoor Pollutants (1981)" also cited the Keller et al. studies and stated, "the evidence of health effects after prolonged exposure at low concentrations is inconsistent … Evidence that nitrogen dioxide induces excess chronic respiratory disease is not convincing" p.359); and

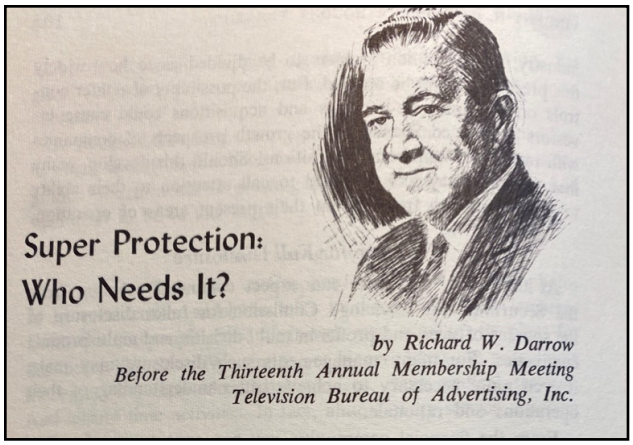
- Hasselblad et al. - this 1992 Duke University and EPA meta-analysis of the available epidemiological evidence, suggested the existence of "an increase of at least 20 percent in the odds of respiratory illness in children exposed to an increase of 30 micrograms/m(3) NO_2." Without the inclusion of the AGA-funded studies, Hasselblad et al.'s meta-analysis would most likely have found "the odds of respiratory illness in children exposed to 30 micrograms/

m(3) NO_2" to be higher than the "20 percent" increase they calculated).

2. **Causing researchers to question their results during this crucial early period of indoor emissions health effects research** - In a 1979 study published in the International Journal of Epidemiology, U.K. researchers Florey et al. identified an association of respiratory illness among primary schoolchildren with exposure to very low NO2 concentrations. However, because of the "inconsistency" between these results in the U.K. and "those from several studies in the U.S.," the authors concluded it was possible that other factors, such as "temperature or humidity," were responsible for the prevalence of respiratory disease. The "studies in the U.S." referenced by Florey et al. included the AGA-funded studies conducted at Battelle Laboratories.

3. **Influencing research over five decades** – Since the 1979 publication of the Keller et al. studies in *Environmental Research*, this undisclosed industry-funded research has since been cited in at least 35 separate studies by researchers around the world (including the U.S., Thailand, Japan, and the U.K.). See full list on Scopus.

4. **Inserting another layer of distortion when included in industry-funded versions of these literature reviews or statistical analyses,** for example, the two 1981 gas-funded literature reviews carried out by Arthur D. Little and H. Daniel Roth (especially when, in the case of the Roth review, this funding source was again not disclosed). Sponsorship of industry-friendly literature reviews and statistical analysis used to attack evidence linking cigarette smoking to cancer was a tactic deployed by the tobacco industry on the advice of Hill & Knowlton.



Sketch of Richard Darrow from Hill & Knowlton's 1968 publication, "Current Thoughts on Public Relations."

In summary, these AGA-funded studies have enabled the gas industry to deny the harms of indoor NO_2 exposure from gas stoves, attack the conclusions of non-industry researchers, and manufacture controversy over the science of indoor NO_2 exposure and its health impacts.

As predicted by Hill & Knowlton's Richard Darrow in 1972, this industry-funded research also played a "role in shaping the decisions" made by the U.S. EPA and CPSC, possibly delaying regulatory action that could have prevented harm or damage (see chapter, "Shaping the Decisions").

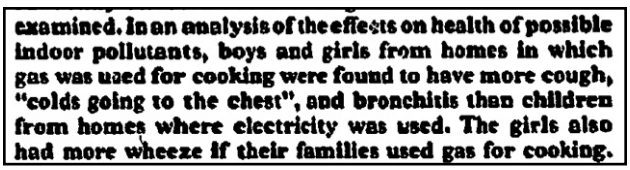
4. An Emerging Health Problem

Summary: Epidemiological researchers around the world continued to find associations between gas stove emissions and respiratory illness throughout the 1970s and early 1980s. Clinical trials also examined the effects of NO_2 in human volunteers exposed for short periods of time under carefully controlled conditions. Some researchers found marked increases in "airway resistance" even at low levels of NO_2 exposure. Likewise, experiments conducted on animals throughout the 1970s showed that repeated exposure to NO_2 at levels as low as 0.5 ppm (500 ppb) produced discernible "biological effects." Results also indicated a cumulative effect, suggesting that "intermittent short-term exposure to NO_2" (such as that experienced indoors as a result of gas stove emissions) "may eventually become equivalent to continuous long-term exposure." By the end of the 1970s, this growing body of evidence escalated calls for regulatory action on indoor air pollution.

In contrast to the AGA-funded studies, independent researchers worldwide continued to find associations between gas stove emissions and respiratory illness in children and adults throughout the 1970s and early 1980s.

Epidemiological studies

In 1977, a U.K. study by Melia et al., published in the British Medical Journal, found that "Boys and girls from homes in which gas was used for cooking were found to have more cough, "colds going to the chest," and bronchitis than children from homes where electricity was used. The girls also had more wheeze if their families used gas for cooking." The authors concluded that "elevated levels of oxides of nitrogen arising from the combustion of gas might be the cause of the increased respiratory illness."


examined. In an analysis of the effects on health of possible indoor pollutants, boys and girls from homes in which gas was used for cooking were found to have more cough, "colds going to the chest", and bronchitis than children from homes where electricity was used. The girls also had more wheeze if their families used gas for cooking.

Melia et al.'s "*Association between gas cooking and respiratory disease in children,*" published in 1977, identified respiratory symptoms among children in homes where gas was used for cooking.

In 1979, the same research team published a series of three follow-up papers in the International Journal of Epidemiology. The first of these papers (Melia et al., 1979) identified a higher prevalence of respiratory symptoms among children (aged 5-10) in homes where gas was used for cooking than in those where electricity was used. The association appeared independent of age, sex, social class, number of cigarette smokers in the home and latitude, but it was only found in urban areas. The second paper (Goldstein et al., 1979) showed that NO2 levels in homes increased proportionately with gas stove usage. Dr. Bernard Goldstein was a U.S. researcher who joined the U.K. research team between 1977 and 1978. The third paper (Florey et al., 1979) examined children aged 6-7 years and again found that "the prevalence of respiratory illness was higher in children from gas than electric cooking homes."

However, as previously described, the authors stated, "Because of the very low levels of NO2 at which an association with illness was observed and the inconsistency between our results in the U.K. and those from several studies in the U.S. it is possible that the NO2 levels were a proxy for some other factor more directly related to respiratory disease such as **temperature** or **humidity.**" (emphasis added)

Florey et al. gave details of these "studies in the U.S.," prompting the authors to reconsider their results. First on the list was the AGA-funded study at Battelle Columbus. However, instead citing the published Mitchell et al. study, Florey et al. reference Battelle's 1974 not yet peer-reviewed lab report, "Lutz, G.A. Mitchell, R.I, Cote, R. W and Keller, M.D., Indoor Epidemiology Study, Battelle Columbus, 1974" (the lead author cited was a Battelle biochemist Garson A. Lutz); and a presentation given by Mitchell et al. at a 1975 symposium in Luxembourg. Florey et al. also referred to two further sources that did not "demonstrate an effect of living in a home with a gas cooker" - an unpublished EPA study for which no specific reference is given and a letter to the editor of the Lancet from two U.S. and Canadian researchers whose research was primarily aimed at evaluating outdoor pollution and did not examine children under aged 7. Of the "studies in the U.S." referred to by Florey et al., the AGA-funded Battelle Columbus research was the most authoritative.

Records show that a utility coalition, the Utility Air Regulatory Group, harnessed the potential benefit of this apparent uncertainty. A 1981 gas industry document reveals that in 1980 Melia et al. presented their comments to the EPA Clean Air Scientific Advisory Committee on the "Health and Welfare Effects Associated with Nitrogen Oxides for Standard-Setting Purposes," reportedly emphasizing that the team's findings had been misinterpreted due to "a failure to consider the impact of other contributory factors." This 1981 gas industry document also records that Melia's comments pertinent to the setting of EPA Nitrogen Oxides Standards were prepared for the Utility Air Regulatory Group, an influential utility-funded group that has fought EPA Clean Air Act regulations.

This amplification of uncertainty echoes the diversionary attempt by the TIRC to encourage studies assessing the effects of "humidity and temperature" on lung cancer. According to a "confidential" list of its research priorities in 1959, "Heredity," "infection," "hormones," "nutrition" and "nervous strain or tension" were also prioritized alongside "humidity and temperature" as potential causes of disease whose research should be funded by the TIRC.

A 1982 follow-up study by Melia et al. concluded that "low temperatures and relative humidity do not appear to explain the association between respiratory illness and indoor levels of NO_2."

Meanwhile, in the U.S., other epidemiological studies were being conducted. In June of 1979, researchers from the Harvard 'Six Cities' study (investigating the health impacts of multiple pollutants across the U.S.) presented a paper at the Annual Meeting of the Air Pollution Control Association, which showed that "populations using gas appliances in a clean city can have NO_2 exposures similar to those of a populations using electric appliances but living in a more polluted city" (Spengler, et al.).

A year later, in 1980, the Harvard 'Six Cities' team published another study in the *American Review of Respiratory Disease*. Speizer et al. found that "Children with households with gas stoves had a greater history of respiratory illness before age 2 and small but significantly lower levels of FEV (Forced Expiratory Volume) and FVC (Forced Vital Capacity)." According to the authors, "These findings were not explained by differences in social class or by parental smoking habits." Measurements taken in the homes for 24-h periods by the Harvard researchers showed that "NO_2 levels were 4 to 7 times higher in homes with gas stoves than in homes with electric stoves." Based on the biology of lung growth, the authors surmised that "only minor difference in the rate of functioning lung growth in young children could lead to these children not reaching their full adult lung size" which might, in turn increase "subsequent susceptibility to developing obstructive lung disease."

In 1981, John Hopkins University researchers Comstock et al. found that "the use of gas for cooking was related to an increased frequency of respiratory symptoms and impaired ventilatory function among men,

being most marked among men who had never smoked." Although the study found no evidence that cooking with gas was harmful to women, the number of women included in the study was far smaller than the number of men. Only 57 women from gas-cooking households participated in the study, compared with 211 men.

According to the record of epidemiological studies viewed during this investigation, the only published studies not to find any association between gas stove emissions and respiratory illness were the AGA-funded Mitchell et al. and Keller et al. studies. A 1976 unpublished EPA study (referred to in a 1982 EPA Review of the National Ambient Air Quality Standards for Nitrogen Oxides) found "no increased respiratory illness associated with gas stove usage" in "housewives cooking with gas stoves compared to those cooking with electric stoves." However, because this study appears not to have been published, no further details (for example, about whether the gas stove emissions were vented, the study's sample size, participation rate, whether the study was controlled for the influence of smoking, etc.) are available.

Clinical Trials

In addition to epidemiological studies, a number of investigators were also conducting clinical trials, examining the effects of NO_2 in human volunteers exposed for short periods of time under carefully controlled conditions.

In 1976, Orehek et al. published the results of a limited clinical trial exposing 20 asthmatics to low levels of NO_2 – 188 μg/m3 (0.1ppm / 100 ppb) – for 1 hour. Even at this low level, marked increases in specific airway resistance were identified in 3 of the 20 subjects.

The levels of NO_2 exposure utilized by Orehek et al. were much lower than the levels routinely detected by researchers in gas stove kitchens. As a comparison, a 1976 survey by Hollowell et al. at the Lawrence Berkeley Laboratory had measured NO_2 concentrations of 2.5 ppm (2500 ppb) during and after gas stove use – i.e., 25 times higher than the level of NO_2 tested in Orehek et al.'s trial. This laboratory finding seems to be in the highest range of NO_2 concentrations generated by gas stoves, as identified by researchers. Nevertheless, since 1972, numerous researchers has identified specific peak NO_2 concentrations related to stove use that were much higher than those tested by Orehek et al. and consistently higher than the outdoor ambient standard. For example, 771 ppb was identified by Wade et al. in 1975, and Speizer et al. recorded 1,000 ppb in 1980. Speizer et al. also noted that exposures in excess of 1,100 μg/m3 [i.e., 585 ppb] "regularly occurred" in gas stove kitchens.

Table 2.

Air pollutants observed from a gas stove operating in an experimental room at a controlled air exchange rate of 1/4 air changes per hour.[a]

Parameter measured	Background		3-hr measurement period		Typical peak polluted urban levels
	Indoor	Outdoor	Gas oven on (1-hour average)	Gas oven off (2-hour average)	
CO (ppm)	.7	.8	35	60	10-20
NO (ppm)	.005	.040	0.8	1.2	.2-.5
NO_2 (ppm)	.045	.050	2.5	2.5	.2-.5
SO_2 (ppm)	.005	.005	.010	.020	.1-.5
S (as SO_4^{--}) ($\mu g/m^3$)	<1	<2	13	14	10-20
Aitken nuclei (no./cm^3)	20K	40K	3000K	200K	100-4000K
Submicron aerosol mass median diameter (μm)	.2-.3	.2-.3	.08	.2	.2-.4

[a]Measurements at center of 27 m^3 room for 3-hr period (gas stove oven operating for first hour only).

Lawrence Berkeley Laboratory measured NO_2 concentrations of 2.5 ppm during and after gas stove use in a 1976 survey by Hollowell et al. (Emphasis added)

According to a 1979 Duke University / EPA evaluation of the health consequences of NO_2 exposure, two other clinical trial studies in Germany by Beil, M., and W. T. Ulmer, 1976, and von Nieding et al., 1977 suggested that "NO_2 may well cause the release of vasoactive hormones, alter bronchial tone or increase mucus secretion. Such effects would tend to exacerbate pre-existing disease and to accelerate the natural course of bronchitis and asthma in man."

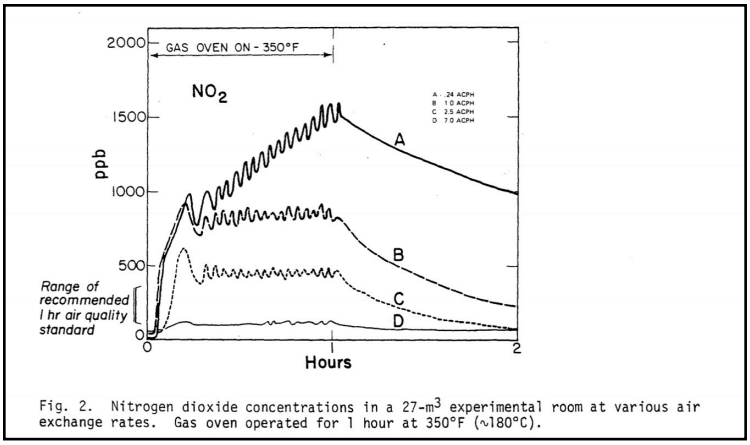


Fig. 2. Nitrogen dioxide concentrations in a 27-m^3 experimental room at various air exchange rates. Gas oven operated for 1 hour at 350°F (~180°C).

In 1978, Lawrence Berkeley Laboratory researchers again measured NO2 concentrations and found "elevated levels of gaseous air pollutants (CO, NO, and) and particulate sulfur and nitrogen compounds are present in indoor environments when gas appliances are in use."

Animal Studies

Experiments conducted on animals throughout the 1970s showed that repeated exposure to NO_2 even at levels as low as 0.5 ppm (500 ppb) produced discernible "biological effects" Results also indicated a cumulative effect with a delay in the onset of symptoms. This cumulative effect was "especially important," stated the Duke University / EPA reviewers, as it suggested that "intermittent short-term exposure to NO_2" (such as that experienced indoors as a result of gas stove emissions) "may eventually become equivalent to continuous long-term exposure." It also offered a possible explanation for the "confounding factors" observed in epidemiological data. "These observations," concluded the EPA reviewers, "may be particularly pertinent to the potential toxicity of this air pollutant to man."

Addressing a criticism often levied at animal exposures by industry representatives – that no models existed for accurately relating animal data to humans – the authors emphasized: "There is little doubt that the inhalation of NO_2 results in toxicity, regardless of the species which has been exposed. Thus, animal experiments are truly indicative of the hazard of this air pollutant to man."

By the end of the 1970s, this growing body of evidence escalated calls for regulatory action on indoor air pollution.

5. What Are Federal Agencies Doing About Indoor Air Pollution?

Summary: Indoor air pollution worsened in the mid-1970s with the introduction of energy conservation measures to address the energy crisis caused by geopolitical events. Policymakers introduced draft reduction standards to conserve heat, decreasing natural ventilation. Concerns over indoor air quality were accompanied by increasing support for regulation to protect the American public from the health effects of indoor pollution. In September 1980, the U.S. General Accounting Office issued a report titled *"Indoor Air Pollution: An Emerging Health Problem,"* recommending that the EPA be authorized to address indoor air quality. In response, the EPA commissioned the National Academy of Sciences (NAS) to produce a landmark report on *"Indoor Air Pollutants,"* a literature review that would "review, compile and appraise the available knowledge." Published in 1981, the NAS report, which weighed the evidence on the health effects of domestic NO_2 exposure, included the AGA-funded Battelle Laboratories studies in its analysis. To resolve 'inconsistencies' in the health effects studies, the NAS reviewers recommended that more research was necessary. Nevertheless, NAS's Executive Summary concluded that NO_2 exposure "may constitute a sufficient threat to the general public health to justify remedial action."

In the 1970s, geopolitical events pushed indoor air pollution to the top of the regulatory agenda. The oil embargo of 1973 and the ensuing energy crisis compelled the U.S. government to introduce energy conservation measures, leading to the introduction of draft-reduction standards for housing aimed at decreasing energy use for heating. Draft-free housing, however, meant a more significant build-up of indoor air pollutants. As a result, scientists and public officials began calling for regulations and standards to mitigate the effects of polluted indoor air.

In 1978, researchers at the Lawrence Berkeley Laboratory (LBL), who had been investigating NO_2 concentrations from indoor combustion sources for several years, presented a paper prepared for the U.S. Department of Energy assessing the impact of this reduced ventilation on indoor air quality in residential buildings.

The LBL study reported that "high initial levels of gaseous pollutants (CO, NO, and NO_2) ... are present in indoor air when gas appliances are in use," demonstrating that when the oven was in use for 1 hour, "NO_2 concentration exceeded the recommended 1-hour standards" even with high air exchange rates (ventilation). Furthermore, they stated, "experiments with the top burners of gas stoves" also showed "high levels of NO_2, even under well-ventilated conditions."

Based on field and laboratory measurements, LBL's Hollowell et al. indicated a potential impact "on human health," which, they stated, "may ultimately have a large impact" on "the need for more stringent control of air pollution from indoor combustion sources."

The levels of NO_2 measured by Hollowell weren't an aberration but were commensurate with NO_2 levels identified in industry-funded studies during and after this period. For example, an AGA-funded study from 1974 identified peak levels of NO_2 as high as 1.47 ppm (1470 ppb), approximately 28 times higher than the outdoor standard.

Reporters began to highlight the scientific community's concern. A June 1977 article in the *New York Times*, "*Air Pollution: It's Inside, Too*," shared early details of the LBL

researchers' findings. Air inside the home was often found to be "more polluted" than "air on a smoggy day outdoors," the Times reported, noting that the LBL researchers had found "extremely high levels of nitrogen gases" with peak levels "more than a thousand times higher" in gas stove kitchens than that in normal outside air. "Our primary concern is gas appliances," LBL's Gregory Traynor told the newspaper.

Air Pollution: It's Inside, Too

By WILLIAM CARLSEN

BERKELEY, CALIF.

THE smog is so thick it makes your eyes water. Even though the tears, you can see the brown-blue haze that coats the buildings in your city—New York, Chicago, Los Angeles or any other American city plagued with air pollution.

You rush home, close the doors and windows and breathe in relief—you're safe. Only you are not safe, say two University of California scientists whose research on indoor air pollution indicates that the air inside the home is often more polluted than air on a smoggy day outdoors.

The study, presented last month at the fourth international Clean Air Congress in Tokyo, also warns that the problem may be compounded because "new energy conservation measures call for sealing up buildings more tightly."

Supported by the United States Energy Research and Development Administration, the scientists have just completed initial studies on six, single-family homes in the San Francisco Bay area. The air in the houses was monitored with sophisticated instruments 24 hours a day. The houses were described by one of the researchers, physicist Gregory Traynor, as "typical 20 to 30-year-old California-type homes."

Results of the study showed that the levels of certain harmful pollutants in the houses were at times two to three times higher than existing air quality standards set by state and Federal agencies. Readings of one pollutant showed a level more than 1,000 times higher than that found in outdoor air on a normal day.

"Houses in the East or Midwest, especially in the winter, could contain even higher levels of pollutants than we found in California, because houses here are not so tightly sealed and insulated against the heat and cold," Mr. Traynor said.

The report, the first of its kind to look closely at indoor pollutants, listed a number of them: carbon monoxide, nitrogen oxide, nitrogen dioxide and sulphur dioxide from gas stoves and furnaces; carbon monoxide and other substances in cigarette smoke; vinyl-chloride and fluocarbons from aerosol spray cans; and organic compounds from products used in cleaning and cooking.

Mr. Traynor said medical research is underway to determine the health hazards of some of these pollutants. But, citing air standards set by the Environmental Protection Agency based on past medical research, he said, "some of these pollutants at high levels can clearly be harmful."

He added, "Indoor pollutants may be potentially more harmful than those outdoors, when you consider that the majority of the population spends more time indoors than out."

David Calkins, spokesman for the Local Environmental Protection Agency office here, said that the E.P.A. has never set air quality standards for indoor pollution. But he said that "pollutants such as carbon monoxide, nitrogen dioxide and sulphur dioxide have

Continued on Page C10

June 1977 article in the *New York Times*, "Air Pollution: It's Inside, Too."

AGA notified its member utilities and other recipients of their July 1977 magazine, AGA Monthly, to say AGA President George H. Lawrence called the article "inaccurate and based on a study which is questionable as to methodology and findings." The message to members also referenced a letter to the editor Lawrence authored, but it does not appear to have been printed.

In August 1979, the *Wall Street Journal* published a story titled, "*Indoor Air Pollution Worries Experts As Buildings Are Sealed to Save Fuel*," which featured the LBL results as well as findings from the Harvard Six Cities study that the prevalence of bronchitis and other respiratory diseases was "significantly higher" in children from gas stove homes. A spokesman for the American Gas Association was also quoted in the article, stating, "There have been isolated incidents of contaminants given off from gas appliances, but the exposures are so short-term that the hazard to health is minimal."

In March 1980, *Science Magazine* ran a feature titled "INDOOR AIR POLLUTION," which suggested that "by sealing up their homes, conservation-minded Americans may be aggravating a hidden health threat." In addition to nitrogen dioxide and carbon monoxide from gas stoves and other combustion appliances, the article also reported the dangers of soot and benzopyrene (from tobacco smoke), radon (from natural sources), and formaldehyde (from processed wood and adhesives).

An Interagency Research Group on Indoor Air Quality was established to coordinate research on indoor air pollution between federal agencies.

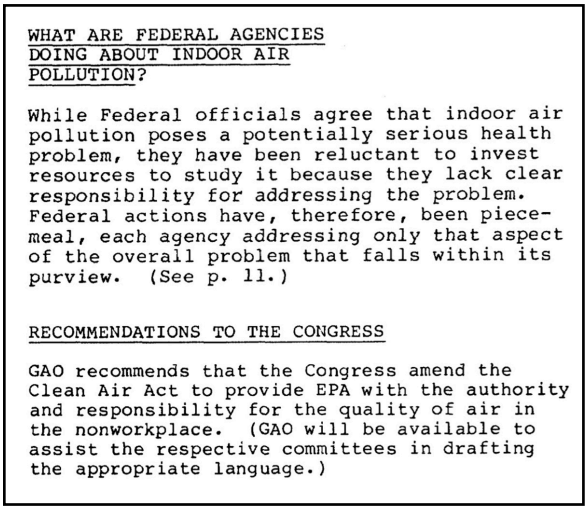
By September 1980, the U.S. General Accounting Office (GAO) issued a report titled *"Indoor Air Pollution: An Emerging Health Problem,"* recommending that the EPA be authorized to address indoor air quality.

"WHAT ARE FEDERAL AGENCIES DOING ABOUT INDOOR AIR POLLUTION?" asked the GAO Report before stating that a "comprehensive, coordinated program" was needed and that "Congress" should "amend the Clean Air Act to provide EPA with the authority and responsibility for the quality of air in the non workplace."

In response, the EPA commissioned the National Academy of Sciences (NAS) to produce a landmark report on *"Indoor Air Pollutants,"* a literature review that would *"review, compile and appraise the available knowledge."*

Published in 1981, a section of the NAS report weighed the evidence on the health effects of domestic NO_2 exposure. This section

illustrates the influence of the AGA-funded studies on independent reviewers. For example, the AGA-funded Keller et al. studies were one of only four sets of epidemiological studies assessed by the NAS reviewers. The NAS reviewers assessed studies by Melia et al. (1977; 1979), Florey et al. (1979), Speizer et al. (1980), and the Keller et al. studies (1979) with their undisclosed AGA funding. The inclusion of the AGA-funded Keller et al. studies influenced the NAS reviewers in the industry's favor. And so too did Florey et al.'s comments, prompted by the findings of Keller et al., that some "other factor" might be responsible for the disease prevalence detected in their study. The comments by Florey et al. were highlighted by the NAS reviewers and tipped the scales even further in the industry's favor.



WHAT ARE FEDERAL AGENCIES DOING ABOUT INDOOR AIR POLLUTION?

While Federal officials agree that indoor air pollution poses a potentially serious health problem, they have been reluctant to invest resources to study it because they lack clear responsibility for addressing the problem. Federal actions have, therefore, been piecemeal, each agency addressing only that aspect of the overall problem that falls within its purview. (See p. 11.)

RECOMMENDATIONS TO THE CONGRESS

GAO recommends that the Congress amend the Clean Air Act to provide EPA with the authority and responsibility for the quality of air in the nonworkplace. (GAO will be available to assist the respective committees in drafting the appropriate language.)

Excerpts from the 1980 GAO report, "*Indoor Air Pollution: An Emerging Health Problem.*"

In this way, gas industry-sponsored research had a significant influence on the NAS report's conclusions that: "The evidence of health effects after prolonged exposure at low concentrations is **inconsistent**;" and that the "Evidence that nitrogen dioxide induces excess chronic respiratory disease is **not convincing**." (emphasis added)

To resolve these 'inconsistencies,' the NAS reviewers suggested that more research was necessary, emphasizing that "the magnitude and prevalence of decreases in pulmonary function and increases in respiratory tract infection rates among children living in homes with gas ranges and homes with electric ranges need to be determined more accurately."

Nevertheless, the NAS's Executive Summary included a statement that illustrated what Hill & Knowlton had called the "continued threat of regulation":

"*Unvented gas cooking is probably responsible for a large portion of nitrogen dioxide exposure in our population. In many homes, chronic exposures to nitrogen dioxide indoors may exceed established national ambient-air quality standards. Shorter-term 1-h average concentrations indoors often exceed the highest hourly concentrations measured outdoors. The concentrations of nitrogen dioxide and carbon monoxide in residences have not been fully documented. However, some studies have shown an association between gas cooking and the impairment of lung function in children.*

Although confirmation is necessary, the available evidence suggests that important population exposures to NO_2 and CO can occur indoors and may constitute a sufficient threat to the general public health to justify ***remedial action***." (p.8)
(emphasis added)

For the gas industry, this reference to "remedial action" represented a threat. But, it was a threat the industry was well-prepared for. Advised by Richard Darrow of Hill & Knowlton in 1972 that it would repeatedly face "new proposals for regulation and restrictions," the industry had not sat idle. Instead, its members had put into action a program to assist them in the fight ahead.

6. Controversial Issues

Summary: In 1976, the gas industry founded the Gas Research Institute (GRI), which would sponsor research magnifying the scientific 'controversy' over the health impacts of gas stove emissions. In 1981, the GRI funded two major reviews of the available scientific literature, attacking the evidence linking gas stove emissions with respiratory problems. Like Battelle, the consulting firm Arthur D. Little, which conducted the first of these 1981 literature reviews, had a track record of working for the tobacco industry. A. D. Little's literature review for GRI targeted uncertainties within the epidemiological evidence surrounding NO_2 emissions from gas stoves, concluding that "a considerable amount of research" was required. The second 1981 review was conducted by Dr. H. Daniel Roth, whose work to date had attacked the science underpinning air pollution regulations. In his review, titled "*The Controversy Over NO_2 And Health*," (which didn't note its GRI funding), Roth claimed that there were "many unanswered questions regarding the indoor NO_2 health issue" and that "additional NO_2 epidemiological data need to be collected." Roth's gas-sponsored review appears to have been the first to label the subject a *"controversy."*

The Gas Research Institute (GRI)

Founded by the gas industry in 1976, the Gas Research Institute aimed to address the problem of developing "urgently needed" gas supplies. Modeled on the Electric Power Research Institute, the gas industry's "new entity" would offer gas companies the opportunity to increase funding for industry-favored research projects via ratepayer levies and federal government grants. It would also provide an opportunity for cooperative research projects with the government, imbuing future gas-industry research with the legitimacy and credibility of government partnerships. (The GRI exists today in the form of GTI Energy.)

The GRI presided over a greatly expanded research program, administering funds in excess of $212 million at its peak and focusing on "supply, transport, distribution, storage and end-use applications for all markets." The GRI also inherited AGA's former research program and would continue the work that AGA had begun, sponsoring research that would magnify the scientific 'controversy' over the health impacts of gas stove emissions as well as playing a key role as a public relations vehicle for disseminating this industry-sponsored research.

Documents within the John W. Hill papers at the Wisconsin Historical Society Archives reveal that establishing an "Institute" focused on "research" was a key element of the Hill & Knowlton formula honed on behalf of the tobacco industry. It remains a popular PR tactic used by corporations to this day.

GRI-Sponsored Attacks on Science

In 1980, the GRI funded two literature reviews attacking evidence linking gas stove emissions with respiratory problems that would be used by the gas industry to counter the potential threat presented by the National Academy of Science's discussion of "remedial action," the GAO's immediate call for the EPA to regulate indoor air quality, and any future recommendations for regulatory intervention.

The first of these reviews was conducted by **Arthur D. Little** (A. D. Little), a U.S. consulting firm that worked for multiple government departments and private interests, including General Motors and Monsanto, as well as the American Petroleum

Image from the "Industry News" section of the AGA Monthly publications.

Institute and the Automobile Manufacturers Association. Like Battelle Laboratories, A. D. Little also had a previous record of working for the tobacco industry and producing industry-friendly results. The second review was conducted by independent consultant and statistician **Dr. H. Daniel Roth**, who would later become a tobacco industry scientist-for-hire; as of 1981, the electric utilities, asbestos, and beryllium industries had paid him to attack health effects data.

Both of these gas industry-funded literature reviews emphasized the existing scientific literature's uncertainties, exploiting the scientific process's nuanced nature, culminating in the creation of a 'controversy,' while appearing to be distanced from direct gas industry interest. They encouraged diversionary science by attempting to focus research on "other factors" beyond the health effects of nitrogen dioxide emissions from gas stoves. These literature reviews would also serve as stepping stones to further industry distortion, when industry representatives later exaggerated or misrepresented their conclusions.

Richard Darrow of Hill & Knowlton had prioritized this tactic of using literature reviews to attack science as part of the TIRC's early program, according to a 1955 memo he authored.

Arthur D. Little

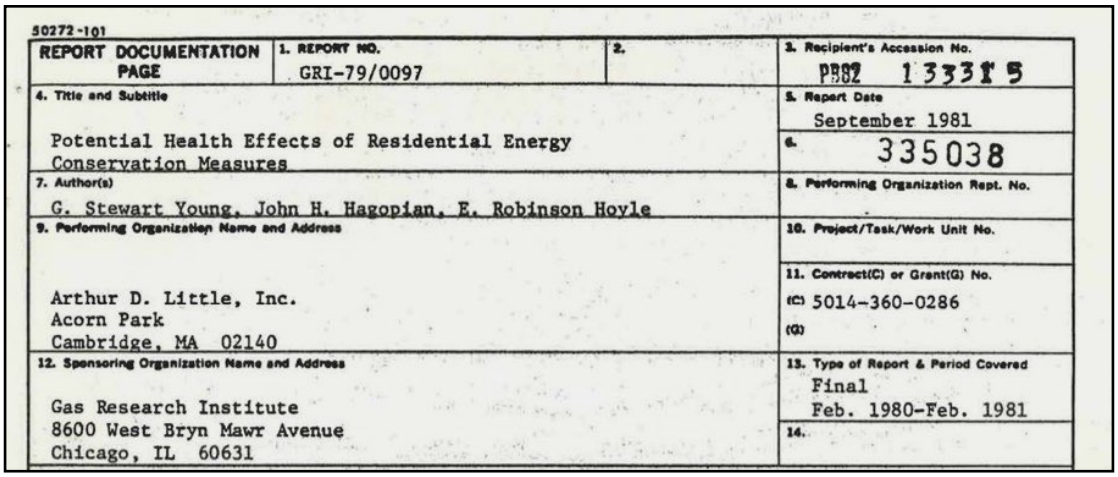
In 1963, A. D. Little produced a 9-volume literature review of the evidence linking smoking to health hazards for cigarette company Liggett & Myers (L&M). The review, which was favorable to its tobacco sponsors, was submitted on behalf of L&M to the U.S. Surgeon General's Advisory Committee.

"We find much of the reported work relating cigarette smoking to death rates or lesser impairments to have been **unreliably conducted** and even some of the otherwise better-conducted studies, **inadequately analyzed,"** stated A. D. Little's review. (emphasis added)

While the review could not deny that cigarette smoke contained cancerous compounds likely to cause tumors, it sought to create doubt, emphasizing the uncertainty over exactly how far smoking could be attributed to deaths among smokers, by attempting to differentiate between the "gross" and "net effect" of smoking and arguing that "many other common habits" should also be considered as possibly significant causes – including underlying personality characteristics, diet, coffee consumption, amount of sleep, nervousness, occupational and educational status and even being divorced.

Impressed with the review, by 1968, "all the companies" in the Council of Tobacco Research (CTR) supported another A. D. Little critique attacking a U.S. government report on the health consequences of smoking. "You have asked us that we review both statistics and the textual material, to develop in a confidential report not for publication," wrote A. D. Little to the Chairman of the tobacco group's Ad Hoc Working Committee, confirming that A. D. Little's "critical notes" were to be used by the CTR "for whatever responses you may make."

A. D. Little agreed that it would give special emphasis to attacking the statistics showing "shorter life expectancies for cigarette smokers."



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7. Author(s) G. Stewart Young, John H. Hagopian, E. Robinson Hoyle			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Arthur D. Little, Inc. Acorn Park Cambridge, MA 02140			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) 5014-360-0286 (G)
12. Sponsoring Organization Name and Address Gas Research Institute 8600 West Bryn Mawr Avenue Chicago, IL 60631			13. Type of Report & Period Covered Final Feb. 1980-Feb. 1981 14.

Report page from Arthur D. Little, September 1981

Gas: 1980s

Echoing its 1963 report for L&M, the Executive Summary of A. D. Little's 1981 report for the Gas Research Institute, *"Potential Health Effects of Residential Energy Conservation Measures,"* promoted doubt and uncertainty.

A.D. Little's reviewers stated, "many questions regarding the health effects of exposure to low levels of nitrogen dioxide remain unanswered." They described the epidemiological data as "incomplete and conflicting" and "limited and of generally poor quality." They classified the results of existing epidemiological studies as "questionable" and argued that to obtain a "valid assessment" outdoor sources of NO_2 as well as "other pollutants" should "be examined" and "fully characterised." Additionally, A. D. Little's authors argued that NO_2 levels might be affected by "many factors" including "family composition" and "life style."

*"*Overall,*"* the review concluded, "there are a variety of serious problems associated with indoor epidemiological studies. The data are limited, imprecise, and contradictory."

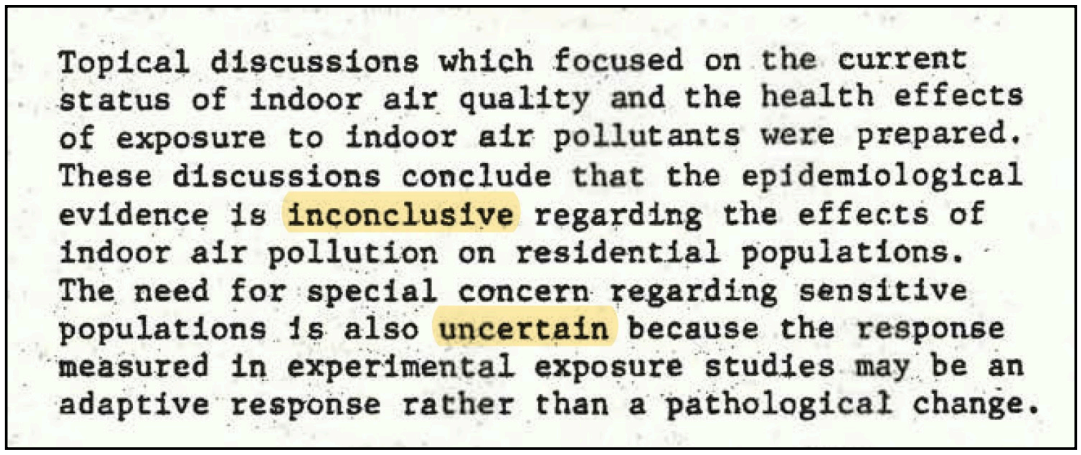
The review included the AGA-funded studies by Keller et al. in the balance of evidence. While the other studies assessed by A. D. Little had identified an association between gas stove emissions and respiratory problems, the Keller et al. studies had identified no such association. Their inclusion inserted a layer of industry-aligned distortion into the review by their presence alone, contributing to the review's conclusion that the data were "contradictory."

Evidence that the GRI guided A. D. Little's authors can be found in the report's official "Acknowledgement" section. Here, the lead author, G. Stewart Young, expresses a special thanks for "the **comments and direction** provided by Dr Donald O. Johnson, Manager of Environmental Research at the GRI, and the GRI Environmental Advisory Group." (emphasis added)

Another layer of industry-backed distortion can be seen in A. D. Little's approach, described in the first paragraph of the report's *"Research Summary*," which stated:

"Controversial issues and areas where knowledge is lacking were identified and formed the basis for developing recommendations for future research and development activities."

In other words, instead of focusing on areas of convergence or the emerging consensus within the growing body of scientific evidence, A. D. Little's approach was premised on identifying "controversial



Topical discussions which focused on the current status of indoor air quality and the health effects of exposure to indoor air pollutants were prepared. These discussions conclude that the epidemiological evidence is inconclusive regarding the effects of indoor air pollution on residential populations. The need for special concern regarding sensitive populations is also uncertain because the response measured in experimental exposure studies may be an adaptive response rather than a pathological change.

A. D. Little's 1981 report for the Gas Research Institute, "*Potential Health Effects of Residential Energy Conservation Measures*," promoted doubt and uncertainty. (Emphasis added)

issues," effectively maximizing uncertainties within the existing evidence alongside its other stated aim of advocating "future research."

For example, although they varied in degree, the majority of the epidemiological studies included in A. D. Little's assessment showed a positive association between gas stove emissions and respiratory problems – but A.D. Little ignored this fact. Instead, the review stated "many questions ... remain unanswered" and that data were "limited, imprecise, and contradictory."

This highlighting of "controversial issues" is evident throughout the review, particularly in the "*Annotated Bibliography*" of selected studies, which frequently attacked the available epidemiological studies without supporting evidence to back up the reviewers' claims. [See *"Potential Health Effects of Residential Energy Conservation Measures"* for full details.]

For instance, while Melia et al. (1977) had identified an association between gas stove emissions and respiratory illness, A.D. Little employed numerous tenuous conditionals to definitively undermine the credibility of that research without providing evidence to back up these claims. For example, the review stated that:

- "significance tests may be invalid because of an inappropriate analysis;"
- "Using recall data on respiratory illness may introduce errors that make the results less precise;"
- "Assumptions for the validity of the analysis methods most probably are not satisfied;"
- "the results are not as precise as they appear to be;"
- and "significant results may be, in fact, insignificant."

The overall effect was to undermine the study's conclusions that gas stove emissions are associated with a higher prevalence of respiratory disease. And, based on the unconfirmed statement that the "analysis methods most probably are not satisfied," A. D. Little's authors definitively conclude that the results "must be viewed with extreme caution."

A. D. Little's treatment of the Harvard Speizer, F.E. et al.'s 1980 study, "Respiratory Disease Rates and Pulmonary Function in Children Associated with NO_2 Exposure," provides another example.

Although the A. D. Little review acknowledged that "the association between reported respiratory illness before age two and gas-cooking appears real," it highlighted the fact that the Harvard study had failed to consider "school-to-school variability" in

"explaining both disease and lung function variability." Even though the children participating in the study were under the age of two, i.e., possibly too young to attend school, A. D. Little's authors backtracked, stating that "quite possibly the overall direction of the results would not change" should this school-to-school variable be included. "But," they argued in another reversal of their previous statement, "the consistency of the result could be determined." Yet the possible influence of factors that vary from "school-to-school" was mentioned twice more, again including in the report's final comments on this study.

One of the most seemingly influential aspects of the A. D. Little review was its focus on an alleged lack of evidence relating to the links between measured concentrations of NO_2 with actual exposures, and personal exposures with specific health effects.

"Gas cooking has been used as a surrogate measure which implies elevated indoor levels of oxides of nitrogen and, thus, implies elevated exposure," stated the review. "However, such a surrogate measure ignores variables such as the frequency and duration of appliance use, venting of appliances, sources and amounts of infiltration, and occupant activities which may have a considerable influence on exposures."

But it was not entirely true that gas cooking had been used as a surrogate, ignoring other variables. For example, the Speizer et al. Harvard Study had measured NO_2 concentrations from between 30 and 66 households. Although these were not necessarily the homes of children in the study, Speizer et al. emphasized that these households had been "selected to be representative of the kinds of living patterns found in each community."

In addition, the use of gas cooking as a surrogate measure for elevated NO_2 exposure would have been justified by virtue of the overwhelming evidence in study after study from that period which consistently identified concentrations of indoor NO_2 emitted by gas stoves that were many times higher than the legal outdoor standard (see the appendix).

Nevertheless, A. D. Little's authors used the alleged lack of evidence to argue that more research was needed. Furthermore, the review argued, it was necessary that "all exposures to nitrogen dioxide" and "other pollutants" be measured.

Attribution, however, to a particular source of NO_2 can be done explicitly without knowing all sources of exposure because studies would seek to measure the change in exposure – e.g., the change in overall NO_2 exposure caused by a gas stove. As a result, undertaking the burdensome and time-consuming task of measuring "all exposures to nitrogen dioxide" would not have been necessary for studies to have revealed important data about gas stove pollution.

EPA scientist Dr. Carl Shy addressed a similar criticism about exposure to other pollutants head-on in 1973. While the setting of primary air quality standards "relied heavily on health effects observed under conditions of mixed pollutant exposures," Dr. Shy explained that knowledge obtained from laboratory experiments or clinical trials allowed researchers to pinpoint the harmfulness of individual pollutants under real-world conditions. "Conclusions about pollutant disease associations cannot be made in isolation from other knowledge about biological effects of individual contaminants," wrote Dr Shy.

Taken at face value, however, A. D. Little's suggested program for "more research" into "all exposures to nitrogen dioxide" and "exposures from other pollutants" might potentially keep researchers busy for decades. It also appears to have influenced regulatory decision-makers over subsequent decades (see chapter, "Shaping The Decisions").

Designing a System for Delay

The cumulative effect of A.D. Little's analysis of the existing epidemiological evidence was to create an impression that this evidence was "inconclusive" and that "a considerable amount of research" was "required."

According to A. D. Little, "the most essential research" needed was "a long-term prospective epidemiological study which should include monitoring of actual personal exposures and investigation of any related adverse health effects."

However, because observational epidemiological studies show correlation and not causation, such an emphasis on epidemiological studies will always benefit an industry seeking to exploit uncertainties or deny the inherent harmfulness of its product over the long term. A. D. Little's report twice called attention to the limits of correlation:

- "None of the results, even with a valid analysis, can support a direct causal relationship between gas cooking and respiratory illness. An observational study, such as this one, can only provide information on associations and not causality." (comments on *Melia et al., 1977*)
- "Indirect correlations do not provide strong evidence that using gas fuel for cooking causes more respiratory illness." (comments on *Melia et al., 1979*)

In this way, the report's steering of the research community towards further observational epidemiological studies had the effect of setting a trap for those who might seek to hold industry to account for the effect of its emissions in the future. By steering researchers towards epidemiological research, A. D. Little's review placed the gas industry in the favorable future position of being able to argue, perhaps indefinitely, that correlation is not causation and that proof of health effects is insufficient – even when long-term epidemiological studies (such as those advocated by A. D. Little in its report) might turn out to indicate strong correlations between NO_2 exposures and health effects.

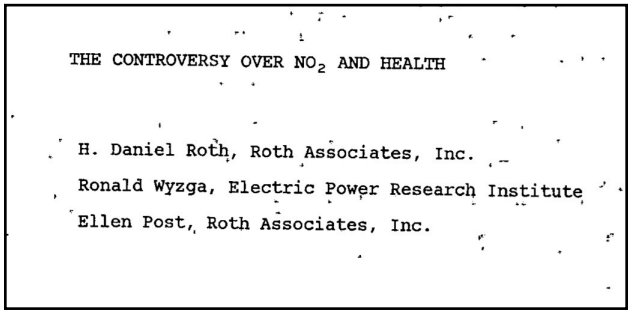
In 2023, AGA continues to attack recent research on the association between gas stove use and asthma on the basis that it "does not demonstrate a causal relationship."

H. Daniel Roth

Where A. D. Little's review maximized uncertainty over associations between gas stove emission and health, the second GRI-funded review conducted by Dr. H. Daniel Roth is the first instance of the label "*controversy*" being publicly used to describe the subject of gas stove emissions and respiratory conditions, based on the literature reviewed for this report.

Like A. D. Little's authors, Roth's review of the available epidemiological evidence would also claim that there were "many unanswered questions regarding the indoor NO_2 health issue," that findings from these epidemiological studies were "mixed" and that, as a result, "additional NO_2 epidemiological data need to be collected."

The source of Roth's funding was not



THE CONTROVERSY OVER NO_2 AND HEALTH

H. Daniel Roth, Roth Associates, Inc.

Ronald Wyzga, Electric Power Research Institute

Ellen Post, Roth Associates, Inc.

Dr. H. Daniel Roth's paper, "*The Controversy Over NO_2 And Health*," was published by the International gas Research Conference in 1981

disclosed in the "Proceedings" of the 1981 International Gas Research Conference, which published his paper, "*The Controversy Over NO_2 And Health*." However, tobacco ligation records reveal that Roth was under contract with GRI to assess clinical and epidemiological data from studies establishing an association between gas cooking and bronchitis in children. Meanwhile, other papers included in the published "Proceedings" stated their industry affiliations.

This was not Roth's first rodeo. For example, from 1975-1976, the Electric Power Research Institute had paid Roth to perform a similar service, targeting the data on asthma, bronchitis and pulmonary function that undergirded the U.S. National Ambient Air Quality Standards for Sulfur Dioxide and Particulate Matter.

This was his forte. A mathematician, Roth specialized in statistical analysis, reviewing bodies of evidence and turning out pro-industry conclusions, minimizing suggested links between substances and serious health impacts, including cancer.

Tobacco documents also show that in 1987, Roth was suggested for the position of head of the tobacco-industry-front group the Center for Indoor Air Research Tobacco (CIAR). A "confidential" profile drawn up for his potential CIAR employers revealed his extensive work for a variety of industrial interests. Roth's "Client List," which included the American Gas Association and the Gas Research Institute as well as American Motors Corporation, Edison Electric Institute, Ford Motor Company, General Motors Corporation, Monsanto, Pacific Gas & Electric, Philip Morris, R.J. Reynolds Company, Southern California Edison and Westinghouse.

Roth's services in defense of the tobacco, alcoholic beverages, asbestos, beryllium, and coal industries have been extensively detailed elsewhere. His work with the gas industry had been lost to history until the publication of this report.

Like A. D. Little's reviewers, Roth exaggerated uncertainty, using spurious argument and distortion to manufacture a "controversy."

Firstly, he dismissed the animal toxicological data on the grounds that they were "of little value" because "currently there are no validated models for quantitatively relating animal data to man."

This was not necessarily the prevailing view at the time. Another perspective on the extrapolation from animal studies was demonstrated in the U.S. EPA Review of the NAAQS for Nitrogen Oxides 1982: "Given the uncertainties existing in the available scientific data, no rigorous rationale can be offered to support a specific NO_2 standard. However, not to establish a standard, we believe, would ignore the cumulative evidence from animal, controlled human exposure, and community indoor air pollution studies which suggest that NO_2 may cause adverse health effects in sensitive population groups exposed to NO_2 at or near existing ambient levels."

Secondly, Roth dismissed the available clinical data, asserting that "while the human clinical data generally indicate that short-term NO_2 exposures at levels below 1ppm do not present a problem, it is difficult to rely on these data because laboratory data do not accurately reflect real world conditions." This claim that short term NO_2 exposure levels below 1 ppm (i.e. 1000 ppb) did not present a general problem ignored sensitive populations, whose greater reactivity had been suggested by two clinical studies published prior to Roth's review.

Roth amplified the findings of the AGA-funded Keller et al. studies and used them to create a "controversy." For example, Roth stated that Speizer's data (from the Harvard *Six Cities* study) appeared to "conflict with Keller's," writing, "Speizer found an association between gas ranges and serious respiratory disease before age two. Keller, however, found no association between gas ranges and respiratory disease in children or adults."

Like A. D. Little's authors, Roth also levied a multitude of criticisms on the epidemiological studies. Results were dismissed as "preliminary," yet Roth offered no evidence as proof that they were invalid. Roth challenged NO_2 measurements because they "might have been of poor quality," yet no evidence was given to substantiate this allegation. Roth deemed another study inadequate because "Socioeconomic information might have been incorrectly analyzed." Again, Roth offered no evidence. Roth also dismissed findings on spurious

grounds such as "data on short term NO_2 peaks ... were not collected," "findings were only true in urban areas," or "in specific age groups" – none of which would necessarily have invalidated the association detected between gas stove emissions and respiratory problems in these particular cases.

Echoing the A. D. Little review, Roth also challenged the premise of using a gas stove as a surrogate for elevated NO_2 levels. "A specific drawback with gas range studies is that they are based on the assumption that NO_2 levels are substantially higher in gas range homes than in electric ones," Roth stated before alleging that this was a "questionable premise" because "NO_2 levels in homes might be attributable to factors other than the presence or absence of gas ranges. Some of these factors are: the amount of cooking done in the house; venting of gas appliances; outdoor infiltration rates."

While NO_2 might be attributable to other sources, the presence or absence of a gas stove remains one of the most important factors responsible for NO_2 levels. Roth also claimed that the "health effects usually investigated in NO_2 studies might be associated with a host of other pollutants."

Like the A. D. Little review, the final paragraph of Roth's report concluded, "It is clear from the above that additional NO_2 epidemiological data are needed."

Roth's arguments, however, go further than those of the A. D. Little reviewers. Throughout his paper, Roth's criticisms take the uncertainty that would have been, and still is, a hallmark of responsible and transparent scientific research, and inflate that uncertainty into a "controversy."

Influence of Gas Industry-Funded Literature Reviews

The gas industry amplified Roth's framing of the subject as a "controversy" by presenting Roth's paper at the 1981 International Conference attended by 557 delegates from 18 countries (including the US, Canada, Japan, China, Norway, France, Germany, New Zealand, Sierra Leone, Netherlands and others); and subsequently via its own publications and spokespeople.

In his 1981 AGA paper, *"Putting Gas Range Emissions in Perspective,"* presented at the University of Massachusetts Symposium on Indoor Air Pollution, Chairman of AGA's Coordinating Group for Environmental Affairs Robert W. Welch also used Roth's work to publicize the message that gas stove emissions were not linked to respiratory illness.

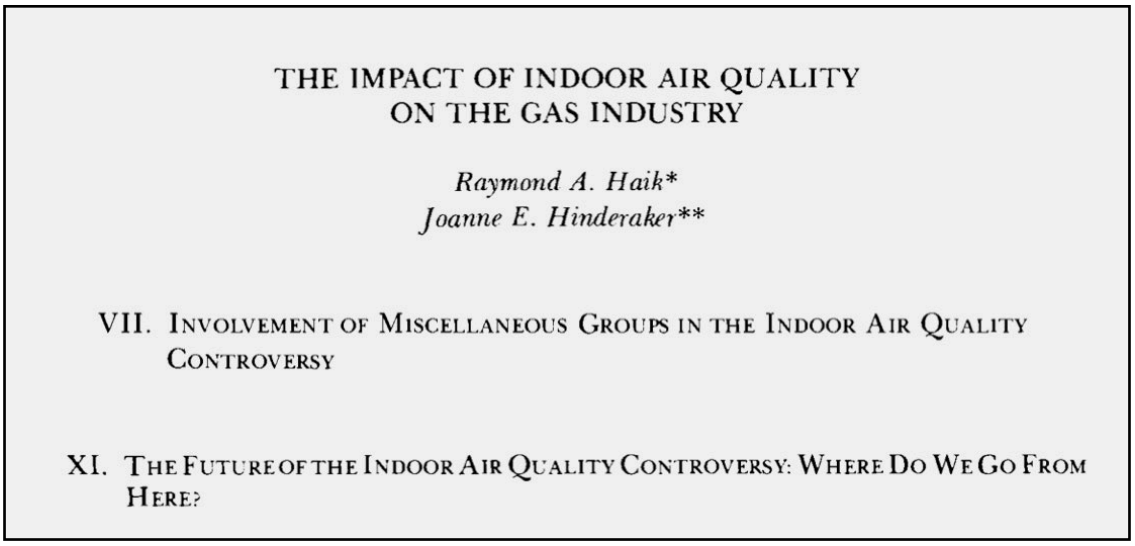
Without mentioning Roth's GRI funding, Welch declared that, based on their "review" of the scientific evidence, Roth et al. "have stated that human clinical data indicate "that short-term exposures to NO_2 either singly or in combination with other pollutants do not pose a threat to human health at levels below 1.0ppm.""

Welch also misrepresented and exaggerated Roth's conclusions, making the much bolder statement that "Roth et al. theorize that NO_2 might not be a health problem at levels well above 1.0ppm" - a claim that Roth did not make in his paper.

Finally, Welch referred to Roth's work, along with the AGA-funded studies by Keller et al., to conclude that gas stove emissions were "not a source of respiratory illness within the indoor environment" - a definitive statement not made by either Roth or Keller.

AGA further disseminated the message that gas stoves were not linked to respiratory illness in 1982 when it published Welch's paper in full in the February edition of AGA's magazine, AGA Monthly.

That same year, the *Gas Research Institute Digest* published an article titled *Indoor Air Quality* stating that: "Based on the AGA studies of the early 1970's and on the conclusions of the Arthur D. Little study, GRI believes that in structures with normal ventilation rates, **emissions from unvented gas appliances do not cause any undesirable effects.**" (emphasis added)



THE IMPACT OF INDOOR AIR QUALITY
ON THE GAS INDUSTRY

*Raymond A. Haik**
*Joanne E. Hinderaker***

VII. INVOLVEMENT OF MISCELLANEOUS GROUPS IN THE INDOOR AIR QUALITY CONTROVERSY

XI. THE FUTURE OF THE INDOOR AIR QUALITY CONTROVERSY: WHERE DO WE GO FROM HERE?

Excerpts from Haik & Hinderaker's "*The Impact of Indoor Air Quality On The Gas Industry*," which also used the term 'controversy' in the 1984 article.

This statement misrepresented the conclusion of even the industry-aligned A. D. Little review. While A. D. Little's reviewers stated that important questions remained unanswered, they did not state outright that "unvented gas appliances do not cause any undesirable effects." Likewise, Keller et al. concluded only that there was "no evidence" that gas cooking is associated "with the incidence of acute respiratory illness." Yet the GRI used this apparent uncertainty to make the much bolder claim, one that would have been easily transmittable in a neat soundbite, that gas appliances did "not cause any undesirable effects."

In 1984, the Energy Law Journal published a paper, "The Impact of Indoor Air Quality on the Gas Industry," by two gas industry lawyers, R. A. Haik and J. E. Hinderaker (assisted by the GRI), who explicitly advised gas companies to counter the conclusions of the 1981 EPA-commissioned National Academy of Sciences report on indoor air pollution with the GRI-sponsored A. D. Little review (referred to as the "*GRI Report*.") While the paper warned the gas industry about the possible implications of the NAS Report's statement that the evidence on NO_2 "might justify remedial action," it recommended that representatives of gas companies should also consult the "*GRI Report*" for what it called a "thorough perspective."

Among multiple references to the GRI-sponsored A. D. Little review, Haik & Hinderaker cited its conclusion that "there are many unanswered questions regarding the health effects of nitrogen oxide exposure" and stated that, based on both the NAS report and the A. D. Little review, "there is a real need for more extensive and comprehensive research on the characterization, sources, concentration and health effects of indoor pollutants," highlighting the fact that this "necessity for more research and development was identified in the NAS and GRI Reports."

Based on their presentation of the evidence, Haik & Hinderaker also argued against the need for any regulatory intervention: "In view of the complex issues relating to indoor air quality, a rigid regulatory approach should not be adopted. Government intervention may be most effective if it focuses on improving the private choices of each individual through economic incentives and public information programs."

Following Roth's lead, Haik & Hinderaker also used the term 'controversy' in their 1984 article, asking "THE FUTURE OF THE INDOOR AIR QUALITY CONTROVERSY: WHERE DO WE GO FROM HERE?"

"Federal Policy / Decision-Making"

The A. D. Little and Roth Reviews echoed in the regulatory decision-making process from 1982 onwards. From that point, deliberations by EPA decision-makers emphasized the need for research that related personal exposures with symptoms – an emphasis expressed by these gas industry-funded reviewers. How much influence these reviews exerted over the regulatory decision-making process is unclear and inherently difficult to ascertain. Records show that individual companies and industry associations submitted written comments to the public dockets relating to numerous EPA decisions on NO_2 in the 1980s and 1990s.

What is clear, however, is that in 1972, Hill & Knowlton's Richard Darrow talked to the gas industry about the "opportunity" for the American businessman to "play a significant role in shaping the decisions that will affect the future course of the nation."

Additionally, gas industry publications show that from 1976 onward, AGA had expanded and strengthened its Government Relations activities, focusing on "appropriate government agencies or offices" (including the EPA and CPSC) with the aim of providing "effective liaison" between Executive agencies, Congress and AGA staff.

William J. Murphy, AGA's Director of Congressional Relations, wrote in a 1976 AGA Monthly article that the Government Relations Division would "specifically" present "to Congress the natural gas industry's viewpoint on pending and proposed legislation and other matters."

During Congressional Hearings on "Indoor Air Quality Research" in 1983, government spokespeople from the Department of Energy and the Environmental Protection Agency referred to research efforts by the Gas Research Institute as evidence that indoor air pollution was being tackled responsibly by the private sector.

"The Gas Research Institute and the Electric Power Research institute have active research programs in indoor air quality ... A number of studies are underway by EPRI, GRI and others, to determine where there are gaps remaining in our knowledge base on indoor air quality," stated Joseph J. Tribble, the Assistant Secretary of Conservation and Renewable Energy at Department of Energy.

Donald J. Ehreth, the Acting Director of the Office of Environmental Engineering and Technology Office of Research and Development at the EPA went further. Challenged over the Reagan EPA's request for zero funding for indoor air research for 1984 and asked about its future plans, Ehreth pointed to a plan for future research to be carried out "with the cooperation of the private sector," later providing the following statement for the record: "In the private sector, the Electric Power Research Institute and the Gas Research Institute have been active in conducting indoor air quality research; together, they are sponsoring several million dollars of research per year ... gas utilities have made a commitment to find out the extent of indoor air quality problems caused by emissions from unvented indoor combustion of natural gas."

7. Shaping The Decisions

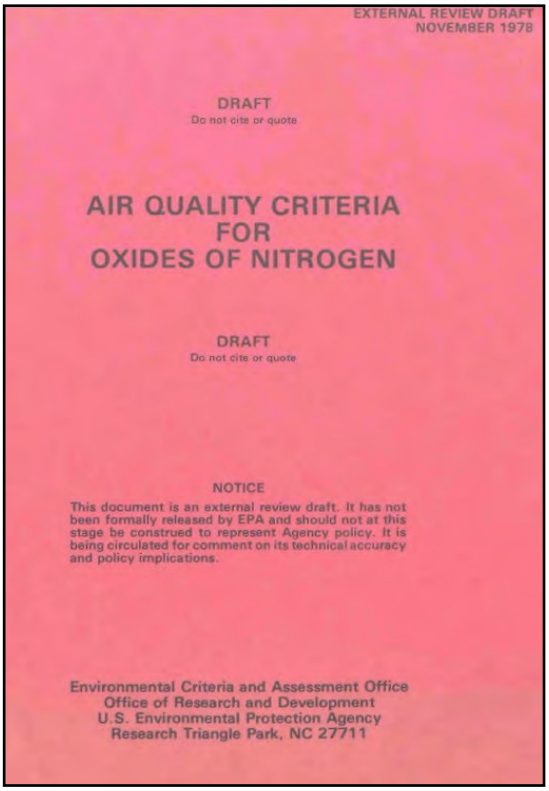
Summary: In the 1980s, industry-funded epidemiological studies were used by the gas industry to influence key regulatory reviews and decisions made by the Environmental Protection Agency on the *National Ambient Air Quality Standards for Nitrogen Dioxide* in 1982 and 1985, and the Consumer Product Safety Commission on the health effects of exposure to nitrogen dioxide in 1986.

The AGA-funded epidemiological studies by Mitchell et al. (1974) and Keller et al. (1979) have influenced public opinion and government regulators, affecting decisions made over subsequent decades by the EPA, Consumer Product Safety Commission (CPSC), and other national bodies.

During this period, only a few studies investigated the impact of outdoor NO_2 exposure on the prevalence of respiratory disease. For this reason, regulatory decision-makers relied heavily on indoor epidemiology studies.

In December 1977, the U.S. EPA produced a draft document reviewing the latest available data on the "*Health Effects for Short-Term Exposures to Nitrogen Dioxide*." The data included in this draft led to the EPA considering proposals for a new short-term NO_2 standard in the range of a 0.25 to 0.5ppm one hour average. Among the newly available data included in this draft were indoor studies conducted by Melia et al. and the EPA. The AGA-funded research by Mitchell et al. and Keller et al., however, was not included.

Four months later at a Public Hearing held by the EPA in April 1978, a spokesman for the Utility Air Regulatory Group (UARG), Dr. Peter C. Freudenthal, criticized the Melia et al. study and argued that "the contrary findings" of Mitchell and Keller et al. "in American homes" should be taken into account by the EPA. "Because the American studies contradicted the conclusions of Melia," argued Freudenthal, "we believe it is misleading to reference Melia ... without also referencing the American studies." As well as representing UARG, a utility-funded group that fought the EPA's Clean Air Act regulations, Freudenthal was the director of the Air and Noise Environmental Program of Consolidated Edison Company, a utility providing electric and gas service in New York.

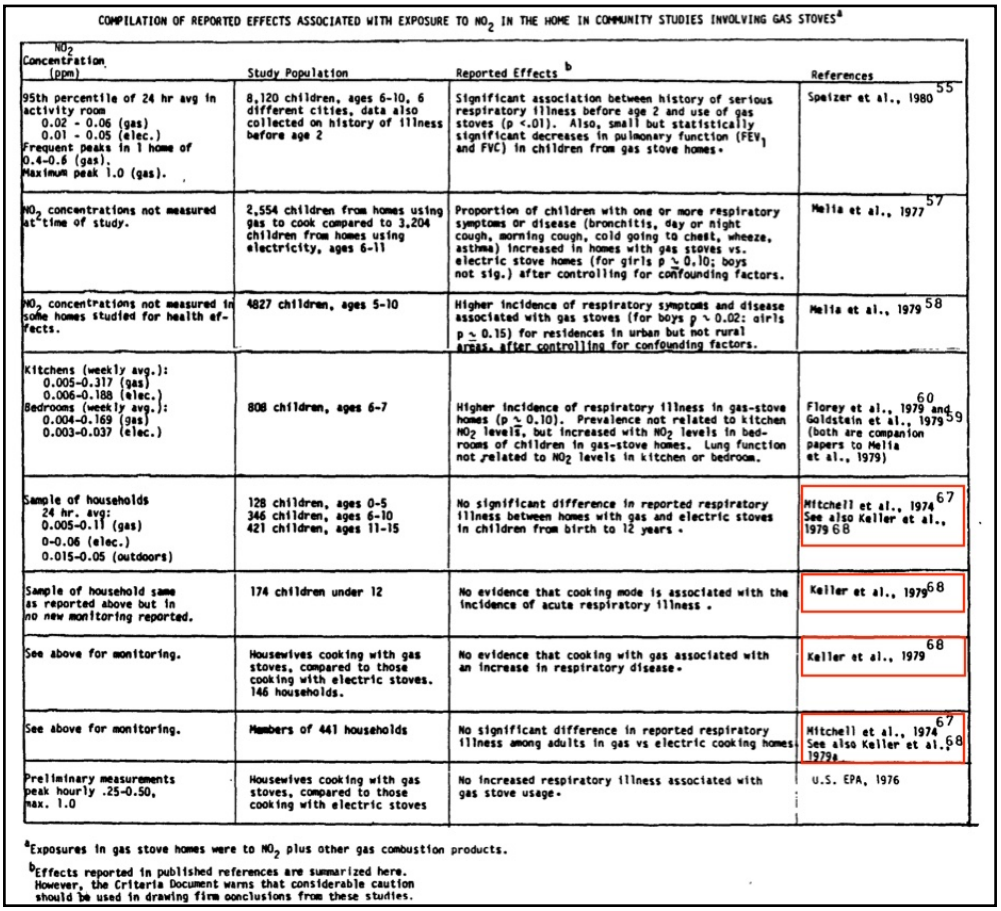


Cover of EPA's 1978 draft, "Air Quality Criteria for Nitrogen Oxides."

In November 1978, an updated "Air Quality Criteria for Nitrogen Oxides" draft was published by the EPA. This new draft included the AGA-funded Mitchell et al. research. It also included references to an *Indoor epidemiology study* (1974; and 1977) by Lutz, G. A., R. I. Mitchell, R. W. Cote, and M. D. Keller, described as reports "prepared for AGA. Battelle Columbus Laboratories." The lead author cited here was biochemist Garson A. Lutz, a thirty-year Battelle employee. These Lutz et al. reports appear to be the unpublished laboratory reports produced by Battelle Columbus Laboratories for AGA prior to the Keller et al. studies published in 1979.

In August 1982, the EPA *Review of the NAAQS for Nitrogen Oxides (Staff Paper)* concluded that evidence for health effects at levels of NO_2 below 1.0 ppm was *"not conclusive."* An accompanying closure letter from the EPA's Clean Air Scientific Advisory Committee (CASAC) stated that *"for scientific and practical reasons"* the annual standard did not need to be revised nor was a separate short-term standard needed.

A table (see below) showing the *"Compilation of Reported Effects Associated With Exposure To NO_2 In The Home In Community Studies Involving Gas Stoves"* provides a striking visual example of the influence of the AGA-funded studies. Out of the nine studies shown, four studies identified a "significant association" between gas stoves and respiratory illness in children, while five found "no evidence" or "no



COMPILATION OF REPORTED EFFECTS ASSOCIATED WITH EXPOSURE TO NO_2 IN THE HOME IN COMMUNITY STUDIES INVOLVING GAS STOVES[a]

NO_2 Concentration (ppm)	Study Population	Reported Effects[b]	References
95th percentile of 24 hr avg in activity room 0.02 - 0.06 (gas) 0.01 - 0.05 (elec.) Frequent peaks in 1 home of 0.4-0.6 (gas). Maximum peak 1.0 (gas).	8,120 children, ages 6-10, 6 different cities, data also collected on history of illness before age 2	Significant association between history of serious respiratory illness before age 2 and use of gas stoves ($p < .01$). Also, small but statistically significant decreases in pulmonary function (FEV_1 and FVC) in children from gas stove homes.	Speizer et al., 1980 [55]
NO_2 concentrations not measured at time of study.	2,554 children from homes using gas to cook compared to 3,204 children from homes using electricity, ages 6-11	Proportion of children with one or more respiratory symptoms or disease (bronchitis, day or night cough, morning cough, cold going to chest, wheeze, asthma) increased in homes with gas stoves vs. electric stove homes (for girls $p \sim 0.10$; boys not sig.) after controlling for confounding factors.	Melia et al., 1977 [57]
NO_2 concentrations not measured in some homes studied for health effects.	4827 children, ages 5-10	Higher incidence of respiratory symptoms and disease associated with gas stoves (for boys $p \sim 0.02$: girls $p \sim 0.15$) for residences in urban but not rural areas, after controlling for confounding factors.	Melia et al., 1979 [58]
Kitchens (weekly avg.): 0.005-0.317 (gas) 0.006-0.188 (elec.) Bedrooms (weekly avg.): 0.004-0.169 (gas) 0.003-0.037 (elec.)	808 children, ages 6-7	Higher incidence of respiratory illness in gas-stove homes ($p \sim 0.10$). Prevalence not related to kitchen NO_2 levels, but increased with NO_2 levels in bedrooms of children in gas-stove homes. Lung function not related to NO_2 levels in kitchen or bedroom.	Florey et al., 1979 [60] and Goldstein et al., 1979 [59] (both are companion papers to Melia et al., 1979)
Sample of households 24 hr. avg: 0.005-0.11 (gas) 0-0.06 (elec.) 0.015-0.05 (outdoors)	128 children, ages 0-5 346 children, ages 6-10 421 children, ages 11-15	No significant difference in reported respiratory illness between homes with gas and electric stoves in children from birth to 12 years.	Mitchell et al., 1974 [67] See also Keller et al., 1979 [68]
Sample of household same as reported above but in no new monitoring reported.	174 children under 12	No evidence that cooking mode is associated with the incidence of acute respiratory illness.	Keller et al., 1979 [68]
See above for monitoring.	Housewives cooking with gas stoves, compared to those cooking with electric stoves. 146 households.	No evidence that cooking with gas associated with an increase in respiratory disease.	Keller et al., 1979 [68]
See above for monitoring.	Members of 441 households	No significant difference in reported respiratory illness among adults in gas vs electric cooking homes.	Mitchell et al., 1974 [67] See also Keller et al. [68] 1979a
Preliminary measurements peak hourly .25-0.50, max. 1.0	Housewives cooking with gas stoves, compared to those cooking with electric stoves	No increased respiratory illness associated with gas stove usage.	U.S. EPA, 1976

[a] Exposures in gas stove homes were to NO_2 plus other gas combustion products.

[b] Effects reported in published references are summarized here. However, the Criteria Document warns that considerable caution should be used in drawing firm conclusions from these studies.

A table from the 1982 EPA report, "*Review of the NAAQS for Nitrogen Oxides: Assessment of Scientific and Technical Information*," shows the compilation of reported effects associated with exposure to NO_2. (Industry-funded reports highlighted in red.)

significant difference" between gas and electric-cooking households.

Of the five that did not find an association, four of these were the undisclosed AGA-funded studies conducted by Mitchell et al. and Keller et al. The fifth study was an unpublished EPA study that examined the effect on "housewives" rather than children - a study that could not be directly compared with the others that assessed and identified effects on children.

The EPA's 1982 Review evaluated scientific information contained within the newly-updated "Air Quality Criteria for Oxides of Nitrogen" for 1982. This 1982 "Criteria" document again included the Mitchell et al. and Keller et al. studies and the Lutz et al. laboratory reports in the balance of evidence

It is not clear why the references to the Lutz et al. reports with their disclosure of AGA-funding were removed from the 1982 EPA "*Review of the NAAQS for Nitrogen Oxides (Staff Paper*)." But, after the reference in the 1982 Criteria document, the Climate Investigations Center has found no further reference to the Lutz et al. reports or the AGA funding of the Battelle Laboratories studies in EPA literature on nitrogen dioxide.

Clean Air Scientific Advisory Committee (CASAC)

The EPA's Clean Air Scientific Advisory Committee (CASAC), which had concluded that no separate short-term standard for NO_2 was needed, had been established under the Clean Air Act Amendments of 1977 and was intended to provide independent advice and recommendations to the EPA Administrator. However, since that time, CASAC has been criticized as a place for industry to gain legitimacy with the agency and to influence policy. A 1986 internal memo shows that the Tobacco Institute viewed the EPA Scientific Advisory Board Committees as "an opportunity to get ahead of the curve in this agency," noting that "several of these scientists consult with industries – and many seem receptive to open discussion. "

CASAC indeed provided an opportunity for both oil and gas industry employees and their paid consultants to influence EPA decision-making during this time. Among the members of the CASAC Subcommittee on Air Quality Criteria for Oxides of Nitrogen was Dr. Domingo Aviado, a former University of Pennsylvania professor who, in 1978, had left academia to become Senior Director of Biomedical Research at Allied Chemical, a corporation that held large natural gas assets via its subsidiary the Union Texas Natural Gas Company. In 1979, Allied Chemical derived 80% of its income from its Union Texas assets.

Tobacco documents also show that Dr. Aviado received significant funding for his services as a consultant to the Council for Tobacco Research (CTR) between 1972 and 1987 (receiving approximately $100,000 a year between 1980 and 1987).

A 1983 letter from the CTR's lawyers Shook, Hardy, and Bacon, recommending that Dr. Aviado's contract be renewed, stated that "Dr. Aviado continues to be a valuable source of information by reason of his work for the EPA Clean Air Advisory Committee and his occasional consultation with **chemical** and pharmaceutical companies." (emphasis added)

Records suggest that by 1982, Dr. Aviado may have taken a "leave of absence" from Allied Chemical in order to establish his own independent consulting firm, Atmospheric Health Sciences Inc. However, because his CASAC listing identifies him as "Dr Domingo M. Aviado, Allied Chemical," the exact nature of his relationship with Allied Chemical is unclear. It's beyond doubt, though, that during the period in which Dr. Aviado was a member of CASAC (1978-1985), he also carried out consultancy work for a variety of other industries and corporations, including the American Petroleum Institute (on benzene 1980-1981) and Mobil Oil Corporation (reviewing health effects data 1980-1981; and preparing position papers on

sulfur oxides and other (unspecified) environmental pollutants 1981-982).

Additionally, documents show that Dr. Vaun Newill, Associate Medical Director at Exxon Corporation, was a CASAC member from 1980-1981 and a CASAC consultant from 1981 to 1984.

In July 1985, the EPA Administrator published the agency's *Retention of the NAAQS for NO_2* announcing its decision not to revise the existing primary and secondary standards for NO_2 set in 1971. The EPA again deferred its decision on the need for a short-term standard, "pending the results from additional research focussed on reducing the uncertainties associated with short-term health effects." Studies consulted by the EPA prior to making this decision again included the gas industry-funded studies by Keller et al. 1979 and Mitchell et al. 1974 - their AGA funding was not disclosed.

The EPA 1985 report detailed anonymous comments it received under the section, "*Community Epidemiology Studies*." One comment stated, "(a) Other combustion products of gas stoves rather than NO_2 may be responsible for the respiratory effects observed in the indoor community studies. (b) EPA should rely more heavily on the studies by Mitchell et al. (1974) and Keller et al. (1979), which showed no correlation between living in gas stove homes and rates of various health effects."

> ***Comments:*** **(a) Other combustion products of gas stoves rather than NO_2 may be responsible for the respiratory effects observed in the indoor community studies.**
> **(b) EPA should rely more heavily on the studies by Mitchell et al. (1974) and Keller et al. (1979), which showed no correlation between living in gas stove homes and rates of various health effects.**

EPA's 1985 report, "*Retention of the NAAQS for NO_2*" detailed anonymous comments.

In response, the EPA said that "the number of children in these "negative" studies was approx. a factor of 10 smaller than in both the British and Six-City studies which reported an association. The relatively small sample size would tend to lessen the likelihood of the studies finding statistically significant associations." Nevertheless, the EPA weighed the "uncertainties" presented by Keller et al. and Mitchell et al. into their decision not to revise the existing standards or introduce a new short-term standard.

Also included in the EPA Review were newer studies by non-industry-funded researchers that had indicated "somewhat weaker findings" in their reports since 1982, such as studies by the Harvard "Six Cities "and Melia et al. research teams. Nevertheless, the EPA noted that the most recent Harvard study had confirmed a small "but statistically significant decrease in lung function" and, more generally, that "none of the recent studies has provided an assessment of short-term NO_2 levels in the residences of the subjects studies." In other words, as suggested by Melia et al. in 1982, the EPA indicated that the statistical associations might have been stronger had these studies been based on "peak" rather than average levels of NO_2.

While the impact of peak level exposure was not sufficiently reflected in the literature, the EPA indicated that it had considered this concern. However, other factors that were also considered during the assessment process listed by the EPA included "uncertainty about the NO_2 levels and duration of exposures associated with effects reported in the "gas stove" studies." This echoed criticisms contained within the GRI-funded A. D. Little and Roth reviews. Evidence shows that this "uncertainty" provided convenient justification for inaction by the Reagan EPA and CPSC.

CPSC Inquiry

Following the 1980 presidential election, the Reagan administration launched an attack on the EPA through dramatic budget and staff cuts, and by appointing officials loyal to the new government's deregulatory agenda. It

also sought to abolish the CPSC outright. When this was rejected by Congress, the administration proceeded to defund the CPSC instead.

In 1983, self-avowed "deregulator," Terrence Scanlon was appointed Commissioner of the CPSC. And, as reported by Vox, it was during this time that the CPSC conducted an inquiry into the effects of gas appliances. In 1985, he told Congress of the CPSC's "plans to develop or revise voluntary standards involving more than 50 products, including kerosene heaters, upholstered furniture, gas heating systems, portable electric heaters and others." Asked by Congress to describe the status of its efforts regarding "potential and known indoor air quality hazards," the CPSC replied that it was "reviewing existing data on emissions from gas stoves and encouraging the development of new technology," specifically "low emitting burners for these appliances." However, it stated, "Additional research on the susceptibility to combustion pollutants of certain population groups, i.e. young children, the elderly, asthmatics, is needed to assure that the voluntary standards currently being pursued will adequately protect these more sensitive individuals."

Congressional records show that in December 1982, Scanlon's predecessor, Stuart Statler, had met with the American Gas Association and toured the trade association's national lab facility.

In March 1985, Scanlon wrote to the EPA Administrator seeking guidance from CASAC on: "the levels of NO_2 for which there are data indicating adverse health effects; the identity of subsets of the population more sensitive to NO_2 than others; and whether exposure to NO_2 leads to irreversible lung damage."

Scanlon also wrote, "Various gas stove and combustion heater industry representatives have indicated a willingness to modify their product in order to reduce consumer exposure to NO2 but there remains some disagreement as to what the target level should be."

The CPSC's request was accompanied by its own assessment (to be evaluated by CASAC) of the potential health hazards associated with exposure to NO_2 generated by unvented domestic combustion sources.

In May 1986, CASAC published its review of the CPSC's assessment. Issuing its guidance, CASAC concluded that despite epidemiological evidence suggesting that repeated peak exposures may cause health effects in some individuals "at concentrations as low as 0.1ppm," the evidence was "somewhat inconsistent," which made it "difficult to be more definitive" about the specific levels of nitrogen dioxide linked to adverse health effects. CASAC based its guidance on the 1982 Criteria Document and the 1982 Staff Paper, both of which prominently featured the AGA-funded Mitchell et al. (1974) and Keller et al. (1979) studies (as discussed above). CPSC's earlier statement that gas stove industry representatives were willing to modify their product to limit NO_2 exposure was not mentioned. Instead, CASAC concluded that more research was necessary, urging the CPSC to "focus on efforts to quantify the NO2 concentrations" produced by unvented combustion sources and referred the CPSC to the EPA's 1982 Criteria Document and Staff Paper.

The presence of the AGA-funded studies within the EPA literature again shifted the balance of evidence in the industry's favor, especially when assessed at this moment in time by the Reagan administration's "reluctant regulators" at the EPA and CPSC.

CASAC's review also echoed criticisms made by both the A. D. Little and Roth literature reviews claiming a lack of information on actual personal exposure. "Unfortunately the majority of epidemiologic studies include no information on NO_2, and among those that do have actual measurements, the number of homes and characterization of concentrations are very limited. This suggests that better quantification of exposure is a major need in future studies."

These recommendations came at a time when the CPSC could have instead recommended introducing technological changes, such as available infrared technology that could

reduce "consumer exposure to nitrogen dioxide" by as much as 40%, according to reporting by NPR.

From 1983 to 1987, the CASAC Chairman was Dr. Morton Lippmann, Professor of Environmental Medicine at NYU. In 1986, Lipmann was discussed in a Tobacco Institute memo that implied he was "receptive to open discussion." By April 1989, Lipmann would be appointed a member of the Science Advisory Board for the Philip Morris-funded tobacco front group the Center for Indoor Air. Similarly, Terry Yosie, a Staff Officer for the EPA's Science Advisory Board who worked alongside Lippmann, would leave CASAC in 1988 to become vice president for health and the environment at the American Petroleum Institute.

8. Tobacco Tactics Through The 1980s And 1990s

Summary: Records reveal that the gas industry continued to utilize tobacco industry-style tactics through the 1980s and early 1990s, sponsoring research to influence EPA decision-makers again.

Having established a successful strategy for countering the prospect of regulation, the gas industry continued to utilize tobacco industry-style tactics through the 1980s and early 1990s.

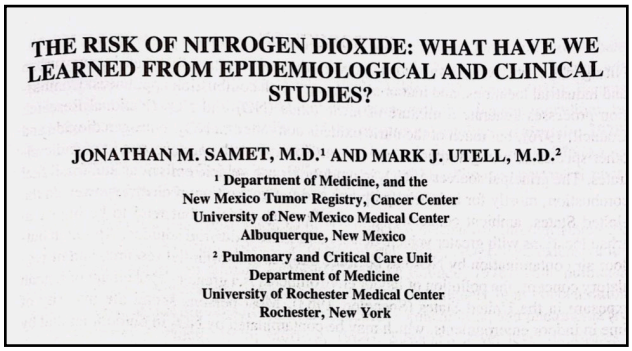
In the late 1980s and early 1990s, as external scientific research continued to link NO_2 emissions from gas stoves with respiratory problems, the gas industry once again funded its own epidemiological research.

In 1987, the Gas Research Institute (GRI) contributed over $1 million to a five-year epidemiological study co-sponsored by the "Health Effects Institute," (HEI), a self-described "independent research organization" that was co-funded by the EPA and 28 companies from the automobile industry. The HEI still exists and today is co-funded by the EPA, the automobile industry, the American Petroleum Institute, ExxonMobil, and ConocoPhillips.

The epidemiological study, titled "*Nitrogen Dioxide and Respiratory Illness in Children*," was published in 1993. Part 1, *Health Outcomes*, under lead author Dr. Jonathan M. Samet, aimed to test the hypothesis that exposure to nitrogen dioxide increased "the incidence and severity of respiratory infections during the first 18 months of life." Between January 1988 and June 1990, 1,315 infants were enrolled in the study at birth and followed with prospective surveillance for respiratory infections and monitoring of nitrogen dioxide concentrations in their homes.

However, peak levels of nitrogen dioxide were not measured, nor were kitchen concentrations. Instead, "exposure to nitrogen dioxide was estimated by two-week average concentrations measured in the subjects' bedrooms."

The authors reported that they found "no association between nitrogen dioxide exposure and the incidence rates for any illness category" and "no association between illness incidence and the presence of a gas stove."



THE RISK OF NITROGEN DIOXIDE: WHAT HAVE WE LEARNED FROM EPIDEMIOLOGICAL AND CLINICAL STUDIES?

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In 1990, Dr. Samet and Dr. Utell declared that, although numerous studies had examined the effects of exposure to NO_2 indoors, the evidence was "inconsistent."

In the interests of "autonomy," HEI's study was supported by an "Advisory Committee" and assessed by a "Review Committee." This Advisory Committee, however, was chaired by Dr. Mark Utell (a Science Advisory Board member of the tobacco-funded front group the Center for Indoor Air Research). Furthermore, HEI's Review Committee referred to the earlier gas-industry-funded Keller et al. studies in its assessment. *"Quality Assurance"* was provided by Arthur D. Little Inc.

Like the earlier AGA-funded studies, this GRI-funded research would influence EPA decision-makers.

Additionally, in 1990, while working on this five-year GRI-funded NO_2 study for HEI, Dr. Samet co-authored a review of the epidemiological and clinical data on the health effects of NO_2 exposure. Samet's co-author was Dr. Mark Utell. Their review, "*The risk of nitrogen dioxide. What have we learned from epidemiological and clinical studies*?," was published in the *Journal of Toxicology and Industrial Health*. Assessing the epidemiological evidence, which included the AGA-funded Keller et al. (1979) study, Samet and Utell declared that, although numerous studies had examined the effects of exposure to NO_2 indoors, the evidence was "inconsistent" and, as a result, the health effects of NO_2 in the indoor environment remained "controversial."

They concluded that "the human health effects of NO_2 exposure" had not been fully characterized" and called for more research, stating there was "immediate rationale for additional epidemiological studies of NO_2 in the indoor environment."

While a 1995 Philip Morris document noted qualities in Dr. Samet that likely would have made him an attractive candidate for the GRI, namely his "scientific conservatism regarding inference and interpretation," Samet now states that "scores of epidemiological studies since the 1990s" have "shown associations between NO_2 exposure and increased asthma symptoms."

In September 2023, Samet, now dean of the Colorado School of Public Health, co-authored a paper titled, "*Gas Stoves and Respiratory Health: Decades of Data, but Not Enough Progress*." The paper stated that "associations of gas stoves with adverse health outcomes have been documented for decades." It also argued that while further studies investigating "the relationship between gas stove replacement and health outcomes in children with asthma" would be "valuable," there is "a precautionary imperative to protect those who are susceptible and to look to mitigation of one source of greenhouse gases to protect the planet."

9. Synthesizing The Evidence

Summary: In 1992, a meta-analysis by Hasselblad et al. (EPA/Duke University) calculated "an increase of at least 20 percent in the odds of respiratory illness in children exposed to an increase of 30 µg/m3 NO_2." Hasselblad et al.'s conclusions looked bad for the gas industry, especially in the light of a forthcoming 1996 EPA *Decision on the NAAQS for Nitrogen Dioxide*. But, once again, the industry deployed tobacco-type tactics to neutralize the threat of regulation. In 1994, Dr. H. Daniel Roth and Roth Associates produced a paper dismissing Hasselblad et al.'s findings, concluding that "at minimum, further investigation and expanded analyses of the individual NO_2 studies would be required prior to estimation of health effect levels." The Roth Associates paper was supported by the Electric Power Research Institute, representing U.S. electric utilities, which, by 1994, were becoming more reliant on gas for electricity generation. Many electric utilities also distributed gas to customers. In 1996, referring to criticisms made in both the GRI-funded 1981 A. D. Little and Roth reviews, EPA announced its decision that, despite the conclusions made by Hasselblad et al., "revisions to neither the primary nor the secondary NAAQS for NO_2 are appropriate at this time."

Historically, differences in size and design meant that the findings of separate epidemiological studies could not meaningfully be synthesized to assess the overall statistical significance of this evidence.

In 1992, however, a joint EPA/Duke University study by Hasselblad et al., "*Synthesis of Environmental Evidence: Nitrogen Dioxide Epidemiology Studies*," demonstrated how statistical "meta-analysis" could be used to synthesize studies that could not previously be combined due to their differences. According to Hasselblad et al., this meta-analysis allowed researchers to analyze the evidence from separate studies simultaneously. While "evidence of the individual studies was inconclusive," argued Hasselblad et al., "when taken as a whole, the results of the meta-analysis suggest an increase of at least 20 percent in the odds of respiratory illness in children exposed to an increase of 30 µg/m3 NO_2."

Eleven studies were included in Hasselblad et al.'s analysis, including the AGA-funded Keller et al. (1979) studies. It is unclear if Hasselblad et al. were aware of AGA funding since it had not been disclosed. Nevertheless, if the industry-funded studies had not been included in Hasselblad et al.'s meta-analysis, then it's likely that the increase in the odds of respiratory illness would have been even higher than the 20% per 30 µg/m3 increase of NO_2 calculated.

Implications

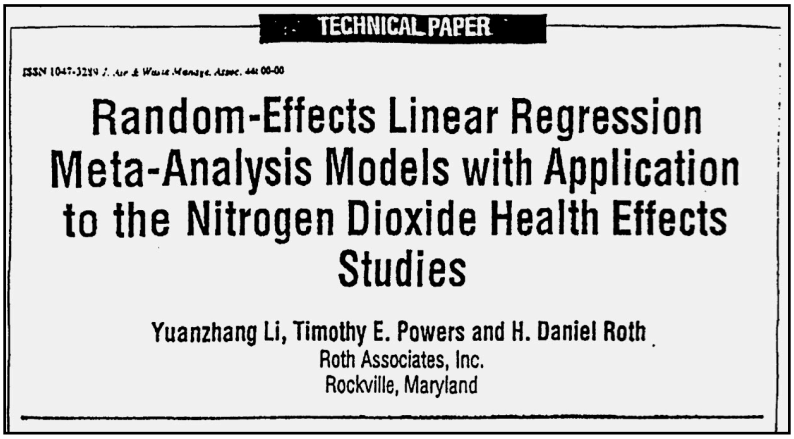
The assessment methodology discussed, meta-analysis, provides an alternative approach for assessing environmental data bases. Meta-analysis has the potential to increase the ability to estimate a small but meaningful change in the risk of a health outcome measure by analyzing the total evidence from all studies simultaneously. The specific example of the relationship of lower respiratory illness and nitrogen dioxide (NO_2) exposure is a case in point. The evidence of the individual studies was inconclusive. When taken as a whole, the results of the meta-analysis suggest an increase of at least 20 percent in the odds of respiratory illness in children exposed to an increase of 30 µg/m^3 NO_2. This analysis can be considered along with other evidence in assessing health effects of exposure to NO_2.

Hasselblad et al.'s 1992 analysis found "an increase of at least 20 percent in the odds of respiratory illness in children expose to an increase of 30 µg/m3 NO_2."

Even with Keller et al.'s inclusion, according to Hasselblad et al., "the final conclusion has to be that there is an increase in the odds of respiratory illness of children, especially those of elementary school age."

Hasselblad et al.'s conclusion looked bad for the gas industry, especially in light of the forthcoming 1996 EPA *Decision on the NAAQS for Nitrogen Dioxide*, which would review the available scientific evidence prior to reevaluating the outdoor standard. Automobile and power plant emissions represented the primary source of NO_2 pollution as they do today. However, due to a scarcity of epidemiological studies on the effects of outdoor NO_2 exposure, EPA decision-making on outdoor standards relied heavily on indoor studies. Therefore, had the EPA decided to revise its outdoor standards based on these indoor studies, the gas industry might have found itself more vulnerable to renewed calls for action against indoor air pollution too.

Re-enter statistical hitman H. Daniel Roth.


TECHNICAL PAPER

Random-Effects Linear Regression Meta-Analysis Models with Application to the Nitrogen Dioxide Health Effects Studies

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Dr. Roth responded to the Hasselblad et al. study in 1994.

Since 1981, when Roth presented "The Controversy Over NO_2 And Health," the consultant had remained busy working for the gas and electric utility industry. He analyzed data for the electric utility industry, specifically the Electric Power Research Institute (an organization analogous to the GRI for electric utilities) and the Utility Air Regulatory Group. He had also examined links between childhood leukemia and electric fields, and sulfur dioxide and mortality. Roth also researched connections between alcoholic beverages and breast cancer for the alcoholic beverages industry. In 1985, Philip Morris hired Roth to assist with the company's litigation efforts in developing methods to attribute lung cancer to asbestos rather than smoking. According to epidemiologist Professor David Michaels, former Assistant Secretary for Environment, Safety and Health at the U.S. Department of Energy and author of "*Doubt Is Their Product,*" which chronicles efforts by industry to manufacture the appearance of scientific uncertainty, "Dr. Roth may be the premier, all-purpose, pro-industry reanalyzer."

In 1994, Roth Associates, the consulting firm started by Dr. Roth, produced a paper, "*Random Effects Linear Regression Meta-Analysis Models with Application to the NO_2 Health Effects Studies,*" published in the Journal of Air and Waste Management.

In its reanalysis of the "Nitrogen Dioxide / Respiratory Effects" studies, Roth Associates specifically responded to the Hasselblad et al. study, outlining "potential problems" and asserting that the analysis methods used by Hasselblad et al. may have ignored important differences in the individual studies, thus invalidating the results. For example, according to Roth Associates, "not all of the NO_2 studies involved children of the same ages," which might have led "to real but unnoticed differences in the NO_2 effect from one study to the other." As a result, Roth Associates asserted that the studies synthesized by Hasselblad et al. "do not appear" to have met "the homogeneity requirements of the fixed-effects model, and the conclusions which may be derived from the random-effects model," (i.e., those employed by Roth Associates), are therefore, "much weaker."

On that basis, Roth Associates dismissed the conclusions of Hasselblad et al., concluding that "at minimum, further investigation and expanded analyses of the individual NO_2 studies would be required prior to estimation of health effect levels."

Using statistics as a defensive and an offensive weapon was another tried-and-tested tobacco tactic. Just as Mitchell et al. had reanalyzed the data from the EPA's Long Island study in 1974, the tobacco industry (under the watch and encouragement of Hill & Knowlton) had seen the value of strategic data reanalysis two decades earlier, proposing "statistical studies" to counter "attacks" on health effects research as early as 1954.

Electric Power Research Institute

In an acknowledgment section following its paper's conclusion, Roth Associates thanked "the Electric Power Research Institute for their support for this study."

By 1994, U.S. utilities were becoming more reliant on gas for electricity generation, and consequently, their interests were becoming more closely aligned with those of the gas industry. According to a 1992 article in the EPRI journal, forecasters had predicted that "natural gas will be the dominant fuel choice for utility capacity additions in the coming decade and that power generation will be by far the largest growth market for gas sales." Many electric utilities distributed and sold gas to customers, as remains the case today.

1996 EPA Decision on Nitrogen Dioxide

In October 1995, the EPA published its proposed decision on the National Ambient Air Quality Standards for Nitrogen Dioxide, inviting comments before its final decision the following year.

EPA records show that the agency received eight written responses to its proposed decision - five were from individual industrial companies or industrial trade associations arguing against revising the NO_2 standards.

In addition to public comments, the docket also contained "other documents," including "relevant scientific literature." The Climate Investigations Center has not obtained the industry comments nor the "other documents" to date but is continuing research in this area.

A key document prepared for EPA decision-makers was the EPA Office of Air Quality Planning & Standards' (OAQPS) Staff Paper Review of the NAAQS for NO_2. Stating that epidemiological studies assessing the health effects of outdoor NO_2 were relatively few, the Staff Paper's authors relied heavily on evidence from "Indoor Studies."

The EPA reviewers referred to a growing number of available indoor epidemiological studies, citing at least twelve separate studies (or reanalyses) which had found a positive association between NO_2 and respiratory problems and six studies (or reanalyses) which had found no association. The six negative studies once again included the Keller et al. studies (AGA funding undisclosed). EPA reviewers stated that "Keller et al. (1979a,b) reported no statistically significant changes in respiratory disease associated with living in homes with gas stove use." The GRI-sponsored study conducted by Samet et al. in 1993 for the Health Effects Institute was also included in this group. Stating that individual studies on the effects of NO_2 on infants provided "no consistent relationship between estimates of NO_2 exposure and the prevalence of respiratory symptoms and disease," EPA reviewers referred to Samet et al.'s findings of "no significant association between NO_2 exposure estimates" and "respiratory illness" in infants during their first 18 months of life.

In addition to assessing the findings of individual indoor epidemiological studies, the EPA reviewers discussed the findings of the new meta-analysis conducted by Hasselblad et al. at considerable length. And, although the EPA authors acknowledged Hasselblad et al.'s conclusions of an increased risk of about 20% for developing respiratory symptoms for children (aged 5 to 12 years) with each increase of 0.015ppm NO_2 exposure, they argued that this meta-analysis was of limited usefulness in developing the basis for a NAAQS for NO_2. Echoing the criticisms of epidemiological studies made by the GRI-

funded 1981 A. D. Little and 1981 Roth literature reviews, the authors of the EPA Staff Paper Review stated that "There remains substantial uncertainty about the actual exposure of subjects in the above studies. The NO_2 levels which were monitored in the gas-stove studies are only estimates of exposure and do not represent actual exposures." The EPA authors were also unconvinced that indoor results could be extrapolated to the outdoor environment.

Summarizing their decision, the EPA authors concluded that "Given the uncertainty associated with determining actual exposure patterns in these homes and the difficulty in extrapolating the data to ambient exposures, results of the meta-analysis provide insufficient data to support specific limits for either short-term or long-term standards for nitrogen dioxide."

Further explanation revealed the continued influence of the scientific evidence provided for the EPA's previous 1985 review of the NO_2 standards. "Based on this current assessment of the available scientific and technical information (which remains largely unchanged since the 1985 review), the staff again recommends consideration be given to setting the level of the annual primary standard within the range of 0.05 to 0.08 ppm NO_2," the EPA authors wrote.

In August 1995, the Chairman of the EPA's Clean Air Scientific Advisory Committee (CASAC), George T. Wolff, wrote to the EPA Administrator stating that the Committee saw no need to revise the existing standard for NO_2. During this time, Wolff also held the position of Principal Scientist at General Motors, Environmental and Energy Staff.

In October 1996, the EPA announced its decision that, despite the findings of the meta-analysis by Hasselblad et al., "revisions to neither the primary nor the secondary NAAQS for NO_2 are appropriate at this time."

10. Protection Of Public Health

Summary: After decades of inaction, in 2010, the EPA introduced a new outdoor 1-hour standard for NO_2 of 100 ppb / 0.1 ppm. Tracing the influence of the AGA-funded epidemiological studies on EPA, CPSC decisions, and CASAC input illustrates how the gas industry studies contributed to delaying the revision of the outdoor NO_2 standard. In the absence of substantial outdoor epidemiological evidence during the 1980s and 1990s, EPA decision-making documents from that period relied heavily on indoor epidemiological studies investigating the association between gas stove emissions and respiratory problems for evidence of NO_2-related health effects. The EPA's explanation of its 2010 decision suggested that this delay had a cost in human life.

In 2010, the EPA introduced a new outdoor 1-hour standard for NO_2 of 100 ppb / 0.1 ppm. According to the EPA, its decision was based on "a substantial amount of new research" with "important new information coming from epidemiological studies." "Two key health effects were of greatest concern," stated the EPA. "The first was increased airway responsiveness in asthmatic individuals after short-term exposures. The second was increased respiratory illness among children associated with longer-term exposures to NO_2."

These new epidemiological studies were also supported by evidence from toxicological and controlled human exposure studies, "particularly those that evaluated airway hyperresponsiveness in asthmatic individuals."

The EPA also included details of comments submitted by industry groups, including the Alliance of Automobile Manufacturers (AAM), the American Petroleum Institute (API), the Interstate Natural Gas Association of America (INGAA), and the Utility Air Regulatory Group (UARG) which expressed support for retaining the current annual standard alone. According to the EPA, these industry commenters had concluded that the current standard was "requisite to protect public health with an adequate margin of safety" and that the available evidence was "not sufficient to support revision of the standard."

The INGAA, an industry association representing large gas pipeline owners, stated that the "EPA should be compelled to retain the current standard and defer a decision on a new short-term standard **until the science is more clearly defined.**" (emphasis added)

Several industry groups including, API, AAM, the National Mining Association (NMA), the American Chemistry Council (ACC), and the National Association of Manufacturers (NAM), as well as oil and gas giant ExxonMobil, commented that "given the presence of **numerous co-pollutants** in the air, epidemiologic studies do not support the contention that NO_2 itself is causing health effects." (emphasis added)

The industry comments reflected the same criticism addressed by EPA researcher Dr. Carl Shy in 1973 and repeated in the A. D. Little and Roth reviews in 1981.

In February 2010, the EPA published its decision, disagreeing with the industry commenters and introducing a new 1-hour Standard "in order to provide requisite protection of public health."

Tracing the influence of the AGA- and GRI-funded epidemiological studies on EPA, CPSC decisions, and CASAC input illustrates how these gas industry studies contributed to delaying the revision of the outdoor NO_2 standard. As previously discussed, in the absence of substantial outdoor epidemiological evidence during the 1980s

and 1990s, EPA decision-making documents from that period relied heavily on indoor epidemiological studies conducted in gas stove homes.

The EPA's explanation of its new 1-hour standard suggested that the delay had a cost in human life:

"The evidence summarized in the ISA indicates that NO_2 associations generally remain robust in these multi-pollutant models and supports a direct effect of short-term NO_2 exposure on respiratory morbidity (see ISA Figures 3.1-7, 3.1-10, 3.1-11). The plausibility and coherence of these effects are also supported by epidemiologic studies of indoor NO_2 as well as experimental (i.e., toxicological and controlled human exposure) studies that have evaluated host defense and immune system changes, airway inflammation, and airway responsiveness (see subsequent sections of this proposal and the ISA, section 5.3.2.1). The ISA (section 5.4) concluded that the robustness of epidemiologic findings to adjustment for co-pollutants, coupled with data from animal and human experimental studies, support a determination that the relationship between NO_2 and respiratory morbidity is likely causal, while still recognizing the relationship between NO_2 and other traffic related pollutants."

Nevertheless, despite the introduction of this first-of-its-kind 1-hour outdoor standard in 2010, regulations for NO_2 stopped at the doorway of American homes, as they continue to do today.

11. Massive, Consistent, Long-Range Public Relations Programs

The gas industry has continued to utilize tobacco industry-style tactics up to the present day.

In 2023, the AGA funded a literature review titled "*Gas Cooking and Respiratory Outcomes in Children: A Systematic Review*" (published in *Global Epidemiology,* Volume 5, December 2023), which concluded that the "epidemiology literature … does not provide sufficient evidence regarding causal relationships between gas cooking or indoor NO_2 and asthma or wheeze."

Gradient has a long history of defending industry clients against health effects research on substances such as mercury and other air toxins, Bisphenol-A, formaldehyde, dioxins, and styrene, frequently providing its in-house experts to submit comments or testify against the need for tighter regulations.

Former Gradient clients have included the American Chemistry Council, the American Plastics Council, and the American Petroleum Institute. "Gradient has provided decades of technical support to the oil and gas industry," the firm states on its website.

Funding sources

All authors are employed by Gradient, a private environmental consulting firm. The American Gas Association (AGA) provided funding for this systematic review. This work was conducted during the authors' normal course of employment. AGA was not involved with the drafting of this paper. The authors had sole responsibility for the writing and content of this paper, which represents the professional opinions of the authors and not necessarily those of AGA. The authors shared initial findings with AGA.

The American Gas Association funded Gradient's review of epidemiology studies that was published in 2023.

According to *Global Epidemiology*, this AGA-funded study was carried out by researchers from Gradient Corporation, a private scientific consulting firm, and Penn State College of Medicine.

As demonstrated by David Michaels in "*Doubt Is Their Product*," Gradient is one of many boutique 'product defense' science shops that have grown out of the success of the Hill & Knowlton formula. These scientific consultancies have provided on-call toxicologists, epidemiologists, and statisticians to help corporations battle the regulation of a growing list of toxic pollutants.

In 2010, API used information provided by a Gradient consultant, Dr. Seeley, against EPA's introduction of the 1-hour NO_2 standard.

Dr. Li Wenchao, lead author of the 2023 study, previously co-authored two studies for Gradient criticizing research linking particulate matter (PM2.5) with human health impacts.

Dr. Li's co-author on the 2023 AGA study, Dr. Julie Goodman, has an extensive track record of pushing back against health risks research – attacking the science on particulate matter (API) and arguing against

research associating BPA with hormone disruption (for the American Plastics Council), dioxins with thyroid function, formaldehyde with leukemia, and soluble nickel and styrene with cancer.

And, while another co-author, Tongyao Fan, is listed in the Global Epidemiology study as being affiliated only with Penn State College of Medicine, Tongyao Fan was also working "full time" at Gradient during the period in which the study was completed (Feb 2022-April 2023), according to her LinkedIn page.

The AGA, which declared its funding of the Gradient study in a News Release, concluded that "there is no scientific basis to draw any conclusions concerning a causal relationship" between "gas cooking and NO_2 and asthma".

After decades of advocating for observational epidemiological research, which can inherently demonstrate only correlation and not causation, AGA is today setting the bar for what constitutes proof of gas stoves' harm to human health at causation – a trap potentially laid for the gas industry's critics as early as 1981 in the Gas Research Institute-funded A.D. Little and H. D. Roth reports. Thus, in 2023, after arguing for over forty years that more epidemiological research was needed investigating the link between gas stove use and respiratory illness, AGA is today attacking the conclusion of such research on the basis that it "does not demonstrate a causal relationship."

In addition to this, the American Public Gas Association (APGA), which represents municipal gas utilities, continues the industry's tradition of promoting diversionary science by claiming that research "fails to accurately characterize the indoor air quality impact of natural gas cooking" because it "did not test appliances in real-life scenarios or compare them to emissions from other cooking sources." It's the latest iteration of the "other factors" argument that the gas industry has been employing since the 1970s.

Today's iteration of the Gas Research Institute, now called GTI Energy after GRI merged with the Institute of Gas Technology in 2000, and re-branded again last year) also continues to fund research that focuses on gas stove emissions. GTI Energy's research suggests that "other factors" might be responsible for indoor pollution impacts. According to AGA, "a 2022 study by GTI Energy, which actually tested gas and electric stoves in a lab showed no difference in their particulate emissions, but it did show what and how you cook matters."

12. Conclusion

This investigation presents evidence that the gas industry has employed Big Tobacco's tactics to manufacture and magnify controversy over the health impacts of gas stove emissions since the early 1970s. It also presents evidence from this same period showing that Hill & Knowlton, a public relations company that was a leading advisor of tobacco companies, shared insight and strategy with the gas industry.

In the fifty years since a 1973 Yale Law Journal editorial described indoor pollution as a "menace" that required "comprehensive federal legislation," evidence demonstrating the harmful effects of gas stove emissions on health has grown enormously, transforming scientific understanding of indoor air pollution in ways which strongly support the conclusions of studies that first associated nitrogen dioxide exposure from gas stoves with respiratory problems. In December 2022, peer-reviewed research by RMI (formerly Rocky Mountain Institute), a non-partisan research organization, the University of Sydney, and the Albert Einstein College of Medicine estimated that "nearly 13 percent of childhood asthma cases in the United States can be linked to having a gas stove in the home."

Additionally, recent studies have shown that adverse health effects are not limited to people with asthma. Indoor NO_2 exposure has been linked to morbidity in people with chronic obstructive pulmonary disease and to respiratory problems in individuals without known lung disease.

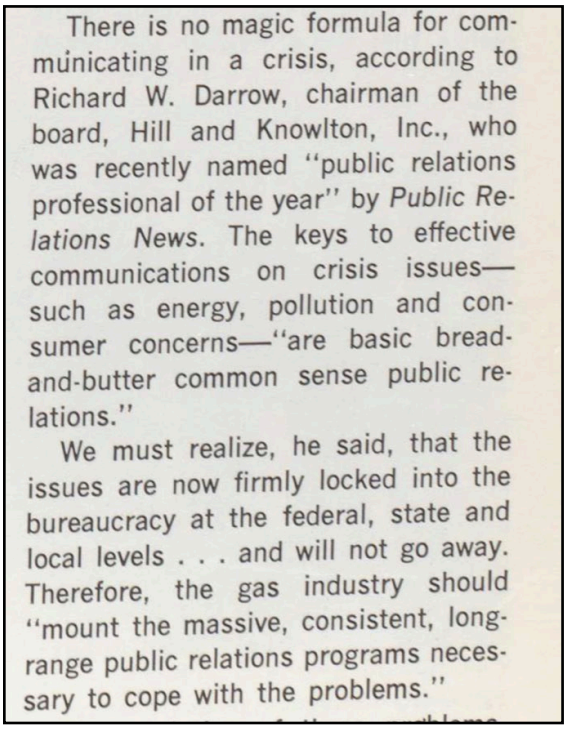
The health impacts of gas stove emissions may also disproportionately affect lower-income households and people of color, many of whom already live in neighborhoods with polluted outdoor air. Concentrations of pollutants are higher in smaller kitchens and living spaces, in kitchens without a working range hood for ventilation, and in homes where windows are kept shut to prevent infiltration from outdoor pollution. Using gas stoves as a heat source to stay warm during winter also increases pollutant levels. According to the Public Health Law Center, "asthma and other respiratory illnesses associated with air pollution disproportionately impact Black, Indigenous, and Puerto Rican communities." A 2005 study found mortality rates among Black and Hispanic people with asthma to be three times higher than among white people with asthma, and emergency department visits and hospitalization rates two to three times higher.

Since the 1970s, studies have also identified the health impacts of other pollutants emitted by gas stoves, including carbon monoxide (which can exacerbate cardiovascular problems for people with coronary heart disease and other vulnerable individuals) and benzene (linked to a variety of cancers, including leukemia and lymphoma).

Dr. Bernard Goldstein, the U.S. researcher who worked on the U.K. team studying gas stove emissions in the late 1970s, wrote an op-ed for the *Pittsburgh-Post Gazette* in June 2023. Referring to his 1970s study group's early findings on both high indoor NO_2 levels from gas stoves and associated respiratory problems, Goldstein wrote that "subsequent studies more than amply confirmed these high nitrogen dioxide levels as well as a causative role for gas stoves in lung problems, including childhood asthma attacks." Highlighting that "it has taken almost 50 years since the discovery of the negative effects on children of nitrogen dioxide from gas stoves to begin preventive action," Goldstein concluded, "We should not wait any longer."

In 1972, Richard Darrow of Hill & Knowlton advised the gas industry to counter the challenges it faced by mounting "massive, consistent, long-range public relations programs." The evidence laid out here shows how the industry heeded Darrow's advice, mounting exactly such a program in the

decades since the 1970s – a program that continues to this day.



There is no magic formula for communicating in a crisis, according to Richard W. Darrow, chairman of the board, Hill and Knowlton, Inc., who was recently named "public relations professional of the year" by *Public Relations News*. The keys to effective communications on crisis issues—such as energy, pollution and consumer concerns—"are basic bread-and-butter common sense public relations."

We must realize, he said, that the issues are now firmly locked into the bureaucracy at the federal, state and local levels . . . and will not go away. Therefore, the gas industry should "mount the massive, consistent, long-range public relations programs necessary to cope with the problems."

Hill & Knowlton's Richard Darrow's advice to the gas industry, 1972.

From this perspective, the gas industry's deployment of tobacco-style tactics to defeat "proposals for regulation and restrictions" (as advocated by Hill & Knowlton in 1972) have played a fundamental role in ensuring a lack of effective action in the U.S. against the "menace" of indoor air pollution.

However, as new scientific research again puts gas stove emissions in the spotlight, a new opportunity exists for policymakers and regulators to take action - this time free of the misinformation the gas industry promotes.

Acknowledgements

Revealed by decades of legal challenges that eventually brought cigarette companies to justice, the 'tobacco' strategy has been used by multiple industries to deny links between their products and harmful impacts on health and the environment. Recent scholarship and investigations, such as '*Merchants of Doubt*' by Naomi Oreskes & Erik Conway; '*Doubt Is Their Product*' by David Michaels;' the '*Smoke & Fumes*' Report by the Center for International Law (CIEL); and '*Drilled*' Series 3 by Amy Westervelt, demonstrate that corporations have used this strategy to deny the hazards posed by cigarettes, asbestos, lead, plastics, toxic chemicals, CFCs and Carbon Dioxide emissions. CIEL's *Smoke & Fumes* Report also revealed that in the 1950s Hill & Knowlton's Richard Darrow managed both the PR firm's tobacco and oil industry accounts - an important clue for this present investigation. *Burning Questions* adds to this work and that of many others (including academics, reporters, former industry employees and environmentalists) who have collectively contributed to a growing body of evidence bringing to light multi-industry efforts to deflect responsibility for the harmful impacts of their products and activities.

Many people have also made invaluable individual contributions to this specific investigation, including Kert Davies and Dan Zegart at the Climate Investigations Center; David Pomerantz, Matt Kasper, and Charlie Spatz at the Energy and Policy Institute; Professor Robert J. Brulle of Brown University; Professor David Michaels of George Washington University. Special thanks also goes to Brendan DeMelle and the DeSmog team for their support of the work that led to these discoveries and to those who provided additional library research. Errors and omissions are the sole responsibility of the Climate Investigations Center.

Methodology

The evidence presented here was obtained from the following sources: the tobacco litigation archives - Industry Documents Library UCSF and Philip Morris USA Public Documents Site; the U.S. National Archives and Records Administration; the John W. Hill Papers at the Wisconsin Historical Society, Division of Library, Archives and Museum Collection; the U.S. Library of Congress; the New York Times newspaper archive; gas and utilities industry journals (including the AGA Monthly and the EPRI Journal); and numerous academic, scientific and legal journals. See the source notes below for full details.

Our investigation has focused on documents pertaining to the gas industry, the tobacco industry, and Hill & Knowlton during a time period beginning in the 1950s. While some questions have been answered, this investigation also raises new questions and opens up further avenues for research. We are still searching for documents to fill in gaps that remain and welcome any and all tips, insights, and documents.

Appendix: Hill & Knowlton And The Gas Industry

This appendix expands on Hill & Knowlton's advice to the gas industry summarized in "Chapter 2: Reassurance Of The Public."

The Hill & Knowlton Formula

When Hill & Knowlton executives advised the gas industry in the early 1970s, their recommendations contained numerous elements of the Hill & Knowlton formula. Documents within the John W. Hill Papers at the Wisconsin Historical Society Archives and the Industry Documents Library at UCSF reveal that Hill & Knowlton developed its formula through decades of experience working for some of the most powerful corporations in America. As summarized by the Climate Investigations Center below, this formula consisted of several key elements:

- **Establish a "Research Committee" or "Institute"**

Hill & Knowlton's formula was often applied across industries via representative trade associations. If these trade associations didn't exist, the PR firm would recommend establishing a "Research Institute" or "Committee" on behalf of that industry to conduct these PR functions. For example, in 1953, a Hill & Knowlton plan-of-action memo advised cigarette manufacturers to establish a committee with "Research" in its name. In 1955, Hill & Knowlton also advised gas producers to do the same. "Such an organization should: Carry the title of an Institute or Foundation," wrote Hill & Knowlton to the gas industry in a proposal for a long-range PR program. As the firm explained to both its tobacco and gas industry clients, the aim of these organizations was to carry out public relations activities on behalf of an industry as a whole, serving that industry with one "forthright voice."

- **Gather as much information as possible via public opinion surveys and background research.**

Hill & Knowlton recommended this approach to the chemical industry in 1951, the tobacco industry in 1953, and gas producers in 1955.

- **Publicize any information showing the industry in a positive light such as how much the industry is spending on finding solutions to the problem or underscoring the industry's importance to the economy and, if possible, national security.**

"People ... should appreciate the many important contributions of chemicals to our food supply instead of regarding the word chemical as something dangerous," wrote a senior Hill & Knowlton executive in August 1951, formulating the firm's crisis work for the Manufacturing Chemists' Association (MCA) in the wake of the 1950 "Chemicals-in-Food" scandal. That same month, Hill & Knowlton sent a PR proposal to the MCA, which emphasized that, "A great deal of additional information should be collected which would illustrate the care exercised by the chemical industry to minimize risks attending use of chemicals in foods. Such material would recount types of laboratories maintained, the tests conducted, and industry experience with chemicals in foods."

Consequently, publicity materials produced by Hill & Knowlton for the MCA stressed the chemical industry's importance to both the economy and national security. "Before the mid-thirties, chemicals played almost wholly a helping-hand role in industry," stated a Hill & Knowlton background memo produced for "wide distribution" to the press and others. "Chemicals are still doing all these things today," the memo continued. "But they have

entered upon a bigger -- and from the standpoint of the national economy and national security -- a vastly more important role. The new synthetic chemicals rival steel, copper and aluminum as important basic materials."

- **Get ahead of "critics" and take control of the narrative by facilitating industry sponsorship of existing or new research to build public confidence by enhancing positives or refuting or casting doubt on scientific findings linking the industry to harmful environmental or health impacts. Recruit established scientists and experts to carry out this research or to speak on the industry's behalf.**

Hill & Knowlton documents reveal that this policy was deployed by the PR firm on behalf of the chemical industry (1951-1953) and the tobacco industry (1953-1969), and recommended to gas producers in 1955. "Without accurate data of its own, experience has shown, an industry is in a weak position to question the accuracy of facts and interpretations about the industry from government and outside sources," Hill & Knowlton told gas producers. The firm also recommended, "The new gas-and-oil producing industry organization may wish to sponsor certain projects at leading universities or research institutions to develop some of this material." The same advice had been given to the tobacco industry in 1953 when Hill & Knowlton recommended it should "start screening and planning a scientific research program" in order to restore public confidence.

Casting doubt on scientific findings linking cigarette smoking to disease was also an essential part of Hill & Knowlton's tobacco work for the best part of two decades. "The most important type of story is that which casts doubt on the cause and effect theory of disease and smoking," wrote Hill & Knowlton's Carl Thompson to the Tobacco Institute in 1968. In the meantime, Hill & Knowlton suggested that people should be encouraged to "let the scientists do the worrying" and to "go on eating, and working, and playing, and smoking, and relaxing, and riding in automobiles, and living a good life everyday."

To achieve success, however, it was important to recruit respected scientists and experts to speak on an industry's behalf. This use of third-party advocacy was also implemented by Hill & Knowlton for the MCA in 1951.

- **Adopt a skeptical stance, arguing that more research is needed. Describe scientific findings as controversial and emphasize that "other factors" need to be properly evaluated.**

This aspect of the formula is evidenced most notably in documents from Hill & Knowlton's PR campaigns conducted on behalf of its tobacco clients. For example, the *"Frank Statement to Cigarette Smokers,"* issued by the tobacco industry in January 1954, displayed the skeptical stance adopted by cigarette manufacturers from the outset of their crisis response. "Although conducted by doctors of professional standing, these experiments are not regarded as conclusive in the field of cancer research," read the statement. "Distinguished authorities point out," it continued, "1. That medical research of recent years indicates many possible causes of lung cancer. 2. That there is no agreement among the authorities regarding what the cause is. 3. That there is no proof that cigarette smoking is one of the causes." Later, in 1954, a Hill & Knowlton Staff Memo reveals how the PR firm framed the health crisis as controversial, arranging for a booklet titled, "*A Scientific Perspective on the Cigarette Controversy*" to be sent to "every doctor in the country."

Placing the potential blame on "other factors" also played a key role in manufacturing doubt. A 1968 memo from Hill & Knowlton's Carl Thompson instructing the Tobacco Institute on how to write headlines for the tobacco industry propaganda mouthpiece "*Tobacco and Health Research*" emphasized that they "should be very carefully written on the premise that doctors and scientists, like

other readers, often grab information from the headlines and nothing more. Thus, the headline should strongly call out the point -- Controversy! Contradiction! Other factors! Unknowns!"

- **Publicize the results of industry-sponsored research efforts through every possible channel.**

This approach is illustrated in multiple documents produced by Hill & Knowlton for its chemical, tobacco and gas industry clients in the 1950s. "The industry should develop a public policy with regard to chemicals in foods and utilize all available public relations media to gain wider public understanding of the industry's position," Hill & Knowlton told the MCA in 1951. Across multiple campaigns, Hill & Knowlton recommended targeting relevant lawmakers, regulators, and opinion leaders, including newspaper editors, writers, radio and television broadcasters, doctors, women's groups, teachers, and others (such as clergymen and librarians) depending on the matter.

- **Once a company or industry averts any immediate crisis, continue with the formula over the long term and stay attuned to potential threats while adjusting research programs accordingly.**

For example, in 1952, Hill & Knowlton told the MCA that it needed "an intelligent, continuing, and carefully-planned long range program" to "foster adequate public appreciation of the industry's contribution to the health, employment, income, standard of living, and general well being of the people." In 1953 Hill & Knowlton told cigarette manufacturers that it should set up "a continuing research project to collect, coordinate and disseminate (where practical) all available information on various medical research activities bearing on every phase of cigarettes and health." And, in 1955 Hill & Knowlton recommended a long-range program for gas producers.

Hill & Knowlton And The Gas Industry

Public relations firms are notoriously secretive, true to the old adage that *'the best PR is invisible PR.'* However, discoveries within the John W. Hill papers at the Wisconsin Historical Society Archives, the Industry Documents Library at UCSF, American Gas Association materials, and Hill & Knowlton publications have helped break down this wall of secrecy.

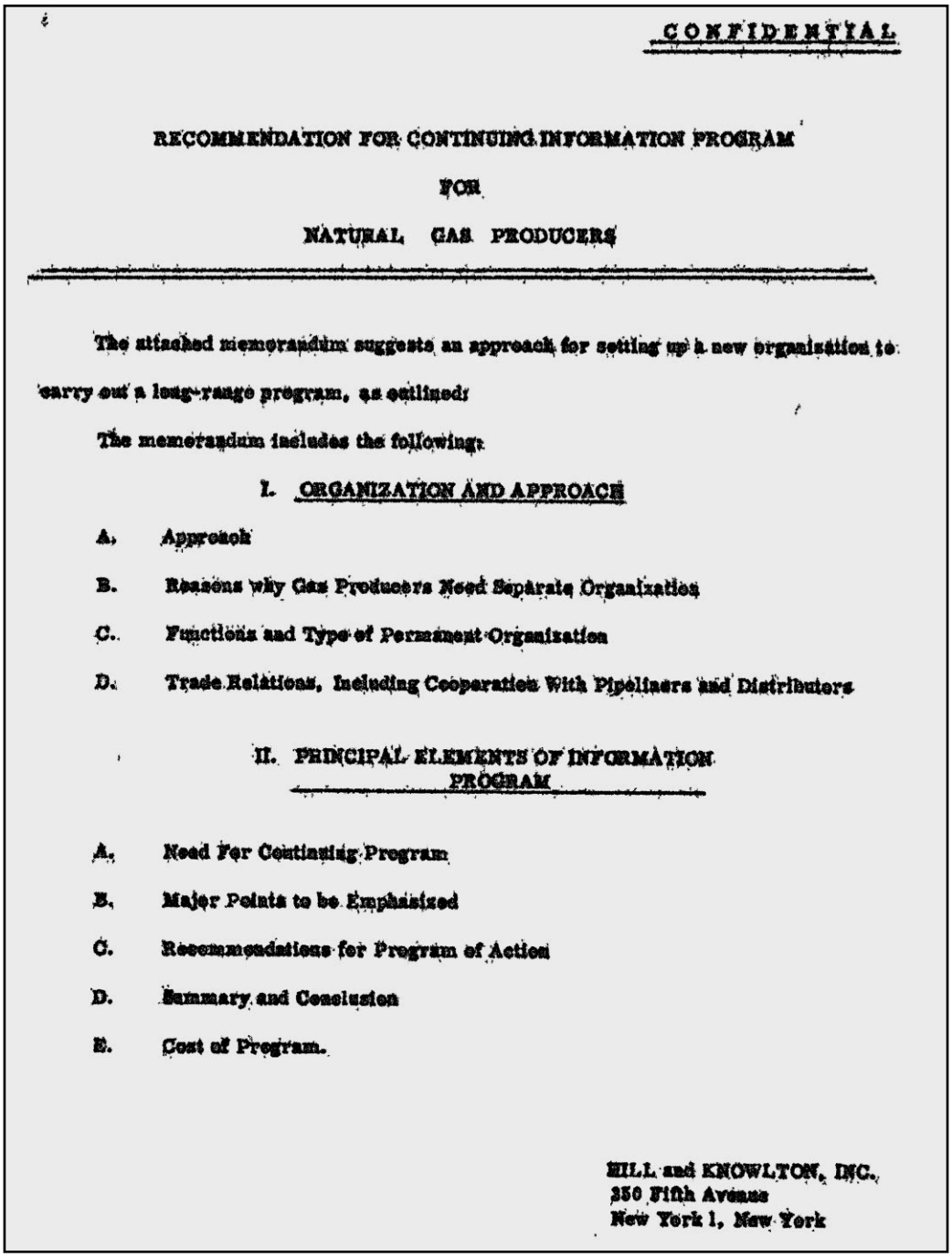
1955

In 1955, a team of Hill & Knowlton's top executives (including Richard Darrow, who was simultaneously head of Hill & Knowlton's tobacco account) pitched the idea of a continuing, long-range public relations program to U.S. gas producers. This long-range program displayed key elements of the Hill & Knowlton formula.

This 1955 pitch followed a successful crisis campaign the PR firm had conducted for the **Natural Gas and Oil Resources Committee (NGORC) –** an ad hoc committee of the major U.S. oil and gas producers formed to fight government regulation of natural gas prices. Member companies included Standard Oil of New Jersey (now ExxonMobil), Continental Oil, El Paso Natural Gas, Cities Service Gas Company, Phillips Petroleum, Shell, and many others. Hill & Knowlton's $1.7 million program for the NGORC involved a campaign that mobilized the gas industry across the U.S. to target influential opinion leaders and the general public via speeches, pamphlets, press releases, advertising campaigns, films (shown on television), radio programs, and carefully crafted background memoranda.

A Continuing Long-Range Program

Following the success of Hill & Knowlton's "NGORC information program," which had informed "Americans about the advantages of



CONFIDENTIAL

RECOMMENDATION FOR CONTINUING INFORMATION PROGRAM

FOR

NATURAL GAS PRODUCERS

The attached memorandum suggests an approach for setting up a new organization to carry out a long-range program, as outlined:

The memorandum includes the following:

I. ORGANIZATION AND APPROACH

A. Approach

B. Reasons why Gas Producers Need Separate Organization

C. Functions and Type of Permanent Organization

D. Trade Relations, Including Cooperation With Pipelines and Distributors

II. PRINCIPAL ELEMENTS OF INFORMATION PROGRAM

A. Need For Continuing Program

B. Major Points to be Emphasized

C. Recommendations for Program of Action

D. Summary and Conclusion

E. Cost of Program.

HILL and KNOWLTON, INC.
350 Fifth Avenue
New York 1, New York

Hill & Knowlton advised gas industry leaders in May 1955 that a "continuing long-range program" was required to inform the public about natural gas production and the work of gas producers.

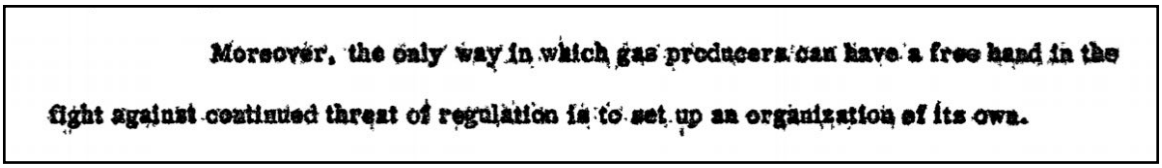
competition in gas production" and the so-called "inherent evils of federal regulation," the PR firm advised gas industry leaders in May 1955 that a "continuing long-range program" was required to inform the public about natural gas production and the work of gas producers. "Regulation will continue to be advocated in one form or another," emphasized Hill & Knowlton, arguing that "gas producers face numerous other

problems about which the public needs to be informed."

Hill & Knowlton declared that "the only way" gas producers could have "a free hand in the fight against continued threat of regulation" was to create an organization of its own. The firm suggested "the creation of a permanent industry organization that will represent the gas producers in relation with the public, the government, other industries and national organizations."

Above all, "Statistical Research" was essential. "Without accurate data of its own," Hill & Knowlton argued, "an industry is in a weak position to question the accuracy of facts and interpretations about the industry from government and outside sources."

Compiling "complete basic data about all segments of the industry" should be "one of the first and most important functions of any industry group carrying out a broad research, information-educating program."


Moreover, the only way in which gas producers can have a free hand in the fight against continued threat of regulation is to set up an organization of its own.

Hill & Knowlton recommended that the gas industry create create an organization of its own to "fight against continued threat of regulation..."

For maximum benefit, such an organization should "carry the title of an Institute or a Foundation," such as the "Natural Gas Resources Foundation" or the "Natural Gas Producers Institute," Hill & Knowlton explained.

"Accurate Data of Its Own"

Having won initial approval from the NGORC leadership, Hill & Knowlton pitched its long-range plan to the entire NGORC in July 1955, outlining the specific functions and benefits of its proposed "permanent industry organization."

Hill & Knowlton recommended that "the functions of such an organization or association would be chiefly concentrated on research, industry relations and information-education activities on behalf of gas producers." Research should be related to "common problems" and focus on "statistical and other factual data regarding the industry" with an ultimate aim of increasing the market for gas in terms of both "household and industrial uses."

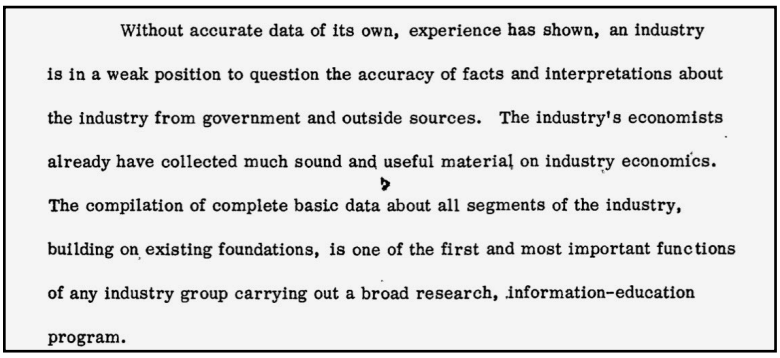
In particular, Hill & Knowlton advised that the new gas industry organization "sponsor certain projects at leading universities or research institutions to develop some of this material. It will also need to collect, interpret and publish basic data on its own."

"Washington Service"

Hill & Knowlton's pitch also outlined the benefits of the PR firm's "Washington Service," stating "that the importance of effective public relations representation in Washington has been demonstrated during hearings over the years on the various gas bills."

According to Hill & Knowlton, the new gas organization's service in Washington could: "keep important Congressmen and key government officials informed about the industry," "keep the industry fully informed about changing legislative and administrative matters," and "supply the Washington press with information about gas production - serving as the industry voice in the Capitol."

"A continuing long-range program is necessary to adequately inform the public," re-iterated Hill & Knowlton. "The same pressures, misconceptions and misrepresentations that have led to today's problems for gas producers are likely to make themselves felt in the future. If allowed to go unchallenged, they could place one part or another of the industry in jeopardy time and again."



Without accurate data of its own, experience has shown, an industry is in a weak position to question the accuracy of facts and interpretations about the industry from government and outside sources. The industry's economists already have collected much sound and useful material on industry economics. The compilation of complete basic data about all segments of the industry, building on existing foundations, is one of the first and most important functions of any industry group carrying out a broad research, information-education program.

In 1956, Hill & Knowlton sent an abridged version of its long-range plan to the president of Continental Oil.

In April 1956, Hill & Knowlton sent an abridged version of its plan to the president of Continental Oil, reiterating the benefits of a "permanent Research Bureau" that would embrace "statistics and facts bearing directly on current and recurring problems that are not now readily available to the industry as a whole."

"Without accurate data of its own," Hill & Knowlton repeated, "experience has shown, an industry is in a weak position to question the accuracy of facts and interpretations about the industry from government and outside sources ... The compilation of complete basic data about all segments of the industry, building on existing foundations, is one of the first and most important functions of any industry group carrying out a broad research, information-education program."

Hill & Knowlton again repeated, "The new gas-and-oil producing industry organization may wish to sponsor certain projects at leading universities or research institutions to develop some of this material. It will also need to collect, interpret and public basic data on its own."

The establishment of a research-based organization with "Institute" in its title that sponsored its research at respected institutions to influence public opinion and fight government regulation was the cornerstone of Hill & Knowlton's tobacco strategy.

While records suggest that gas producers did not pursue Hill & Knowlton's proposal for this long-range program in the 1950s, elements of this program and the 'tobacco' strategy it contained are, nevertheless, strikingly visible in the actions taken by the gas industry in the 1970s. Still, the PR firm continued to represent individual oil and gas interests, including Cities Service, the California Texas Oil Company, and the Texas Company (Texaco) after 1956. By 1960, it would also represent the American Petroleum Institute, the principal representative of the major U.S. oil and gas companies.

1970s

While the extent of Hill & Knowlton's services for the American Gas Association and its members in the early 1970s is not clear, elements of Hill & Knowlton's 'tobacco' formula are visible within the gas industry's actions during this period as illustrated by documents detailed in this report and appendix. The John W. Hill Papers at the Wisconsin Historical Society Archives terminate for the most part in 1964. However, *O'Dwyer's Directory of Public Relations Firms* combined with publications produced by American Gas Association (AGA) and Hill & Knowlton in the 1970s show a continued association between Hill & Knowlton and the gas industry.

In 1972, Hill & Knowlton was the largest and most profitable PR firm in the U.S. with a net income of H&K $8,829,863. It represented

Cities Service, Continental Oil, El Paso Natural Gas, Lone Star Gas, Marathon Oil, R. J. Reynolds Industries (the tobacco giant which also owned the American Independent Oil Company), the Pennsylvania Electric Association, and the American Petroleum Institute.

Numerous editions of the AGA's in-house magazine, *AGA Monthly*, show top-level PR representatives from Hill & Knowlton attending AGA-INGAA Public Relations workshops organized by the AGA and INGAA (Interstate Natural Gas Association of America) in the 1970s. The pages of AGA monthly reveal some of the most senior figures at Hill & Knowlton, including its then president and chairman of the board, Richard Darrow, traveling long distances to attend these workshops, taking a center stage role, and publicly advising the industry in line with its tried-and-tested 'formula' - advice that the industry followed in the 1970s and beyond.

AGA-INGAA's PR workshop in 1972

A March 1972 AGA Monthly article announced that Disney World, Florida, would be the venue for the AGA-INGAA's annual PR workshop, stating that "the opening session will cover economics and communications. Speakers include John G. Winter, vice president, Chase Manhattan Bank; Richard W. Darrow, president, Hill and Knowlton; John W. Morton, chairman of INGAA and president of CEO of Cities Service Company."

In April 1972,Hill & Knowlton's Richard Darrow attended the AGA-INGAA Public Relations Workshop at Disney World. He counselled the gas industry on its PR activities, offering various strategies to solve its challenges.

During the workshop, Darrow advised the gas industry to counter its "crisis issues" by mounting "massive, consistent, long-range public relations programs**."**

A full version of Darrow's speech was also published in a 1975 book comprised of Hill & Knowlton executive speeches. Darrow stated, "I have been asked to look at the recent survey of consumer attitudes conducted for the American Gas Association (AGA) and to suggest some ways to cope with three problem areas outlined in the study – the energy gap, pollution and consumer concerns." Darrow also stated that he had been "associated with the natural gas and oil industry for many years as a consultant." Darrow told the gathered industry delegates that "the issues are now firmly locked into bureaucracy at the federal, state and local levels ... and will not go away."

"There must," said Darrow, "be an understanding that a single defeat for the critics and adversaries doesn't mean an end to the problem. It has been our experience that the critics come back again and again with new facts or alleged facts, with new allies and with new proposals for regulation and restrictions."

Tackling the issue of gas stove emissions head-on, Richard Darrow referred to a recently published report that had identified "gas appliances" as "major indoor polluters;"

"Do we know enough about pollution within the home? And can we say something useful about this problem that will be of help to the consumer?" Richard Darrow asked over 100 delegates from the nation's gas companies before offering the following advice: "we must be willing to explain as fully as possible what the situation is ... and we should do this before the critics take the floor and demand it;"

"Continuing research, continuing action, continuing planning ... must be a part of your daily activities" Darrow told the gas industry if it was to "cope" with the "problem areas" of "pollution and consumer concerns."

"When a crisis hits, it is usually too late to do the kind of background work and planning that is fundamental to a strong communications effort."

In line with this strategy of proactive yet defensive research, forgotten industry documents reveal that the AGA began

funding its own epidemiological studies investigating the health effects of nitrogen dioxide emissions from gas stoves in November 1972.

AGA-INGAA's PR workshop in 1973

In April 1973, AGA and INGAA sponsored another public relations workshop titled "*Communicating The Facts About Conservation, Ecology, And Energy Supply*" held in New Orleans.

This time, Carl Thompson**,** executive vice president of Hill & Knowlton, participated in "an intense panel discussion on energy and the environment." Like Darrow, Carl Thompson was a central figure on Hill & Knowlton's tobacco account and, according to a 1960s Brown & Williamson memo, was "regarded as the principal contact or informational source" at the Hill & Knowlton creation, the Tobacco Industry Research Committee (TIRC).

According to AGA Monthly:

"Thompson pointed out that man is not always the villain in environmental matters. "Man has improved the environment far more than nature," he contended, "nature is often not a good environmentalist." The energy industry must work harder at face-to-face communication with the public in order to let them know what the situation is. ***"If you don't help inform them," Thompson told the PR men, "they'll get all of their information from your critics.""*** (emphasis added)

The strategy detailed by Thompson in 1973 is precisely what the gas industry did over the subsequent decade - financing studies, literature reviews, and data re-analysis to "inform" the public in an attempt to counter the information the public was receiving from the industry's "critics" raising concerns about associations between nitrogen dioxide emissions from gas stoves and respiratory problems.

Another frequent speaker at AGA-INGAA events was Elias Buchwald, President of Burson-Marsteller, another PR firm active in the history of tobacco defense. Buchwald addressed the 1973 PR Workshop on the subject of "*Gas Industry Public Relations Priorities*," stating that "an important priority and one which has been too long neglected is the need to enlist classic communications techniques to develop and bring into play third-party endorsement." (Third-party endorsement was another key element of the 'tobacco' strategy – one that Burson-Marsteller would embrace in the 1980s when it became PR counsel for The Tobacco Institute.) According to Buchwald, this required "immediate and very serious attention. Public relations men need not be reminded of the value of third-party endorsement. It is a highly useful, valid and totally ethical technique which, when utilized properly, is most effective."

Alluding to the indoor pollution issue, Buchwald highlighted the "continuing need to remain alert and address ourselves to newly emerging environmental challenges such as that which has recently brought into question the health effects of carbon monoxide pollution in homes."

As this investigation has revealed, third-party endorsement via industry-sponsored epidemiological studies, literature reviews, and data re-analysis would play a powerful role in the gas industry's strategy to address environmental challenges such as the health effects of indoor air pollution in homes.

AGA-INGAA's PR workshop in 1974

Hill & Knowlton Senior Vice President **Ward Stevenson** attended the AGA-INGAA PR Workshop in March 1974 and addressed workshop attendees at the closing luncheon. According to *AGA Monthly*, Stevenson presented the following five guidelines for "communicating in a crisis:"

"(1) take the initiative; (2) be dramatic; (3) keep the issue simple; (4) management needs

to be willing to stick its neck out; and (5) to survive the crisis in healthier condition than you entered it, the industry must work together. This is no place for in-fighting or back-biting."

This last guideline, stressing the importance of separate companies working together as a unified whole when under threat, was one of the main tenets of the Hill & Knowlton approach to solving industry-wide problems.

1975 and Beyond

Beyond 1974, AGA Monthly does not seem to record any further appearances of Hill & Knowlton executives at AGA-INGAA PR Workshops. In 1975, Hill & Knowlton remained the largest and most profitable PR firm in the U.S increasing its annual net income to $15,030,754 .

It had also expanded its oil, gas and utility client list, representing the American Petroleum Institute, Atlantic Richfield, Continental Oil, El Paso Natural Gas, Hanover Petroleum, Lone Star Gas, Marathon Oil, Pennsylvania Electric Association, Philadelphia Electric, Puget Sound Power, Reserve Oil & Gas, R. J. Reynolds Industries, Tesoro Petroleum, Texaco and Texas Utilities.

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Climate Investigations Center is a watchdog group that focuses on the individuals, corporations, trade associations, political organizations and front groups who work to delay the implementation of sound energy and environmental policies that are necessary in the face of the ongoing climate crisis. Our team has expertise in investigative journalism, in-depth corporate accountability research and campaigns and news analysis.