



The Politics of Rocket Fuel Pollution

The Perchlorate Study Group
and Its Industry Backers

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Executive Summary

For decades, tobacco companies have ignored evidence and distorted science in order to mislead the public and decision-makers, despite clear evidence that tobacco smoking is hazardous to public health. Now companies facing government action over rocket fuel pollution are deploying similar tactics.

The main ingredient in solid rocket fuel—perchlorate—pollutes drinking water sources in more than 20 states. Tests also reveal perchlorate in grocery store food supplies and in breast milk from women across the country. A 2005 study by researchers at Texas Tech University suggests that breastfed babies ingest levels of perchlorate that exceed the ‘safe dose’ recently established by the National Academy of Science—putting children at risk for development damage. California state agencies have discovered perchlorate in more than 400 water sources since 1997, including the Colorado River and hundreds of municipal wells.

In 1992 the U.S. Environmental Protection Agency (EPA) took the first steps

toward requiring cleanup of perchlorate from drinking water. In response, a group of manufacturers and users of rocket fuel joined to form the Perchlorate Study Group (PSG), with the stated intention of helping EPA by providing scientific information.

However, documents from the internal files of participants in the PSG reveal that, much like the tobacco industry, these companies paid millions of dollars to fund misleading research and millions more to influence the scientific and public debate.

Environment California Research & Policy Center investigated the activities of the PSG, using recently uncovered sources of information—including files and testimony obtained in the course of litigation. For the first time, these documents provide an inside look at the money spent and strategies employed by the industry in the ongoing debate over how to address rocket fuel pollution.

Members of the Perchlorate Study Group

- Kerr-McGee Chemical Corporation manufactured perchlorate at a plant in Henderson, Nevada for four decades. In the process, the company polluted the downstream sections of the Colorado River—an important source of water for drinking and agriculture.
- Goodrich Corp. spilled perchlorate at a facility near Rialto, California, polluting the city’s drinking water sources at levels up to 800 times higher than safety recommendations issued in other states.
- Aerojet opened a facility near Rancho Cordova, CA in the 1950s, at times dumping 300 pounds of perchlorate into the ground every day.
- Lockheed Martin operated a missile factory in the Redlands area of San Bernardino County from 1961 to 1974, contaminating groundwater with perchlorate.
- American Pacific spilled perchlorate into the groundwater beneath its now-destroyed factory in Henderson, Nevada—with contamination reaching as high as 750,000 parts per billion.
- Alliant Techsystems and Boeing also caused perchlorate contamination near facilities in Utah and California.

The Perchlorate Study Group campaigns for weak regulation of rocket fuel spills.

Publicly, the PSG describes itself as unbiased, with a mission of working “cooperatively with the U.S. Environmental Protection Agency to increase scientific and medical understanding of perchlorate’s risk to human health.”

However, according to an internal Aerojet presentation, the PSG was founded to “provide EPA with a scientific based argument to justify a higher RfD and thus a more reasonable remediation standard.” RfD is a scientific term meaning ‘safe dose’ and is the foundation of cleanup regulations. A “more reasonable remediation standard” would have the effect of limiting the manufacturers’ financial liability for existing and future spills while also providing support for defense against lawsuits.

The Perchlorate Study Group hired a public relations firm, which then downplayed concerns about rocket fuel spills. This same firm once performed a similar service for tobacco giant Philip Morris.

The PSG supports an organization called the Council on Water Quality, including a prominent spokesperson (former California EPA director James Strock). The Council has consistently and publicly downplayed concerns about rocket fuel exposure. Deeper investigation reveals that:

- The Council on Water Quality is actually a project of the public relations firm APCO Worldwide;
- In 2004, the PSG paid APCO \$770,000 to run this effort (See “Perchlorate Study Group Budget, 2004” on page 4); and
- On behalf of Philip Morris, APCO has used similar front groups to challenge the use of science in policy-making and make it harder for citizens to sue corporations.

The Perchlorate Study Group funded scientific research that was then used to argue that rocket fuel exposure was not a big concern.

- New analysis by Environment California Research & Policy Center shows that the PSG or its members funded more than half of all studies directly addressing the health effects of perchlorate exposure that were published between 1996 and January 2005 when the National Academy of Sciences issued a report on perchlorate. Independent sources like the National Institutes of Health funded less than 10 percent of the research.
- In some cases, PSG research appears to have deliberately employed an experimental approach that was inappropriate for the task.
- The Council on Water Quality concludes that perchlorate is not a health threat at low levels using only PSG-funded research. The Council Website omits concerns raised by independent scientists who believe that perchlorate in drinking water at even a few parts per billion, or ppb, could constitute a significant health threat.

The Perchlorate Study Group worked to influence the conclusions of a National Academy of Sciences panel charged with evaluating perchlorate for the U.S. government.

- The PSG paid a consultant to present PSG-funded research at meetings of the American Thyroid Association, where members of the National Academy of Sciences (NAS) panel were present and while the panel was active.
 - Dr. Steven Lamm, the director of a firm called Consultants in Epidemiology and Occupational Health, requested \$25,000 from the PSG to attend the American Thyroid Association annual meeting in 2004. He justified this request by noting that National Academy panelists would be in attendance. He wrote: “The session is chaired and hosted by a member of the NAS committee and this will probably be the last

opportunity before the finalization of the NAS report for a PSG presentation to be observed by the many NAS panel members who are part of that panel.”

- While acting as a consultant for the PSG, Dr. Lamm became a member of the Public Health Committee at the American Thyroid Society. During his tenure, the Thyroid Society issued two formal statements favorable to industry.
- An email exchange between members of the PSG indicates that industry-funded research was intended to influence the panel to deliver a weak recommendation.
 - In an email about PSG research strategy, Dan Guth of Boeing wrote: “I don’t think it is too late to affect the NAS conclusions if a paper is submitted by mid Sept. Even if it is too late, the model will give us a valuable tool to support and ‘validate’ the NAS conclusions if they conclude that perchlorate up to several hundred ppb are not a risk.”
- PSG consultants hid the depth of industry involvement in a one-sided scientific conference called the “Perchlorate State of the Science Symposium,” held as the National Academy panel was beginning its work in fall 2003.
 - The PSG paid a consulting firm Intertox to organize the event. The event, billed by organizers as “an independent and impartial review,” addressed the same questions being evaluated by the National Academy

panel and its conclusions downplayed the concerns of EPA scientists. After the conference, Intertox director Dr. Richard Pleus and other conference organizers submitted to the National Academy panel a report in which it was stated that the PSG did not participate in the selection of expert panelists or of studies to review. However, internal invoices show that Intertox did engage in these activities—and billed the PSG over \$120,000 for its time.

Rocket Fuel Cleanup Standards Should Be Based on Independent Science

State and federal regulatory decisions affecting rocket fuel spills will directly dictate what the corporate members of the PSG will have to pay to clean up rocket fuel spills. As a result, the PSG has a clear motivation to corrupt the regulatory process.

Actors with a clear financial stake in decisions that could affect the health of millions of people across California and the U.S. should not be allowed to influence the regulatory process. Rocket fuel manufacturers should not play any role in crafting scientific standards meant to protect public health against the effects of their products.

California’s public health goal (and other state and federal regulatory standards for perchlorate) should reflect the findings of independent science, not bought-and-paid-for science. We all have the right to clean water and food free of rocket fuel contamination.

| Perchlorate Study Group Budget, 2004 | |
|---|--------------------|
| Federal Policy | |
| EOP [The EOP Group, a lobbying firm in Washington, D.C.] | \$799,200 |
| Rick Belzer Support [Anti-Regulatory Economist] | \$60,000 |
| State Policy | |
| Kahl Pownall [Kahl-Pownall Advocates, a lobbying firm in Sacramento, CA] | \$610,800 |
| Perchlorate Study Group | |
| PSG Budget Status 2004 [Including funding for research and technical consultants] | \$1,264,536 |
| Public Relations | |
| APCO Worldwide | \$554,000 |
| James Strock Support | \$216,000 |
| TOTAL | \$3,504,536 |

Introduction: The Tobacco Industry Playbook

As scientific evidence of the harmful public health impacts of second-hand smoke became irrefutable, Philip Morris and the tobacco industry faced a crisis. The U.S. Environmental Protection Agency moved to label second-hand smoke a Class-A human carcinogen. Legislation threatened to crack down on smoking in public places. Attorneys general planned lawsuits for the damage smoking caused to public health and the burden it placed on the health care system. The public image of smoking and the tobacco industry was becoming permanently tarred.

Philip Morris decided to do something to protect its profits. As revealed in documents made public as a result of the major tobacco lawsuits over the last decade, the company launched an effort called “The Whitecoat Project.”¹

“The project sought to “Resist and roll back smoking restrictions.....Restore smoker confidence....[and] address product liability concerns.”² To achieve those goals, Phillip Morris planned to “Reverse scientific and popular misconception that [second-hand smoke] is harmful....generate a body of scientific and technical knowledge in the field of [environmental tobacco smoke]... undertaken by whitecoats, contract laboratories and commercial organizations...disseminate and exploit such knowledge within specific communication programmes....[and to use] scientific and technical resources to challenge existing laws; to counter specific legislative and regulatory threats; and to respond to specific misinformation and bias as it arises...”³

Perhaps recognizing that the tobacco industry wasn’t the best or most credible

spokesperson on this issue, Philip Morris called in APCO Associates, a public relations firm, to implement the strategy.

APCO organized a front group called “The Advancement of Sound Science Coalition,” or TASSC. APCO had the explicit goal of challenging the use of science in policy making, creating an anti-regulatory atmosphere that would benefit its client.⁴ APCO hired the former governor of New Mexico, Garrey Carruthers, as the official spokesperson for the group. Using Phillip Morris money, APCO proceeded to launch a wide-ranging anti-regulation campaign, claiming that many rules based on public health science were not justified by the evidence, and that such rules hurt the economy.⁵

TASSC quietly faded away in 1998—and its efforts to negate the evidence about secondhand smoke were ultimately unsuccessful—but the strategy bought tobacco manufacturers valuable time at the expense of the public. In addition, the tobacco industry’s strategy provided a playbook for other industries facing potential liability for harming public health.

Rocket fuel manufacturers, faced with lawsuits and government regulations that could require a massive cleanup of widespread perchlorate contamination, are deploying similar strategies.

Perchlorate is the major ingredient in solid rocket fuel. Perchlorate was used as a drug to treat thyroid problems until the 1960s, when its use was discontinued because of concerns about toxic side effects, including potentially fatal bone marrow damage.⁶ Now this erstwhile drug has turned up in everything from the Colorado River to food supplies to

the breast milk of nursing women from across the country. Scientists don't know exactly what effect this is having on children. However, because perchlorate affects a system in the body known to be a critical part of normal brain development, perchlorate contamination could be causing learning and behavior problems in children as they grow up—the kind that have been increasing in California's school systems over the last decade.⁷

Facing widespread concern about perchlorate contamination, EPA and state environmental agencies are in the process of setting cleanup standards. Companies responsible for rocket fuel pollution are undermining the case for thorough cleanup. Taking a page from the tobacco playbook, these companies have even hired APCO as part of their public relations operation, putting together a brand new version of the "Whitecoat Project" armed with "sound science" funded by industry dollars. The strategy is hampering rapid cleanup of rocket fuel contamination in

communities across California. Ultimately, industry efforts are leading to longer and greater public exposure to this chemical—and potentially great harm to society.

Environment California Research & Policy Center investigated the activities of a coalition of companies responsible for rocket fuel pollution, called the Perchlorate Study Group (PSG). The investigation included recently uncovered sources of information—including internal files, emails and depositions obtained through litigation from PSG members and consultants. These individuals include Michael Girard of Aerojet, chairman of PSG; Dr. Richard Pleus, director of PSG consulting firm Intertox; and James Strock, spokesperson for the Council on Water Quality, a PSG public relations effort. Through these sources, we get an inside look into the strategy and tactics behind the industry's coordinated campaign to weaken regulations and escape liability for rocket fuel pollution.

Companies that Face Potential Liability for Rocket Fuel Pollution

Chemical companies, aerospace contractors and the military have contaminated California’s food and water supplies with perchlorate—the main ingredient in solid rocket fuel.

In the 1980s, the U.S. Environmental Protection Agency (EPA) first detected perchlorate near military bases, finding “widespread groundwater contamination.”⁸ EPA staff measured water pollution levels in the hundreds of parts per billion (ppb).

Water utilities have since discovered perchlorate pollution in almost 400 California water sources, including the Colorado River and hundreds of municipal wells.⁹ The contamination extends into more than 10 counties, including San Bernardino, Sacramento, Los Angeles, Riverside, Ventura,

Tulare, Orange, Santa Clara, Sonoma and San Diego (Table 1).¹⁰ Southern California communities in Los Angeles and the Inland Valley have been hard-hit, as well as Northern California communities such as Rancho Cordova outside of Sacramento.

Perchlorate contamination is also found in the human body. In 2005, researchers at Texas Tech University found rocket fuel in the breast milk of nursing mothers across the country.¹² The researchers found perchlorate in the breast milk of every one of 36 women tested, at an average level of 10.5 ppb, ranging up to 92 ppb. The levels were high enough to suggest that people may concentrate perchlorate in their bodies, or that perchlorate may concentrate in the food supply. An infant exposed to the highest level of contamination would receive a dose larger

than the “safe dose” established by the National Academy of Sciences—comparable to levels that interfere with normal brain development in infant rats. (See “Perchlorate Threatens Children’s Health” on page 8.)

Companies involved in perchlorate spills include Kerr-McGee Chemical, Goodrich Corp., American Pacific, Lockheed Martin, Aerojet, United Technologies Chemical Systems and Boeing.¹³ All of these companies have participated in the PSG.¹⁴

Table 1: Number of Perchlorate Contaminated Water Sources Discovered Since 1997¹¹

| County | Number of Contaminated Sources |
|----------------|--------------------------------|
| Los Angeles | 146 |
| San Bernardino | 90 |
| Riverside | 73 |
| Orange | 34 |
| Sacramento | 22 |
| Santa Clara | 9 |
| Tulare | 8 |
| San Diego | 5 |
| Ventura | 4 |
| Imperial | 4 |
| Sonoma | 1 |
| Stanislaus | 1 |

Perchlorate Threatens Children's Health

Perchlorate, the major component of solid rocket fuel, is a health threat for expectant mothers, developing fetuses and infant children. Exposure to perchlorate has the potential to interfere with brain development, leading to a variety of learning and behavior problems.

- Perchlorate affects the thyroid hormone system at very low levels of exposure. It acts by preventing uptake of iodine into the thyroid gland, reducing the gland's ability to produce enough hormone.¹⁵
- Low iodine or thyroid hormone levels can lead to developmental problems, including lower IQ, impaired learning, hyperactive behavior, delayed growth, mental retardation, or other serious problems.¹⁶
- Evidence exists that changes in thyroid hormone levels may be part of the cause of attention deficit and hyperactivity disorder (ADHD), a serious and growing problem in California.¹⁷
- Newborns in particular are likely to be much more vulnerable to perchlorate than adults. They have no thyroid hormone stored in their glands, they have very low body weight, and thyroid hormone in their blood recycles more quickly than in adults.¹⁸
- According to a study of rocket fuel levels in human breast milk, breast-fed babies ingest more than twice as much perchlorate on average than the National Academy of Sciences' recommended "safe dose."¹⁹
- Infants exposed to the highest levels of contamination receive a dose comparable to levels that cause changes in brain structure and behavior in infant rats.²⁰

Perchlorate is one of several major environmental contaminants—including toxic flame retardants, lead, mercury and polychlorinated biphenyls (PCBs)—that pose serious (and potentially additive) threats to the developmental health of infants in California and across the country.

Kerr-McGee

Kerr-McGee Chemical Corporation manufactured perchlorate—the main ingredient in solid rocket fuel—at a plant in Henderson, Nevada for four decades. In the process, the company polluted the downstream sections of the Colorado River—with consequences stretching far beyond the factory site.

In terms of the number of people exposed, Kerr McGee's contamination of the Colorado River with rocket fuel ranks as one of the largest toxic spills in the country. The Colorado River supplies drinking water for 20 million people in southern California and Arizona. Additionally, it provides irrigation for much of the nation's winter vegetable supply and for cattle feed.

Perchlorate-contaminated irrigation water drawn from the Colorado River has likely led to contamination of California's agricultural products. In November 2004, the U.S. Food and Drug Administration detected perchlorate in most or all samples of lettuce and milk from

supermarket shelves, including 38 of 38 milk samples and 67 of 78 lettuce samples from California.²¹ The levels were higher than many experts anticipated, suggesting that perchlorate accumulates to some degree in plants or animals.

Kerr-McGee released millions of pounds of perchlorate from its factory over four decades of operation—from the 1950s, when the Henderson facility was operated by a corporate predecessor of Kerr-McGee—to 1998, when Kerr-McGee stopped making any new rocket fuel on the site.²²

The chemical contaminated the groundwater beneath the factory.²³ Perchlorate, being highly mobile in water, found its way downstream. It entered the Las Vegas Wash, contaminated Lake Mead, and washed downstream in the Colorado River. Although the contamination was not detected until 1997, perchlorate likely contaminated the river for decades.

Reducing widespread exposure to perchlorate will require a significant effort. Professor Jacimaria Batista at the University of

Nevada estimated that sediments downstream from the Kerr-McGee factory in Henderson hold more than 20 million pounds of perchlorate.²⁴ At the current pace of on-site cleanup and with natural flushing of the river, Dr. Batista and her colleagues estimated that the lower Colorado River will remain contaminated for the next 50 years.²⁵

In addition to the cost of cleanup at the Henderson site, Kerr-McGee faces potential liability for contamination of downstream uses of the Colorado River. Accordingly, the company has a huge financial stake in the regulation of perchlorate spills.

Goodrich Corporation

Nestled below the San Bernardino Mountains, the city of Rialto had what local water officials described as one of the purest drinking water supplies in the region. However, in the late 1990's, officials discovered rocket fuel pollution in Rialto's water supply. The contamination reached levels up to 800 times higher than safety recommendations issued by other states.²⁶

Goodrich operated a solid rocket fuel plant in Rialto in the 1950s and 1960s, and local water officials believe that pollution at this plant contributed to the contamination of the city's water supply.²⁷ At the site, waste rocket fuel was dumped in unlined holes in the ground, according to testimony from a former plant employee.²⁸

In 2001, the Santa Ana Regional Water Quality Control Board (Board) ordered Goodrich to clean up the contamination it caused.²⁹ Goodrich refused to admit responsibility. Instead, company representatives stated that "to the best of Goodrich's knowledge

and belief at this time, it recycled and re-used any excess perchlorate in its manufacturing process."³⁰

Seven years after the discovery of rocket fuel in Rialto's water supply, the city is on the brink of running out of water. Several public water wells are completely shut down. Residents are paying more for their water to pay the cost of tracking down the companies responsible for the pollution.³¹ Goodrich has yet to agree to clean up the contamination.

Aerojet

In the 1950s, Aerojet opened a facility near Rancho Cordova, about 15 miles east of Sacramento. At the time, the facility was America's largest site for rocket engine development, testing and production.³⁴

Daily operations at the site contaminated the underground aquifer at times with 300 pounds of perchlorate every day.³⁵ Indicative of company practices at the time, Aerojet was warned in 1949 by the Los Angeles County engineer that dumping its hazardous waste into "cesspools" and "seepage beds" at other manufacturing plants in the state posed an "extreme hazard" to the underground water supply.³⁶ Today, Aerojet continues to manufacture products for missile and space propulsion at the site—now located much closer to residential development around Sacramento.

Perchlorate concentrations in well water near the Aerojet site range as high as 360 ppb.³⁷ Where water previously treated for other contaminants was re-injected into the ground, perchlorate levels can exceed 100,000 ppb.³⁸ An underground perchlorate plume extends four miles offsite and has contaminated at least seven water supply wells.³⁹

Goodrich: The Newest Member of the Perchlorate Study Group

Goodrich faces potential liability for polluting drinking water supplies in the area around Rialto. The eventual remediation requirements—as well as any potential lawsuits—will be influenced by the eventual establishment of a state water quality standard.

Instead of cleaning up contamination, Goodrich joined the PSG, a coalition of rocket fuel manufacturers and users campaigning against potential cleanup regulations. Goodrich contributed \$120,000 to PSG activities in 2004, according to the PSG budget for that year.³² Goodrich dollars were mainly budgeted on California-level work—including funding for lobbyists in Sacramento.³³

Aerojet also owns a facility near East Camden, Arkansas formerly operated by Atlantic Research Corporation (ARC). Perchlorate contamination at this facility presents a serious threat to southern Arkansas' drinking water.⁴⁰ If the perchlorate plume from this site reaches the Sparta aquifer, it would contaminate water for the state's agriculture industry and drinking water for tens of thousands of people. The year before being purchased by Aerojet, ARC began a cleanup effort; however the bulk of the clean up work is now left to Aerojet.⁴¹

These spills expose Aerojet to potential cleanup liability. The company also faces lawsuits initiated by residents of the Rancho Cordova area, alleging health problems caused by exposure to contamination. The outcome of state and federal regulatory decisions on perchlorate will affect the amount of liability Aerojet faces.

Lockheed Martin

Lockheed Martin, the world's largest defense contractor, polluted water supplies in the Redlands area of San Bernardino County, California, near where it made missiles from 1961 to 1974.⁴²

Officials discovered trichloroethylene, an industrial solvent, in water wells near the former Lockheed site in 1980. The chemical was gradually polluting Redland's water supply. The pollution plume—one of the largest in California—spanned more than 14 miles.⁴³

In 1997, officials discovered widespread perchlorate contamination in the same area.⁴⁴ Contamination from the Lockheed facility created a perchlorate plume measuring approximately seven square miles. Forty-seven drinking water wells have been affected to date, and concentrations as high as 70 ppb have led to the shutdown of five wells.⁴⁵

Analysis showed that 63 percent of water delivered to residents in Loma Linda and 18 percent of the water supply in Redlands came from perchlorate-tainted wells.⁴⁶ A group of nearly 800 people filed lawsuits against Lockheed Martin, seeking damages for health problems that could have been caused by exposure to pollution from the site, including cancer.⁴⁷

Since 1998, Lockheed has spent \$80 million cleaning and replacing contaminated municipal water systems around Redlands and Riverside, California. The company expects to pay \$180 million more over the next 20 years cleaning up perchlorate and other chemicals that seeped into underground water supplies near this facility.⁴⁸

Regulatory standards for cleanup of perchlorate contamination will affect the amount of liability Lockheed will face for cleanup and affect any pending legal cases. Regarding these standards, Lockheed spokeswoman Gail Rymer said, "Those levels determine how much treatment is necessary. It's a cost issue."⁴⁹

American Pacific

The American Pacific Corporation manufactured perchlorate at a facility in Henderson, Nevada from 1958 until 1988, when the facility was destroyed in a massive explosion.⁵⁰ Currently, the company produces perchlorate at a factory in Iron County, Utah. American Pacific is currently the sole perchlorate manufacturer in the United States—producing close to 20 million pounds of the chemical in 2004.⁵¹

The groundwater beneath American Pacific's Nevada site—just west of the old Kerr-McGee facility—is contaminated with large amounts of perchlorate. Test wells contain perchlorate at levels as high as 750,000 ppb.⁵² The perchlorate contamination plume extends 300 feet down through five groundwater layers.⁵³ While the contamination does not appear to have reached the Las Vegas Wash, which feeds into the Colorado River, groundwater flows toward the wash and must be scrubbed of perchlorate to prevent downstream pollution.⁵⁴ Testing of public drinking water supplies in the Henderson area show 4 to 18 ppb.⁵⁵

In addition to contamination caused by the explosion, former workers at the plant have described careless handling of waste that could have led to contamination. These practices include the disposal of drums of ammonium perchlorate in a trench on the factory site, and washing down the plant—creating a pond of contaminated water called "Lake Louise."⁵⁶

In American Pacific's 2004 10-K form filed with the U.S. Securities and Exchange

Commission, the company discusses the potential impact of federal regulation of perchlorate contamination. The company writes, “the lower the level at which the final ... [standard] is established, the more severe the negative impact will likely be on our financial condition, results of operations and ability to manufacture and handle perchlorate chemicals.”⁵⁷

Other Aerospace and Defense Contractors

Other aerospace and defense contractors are associated with perchlorate pollution and face potential cleanup liability.

Alliant Techsystems manufactures rocket motors and munitions at several facilities located in Utah. Officials have detected perchlorate pollution in the groundwater at Alliant facilities in West Valley City and Magna—less than 15 miles southwest of Salt Lake City. The pollution has reached a few public drinking water wells.⁵⁸ Alliant Techsystems also owns a manufacturing facility west of Brigham City, Utah formerly operated by Thiokol Propulsion Group. This facility produces missiles, rockets, flares and other products containing perchlorate.

Beneath this facility, water quality experts are examining the extent of a plume of perchlorate contamination.⁵⁹

United Technologies Corporation is a conglomerate of well-known companies, including Hamilton Sundstrand and Pratt & Whitney, with business activity in aerospace and defense. Test wells at the recently closed Pratt & Whitney Space Propulsion plant, east of San Jose’s Coyote Valley, show concentrations of perchlorate in excess of 100,000 parts per billion.⁶⁰ Under orders from state regulators, the company began pumping and treating ground water for perchlorate contamination in 2000.⁶¹ Although contamination to drinking water has not yet occurred, storm water and runoff sampling indicate perchlorate at levels of concern.⁶² This type of runoff is especially worrisome since four creeks flow through the property before draining into Anderson Reservoir, a source of community drinking water, located less than a mile away.

Boeing owns a facility in Simi Valley where Rocketdyne used to test rocket engines and nuclear reactors. Officials have detected perchlorate contamination at the site and in nearby wells—in addition to other toxic and radioactive contaminants.⁶³

The Formation of the Perchlorate Study Group

Soon after perchlorate was discovered in groundwater in 1980, the U.S. Environmental Protection Agency (EPA) began gathering information about the potential health effects of perchlorate exposure, the first step in establishing a standard for cleanup.

Late in 1992, EPA released an issue paper on perchlorate, labeling the chemical as a “Probable Human Carcinogen” and setting a provisional “safe dose” that equated to a cleanup standard of 3.5 parts per billion (ppb) in groundwater.⁶⁴ At this point, the industry likely knew that future costs and liability associated with potential perchlorate spills would hinge on the outcome of a scientific and technical debate.

Much as Philip Morris launched the “Whitecoat Project,” a group of rocket fuel manufacturers and users responded to pending action at EPA by generating a body of scientific and technical knowledge using contract laboratories. These companies launched a coalition called the Perchlorate Study Group (PSG), with the stated intention of helping EPA by providing scientific information.⁶⁵

However, newly revealed documents from the internal files of participants in the PSG suggest that, much like the tobacco industry, these companies paid millions of dollars to fund misleading research and millions more for PR to influence the scientific and public debate.

The Real Agenda of the Perchlorate Study Group

Publicly, the PSG has described its purpose thus: “to fund and perform scientific research to identify and estimate the human health effects of perchlorate exposure.”⁶⁶ In addition, the

PSG claims that it “has worked cooperatively with the U.S. Environmental Protection Agency to increase scientific and medical understanding of perchlorate’s risk to human health” over the past decade.⁶⁷

But in internal documents, an agenda is revealed that never made its way into any public relations materials. According to the files of Michael Girard, chairman of the PSG, the agenda of PSG as expressed in an internal Aerojet presentation was “to provide EPA with a scientific based argument to justify a higher RfD and thus a more reasonable remediation standard.”⁶⁸ RfD is a scientific term meaning “safe dose” and is the foundation of cleanup regulations.

With the predetermined goal of setting a higher “safe dose,” the research funded by the PSG appears to have been intended from the start to weaken regulatory standards. The PSG has a plausible motive for this goal. As described in the previous chapter, all of the participants in the PSG have a direct financial stake in the eventual regulation of perchlorate spills. A weak cleanup standard would limit cleanup liability for existing and future spills while also establishing a foundation for legal defense against lawsuits alleging harm from perchlorate exposure.

Recommendations for a Weak Standard

The PSG and its contractors have made public recommendations over time for a “safe level” of perchlorate in drinking water that have been far weaker than the recommendations of government agencies.⁶⁹ The group began in 1995 by recommending an RfD of 42,000 ppb, more than 10,000 times weaker than the first level suggested by EPA.⁷⁰

EPA responded in October of that year with a slightly weaker recommendation equivalent to a cleanup standard for perchlorate of 3.5 to 17.5 ppb.⁷¹ This number, although higher than earlier EPA recommendations, was still much stronger than the standard the Perchlorate Study Group continued to advocate for.

The group took further steps to obtain a less stringent result. According to a 1997 letter between Aerojet and Lockheed, “PSG enlisted the support of Mike Dourson (former Chief Systemic Toxicants Branch for EPA, NCEA) to interface with the EPA and the scientific community.”⁷² Michael Dourson had worked in the EPA department that produced the original issue paper on perchlorate. He left EPA in 1995 to found a consulting organization called Toxicology Excellence for Risk Assessment (TERA). TERA soon developed strong ties to the PSG (see box).

In March of 1997, the PSG asked TERA to convene a scientific review panel. The panel concluded that regulators would need more information on perchlorate in order to set a standard. The PSG, along with the U.S. Air Force, set out to gather that information by funding and carrying out research.⁷³ According to the files of Michael Girard, chairman of the PSG, The PSG expected these efforts would deliver a “best case RfD [that] will result in a MCL (drinking water standard) of 175 to 350 ppb.”⁷⁴ This documents suggests that the PSG expected that PSG-funded research would influence EPA’s eventual conclusion to be up to 100-fold less stringent than originally proposed. (See Appendix on page 26 for a chart comparing the public recommendations of the PSG with other agencies through 2006.)

From EPA to Industry: Toxicology Excellence for Risk Assessment

The PSG has benefited from the assistance of former EPA employees who now run a consulting firm called Toxicology Excellence for Risk Assessment (TERA).

Michael Dourson founded TERA in 1995, after a 15-year career at EPA. He later recruited his former colleague Joan Dollarhide, now Joan Strawson, to work for him. Joan was the original author of the EPA’s first issue paper on perchlorate—the paper that was released immediately before the organization of the PSG.

TERA quickly developed strong ties with the PSG. In addition to organizing a scientific review panel about perchlorate for the PSG, TERA coordinated billing for PSG-funded research—receiving invoices from contract labs and splitting the costs between the various companies contributing money.⁷⁵ TERA has also billed the PSG for preparing research reports to submit to regulatory agencies including the EPA, predicting what information EPA would be using to base its perchlorate judgments on, helping PSG members respond to a subpoena in the Redlands lawsuit, and responding to questions about TERA’s work with the PSG from Peter Waldman, a reporter for the *Wall Street Journal*.⁷⁶

Perchlorate Study Group Science

By providing a substantial portion of the published research on the health effects of perchlorate, the PSG positioned itself to strongly influence the debate over an appropriate regulatory response.

Environment California Research & Policy Center analyzed the funding sources of published literature as listed in the National Library of Medicine's PubMed Database. We found that a preponderance of research addressing the dangers of perchlorate exposure published before January 2005 was funded wholly or in part by members of the PSG. (In January 2005, the National Academy of Sciences released a report on perchlorate, discussed on page 20.)

In addition to producing most of the research, PSG appears to have attempted to design studies to fit their desired outcomes, and then to hide their fingerprints. In some cases, PSG research appears to have deliberately employed an experimental approach that was inappropriate for the task. PSG representatives also provided misleading interpretations of the group's funded research—even going as far as to remove mention of the PSG from a news article about a funded study. Tellingly, PSG representatives use only PSG-funded research to conclude that rocket fuel is not a health threat, omitting concerns raised by independent scientists.

Most Research Addressing the Dangers of Perchlorate Exposure Was Funded by Industry

The PSG, or individual member companies, funded 16 studies that were published in the scientific literature after 1996 and before January 2005, when the National Academy of

Sciences released its report. Together, these studies accounted for more than half of all published research directly examining the health effects of perchlorate exposure at the time. (See Appendix A for a list of identified studies and funding sources, plus a list of more recent studies.) In addition to published research, the PSG funded a variety of unpublished work delivered directly to regulatory agencies.

In contrast, independent organizations like the National Institutes of Health funded only three studies directly examining the potential consequences of perchlorate ingestion by that time. These studies made up only 10 percent of the published research on the issue.

The U.S. Department of Defense (DOD) funded the remaining 12 studies published before January 2005—39 percent of the research directly addressing the health effects of perchlorate exposure. The PSG was involved in the design or execution of at least two of these studies.⁷⁷ (As the owners of military facilities across the country with extensive perchlorate contamination, the Department of Defense has a stake in the outcome of perchlorate regulation as well, and cannot be considered disinterested observers.)

The public often assumes that objectivity is a prerequisite in scientific research, but in reality, the source of funding of a scientific study often affects the conclusions drawn. (For examples of how funding can influence the conclusions of research, see “In Science, Where the Money Comes from Matters,” on this page.)

PSG Representatives use only PSG-funded research to conclude that rocket fuel is not a health threat, omitting concerns raised by independent scientists.⁷⁸ (See page 15 in the following chapter.)

In Science, Where the Money Comes from Matters

- How do smoke-free regulations affect business in bars and restaurants? Of all the research on this issue published before 2002, every single study concluding that smoke-free laws were bad for business was funded with tobacco-industry money. In contrast, not even one independently-funded study reached that conclusion.⁷⁹
- Are calcium-channel blockers (drugs used to treat high-blood pressure) effective? The *New England Journal of Medicine* conducted a study looking at the relationship of drug-industry funding and research conclusions. It found that of articles with favorable conclusions, 96 percent of the authors had financial ties to manufacturers of calcium-channel blockers. In contrast, only 37 percent of the authors of critical studies had such ties.⁸⁰
- Are PCBs a threat to human health? Monsanto manufactured polychlorinated biphenyls (PCBs) from the 1920s to 1976. In the 1970s, seeking to continue sales of PCB-containing products in the face of evidence of ongoing harm to public health and the environment, Monsanto hired Industrial Bio-Test Labs (IBT) to perform safety studies. In response to instructions from Monsanto executives, laboratory staff characterized PCBs as non-carcinogenic despite the fact that most rats fed small amounts of PCBs developed tumors.⁸¹ Eventually, Dr. Paul Wright (a Monsanto toxicologist who went to work for IBT in part to supervise the PCB tests) was convicted of multiple counts of fraud in federal court.⁸²

PSG Research: Flaws by Design

Just under half of the research sponsored by the PSG and published before January 2005 is inherently biased toward finding no health effects as a result of the study design. To support the claim that exposure to small amounts of perchlorate are not a risk, PSG representatives used studies that could not definitively prove that claim.⁸³

At least seven PSG studies look for direct evidence of perchlorate-caused harm in communities with water contamination. These types of studies (known as ecological studies) are useful in some circumstances—particularly to generate hypotheses when the contaminant causing harm is unknown, or when there is no other practical way to approach the issue. However, it is a general principle of epidemiology that these types of studies have limitations and cannot prove that exposure to a chemical has no effect, as discussed below.

EPA has thoroughly reviewed all but the most recent of these seven studies, and discusses their weaknesses in detail in a 2002 report on perchlorate.⁸⁴ In summary, EPA concluded that these studies “offer little help beyond indicating that clinical thyroid disease is not greatly increased in populations with sustained drinking water contamination as high as 15 micrograms per liter [15 ppb],” failing to answer any questions about perchlorate and neurobehavioral disease.⁸⁵ A peer reviewer

noted that one of the largest studies of radioactive radon gas with this type of design found no connection between exposure and lung cancer—a result that directly contradicts research with more careful design.⁸⁶

Studies of this design face many obstacles in their quest to provide meaningful information.⁸⁷ When the obstacles can be overcome, studies that provide positive links between exposure to a contaminant and development of a disease can be powerful and provide ideas for experiments that can provide more definitive conclusions. However, the lack of a positive link in an ill-designed study is completely inadequate to produce the conclusion that exposure to small amounts of perchlorate entails “no effect.”

PSG Research: Funding Sources Obscured

PSG representatives have avoided candidly identifying themselves and their funders when communicating with the public about study results.

For example, the PSG funded an experiment where human volunteers drank perchlorate-tainted water. The study was designed in part by a consulting firm called Intertox, employed by the PSG. To be fully transparent, PSG representatives should have fully acknowledged their role in the work. Instead, they influenced the editing of an article in a scientific journal to remove reference to PSG’s involvement in the study.

Intertox director Dr. Richard Pleus and chief toxicologist Dr. Gay Goodman worked with Dr. Monte Greer at the Oregon Health Sciences University to carry out the study (called the Greer study). Dr. Greer gave differing amounts of perchlorate to healthy adult human volunteers over the course of two weeks, and measured the effect on the thyroid gland.⁸⁸ The study found a clear and direct relationship between the amount of perchlorate exposure and the ability of the thyroid gland to take up iodine.

Industry representatives claim that the study demonstrates that harmful effects do not occur at perchlorate exposures lower than 14,000 ppb in drinking water.⁸⁹ In contrast, EPA scientists have used the study as support for a preliminary “safe dose” equivalent to 1 ppb.⁹⁰

Dr. Greer died in a car crash on March 24, 2002, five months before publication of the study.

Editing a News Article About the Greer Study

When it appeared, the Greer Study was clearly an important addition to the ongoing perchlorate controversy. To inform a wider audience than the study itself would, the news editors of *Environmental Health Perspectives* hired Rebecca Renner, a regular contributor and nationally-known science writer, to write an article summarizing the Greer study.

The article Ms. Renner originally submitted to the journal covered the results of the Greer

study. It also discussed the context around the overall perchlorate controversy and identified the financial sponsor of the study, the PSG.

However, the final published piece contained no mention of the ongoing controversy over perchlorate or the fact that the PSG paid for the study. The editor explained to Ms. Renner that the article was supposed to be a simple lay-language summary, and the additional information didn’t fit. The article ran with a headline favorable to the PSG: “Reprieve for Perchlorate. Effects Not a Significant Concern.”⁹¹

However, investigative reporter David Danelski at the *Riverside Press Enterprise* later obtained a communication from Intertox director Dr. Richard Pleus to the PSG. The document explained a charge for editing Ms. Renner’s article. The document said, “The first version of the news article presented to Intertox demonstrated a lack of understanding of the article’s implications and was potentially very damaging to PSG. Dr. Goodman gained the trust of the editor, and through a cooperative process entailing five or more drafts, provided substantial and critical improvements to the article.”⁹²

One of those drafts, obtained from the files of Dr. Pleus through litigation, contains a note written by Susan Booker, the journal’s managing news editor. It says, “NOTE TO KT: [...] as you can see, Gay Goodman edited the heck out of this article.”⁹³

Statistical Uncertainty in the Greer Study

Intertox staff, including Dr. Gay Goodman and Dr. Richard Pleus, designed the research protocol along with Dr. Monte Greer. But the study was too small to reveal with statistical precision whether perchlorate is harmful in small doses.⁹⁵

The Greer study involved only 37 volunteers, divided into four exposure groups. Researchers gave the smallest perchlorate dose to a group of only seven people. Scientists at EPA determined that at the smallest exposure level, the Greer study had only one-tenth of the statistical power to detect effects as at the largest dose level.⁹⁶ As a result, it becomes difficult to interpret the effect of smaller doses. Since the Greer study has been relied upon as a key piece of evidence by most regulatory agencies working on perchlorate, it is important to note this limitation.

The contract for the Greer study, drawn up between the PSG and the University of Oregon Health Sciences Center, only provides funding for up to 30 subjects—\$239,130.⁹⁷ Some additional funding was provided by the National Institutes of Health.⁹⁸

It appears that Intertox designed the study with a small number of subjects because of cost. This limitation affects how much information the Greer Study can provide alone.

PSG Consultants Downplay Concerns About Rocket Fuel

Much as Philip Morris backed the Advancement of Sound Science Coalition (which spread the idea that government regulation of health risks was excessive), the PSG hired a PR firm that downplays concerns about rocket fuel exposure.

The PSG funds a public relations effort called “The Council on Water Quality.” The effort bills itself as “a public education project dedicated to ensuring that the media and the public have access to credible information about perchlorate in the environment; best available science drives government actions on setting standards for perchlorate in water; and the potential impacts of perchlorate regulation on water systems, agriculture and taxpayers are understood.”⁹⁹

The Website reveals that the Council on Water Quality is supported by members of the PSG. What it does not reveal, however, is that the Council on Water Quality was created by the same public relations firm that helped Philip Morris dodge liability and regulation of second-hand smoke. The firm, APCO Worldwide, has a history of promoting the concept of “sound science” with the explicit purpose of weakening and delaying regulations that would harm its clients’ profitability.

The Council on Water Quality: A Project of a Public Relations Firm with Ties to the Tobacco Industry

The Council on Water Quality acts as the public mouthpiece of the PSG. It disseminates industry-funded research and propaganda to the press and the public through a slick Website and a stable of experts ready to answer questions. The Council on Water Quality Website

acknowledges support from Kerr-McGee, Lockheed Martin, Aerojet and American Pacific. Despite this acknowledgement, the organization benefits from a perception of independence through its neutral-sounding name and by repeatedly making references to “the most up-to-date scientific studies.”¹⁰⁰

The Council describes itself in the following terms:

*Grounded in the most credible, up-to-date science and education, the Council on Water Quality is dedicated to improving the public dialogue on the facts about perchlorate in drinking and irrigation water, as well as food, and the potential impacts of perchlorate regulation on human health, water supply, water rates and taxpayers.*¹⁰¹

However, the content of the Website exclusively downplays the potential risks of rocket fuel exposure. The site claims that:

Sound scientific and medical research shows that the low levels of perchlorate being detected in drinking water are not dangerous to human health. These studies on adults, newborns and children provide reason to believe that low levels of perchlorate (even at levels many times higher than the minute amounts being found in some drinking water supplies) also have no measurable effect on pregnant women or fetuses.¹⁰²

As evidence, the site refers only to expert sources paid by the PSG or studies funded by the PSG. It claims that “the body of scientific and medical knowledge about perchlorate includes 16 studies conducted between 1998 and 2002 specifically to determine any health effects of perchlorate at varying levels in water.”¹⁰³

The site makes no reference to the fact that industry paid for all of the 16 studies. It fails to mention that the body of scientific and medical knowledge about perchlorate includes additional

research beyond these 16 studies. It also fails to mention concerns raised by independently funded researchers or public health advocates.

The Council on Water Quality Is Created and Operated by a Public Relations Firm

The Council on Water Quality is not, as the name might suggest, a body of authorities on water. In actuality, it is a project of a public relations firm called APCO Worldwide. In 2004, the PSG paid \$770,000 to APCO to fund this effort.¹⁰⁴

In testimony about the Council on Water Quality, Michael Girard of Aerojet revealed that the organization is operated out of the APCO office in Sacramento.¹⁰⁵ The office is located at 1215 K Street, right across the street from California's Capitol Building. The domain name for the Council on Water Quality's Web page is registered to APCO Worldwide in Washington, D.C.¹⁰⁶ Phone calls to the Council on Water Quality ring in the offices of APCO Worldwide.¹⁰⁷

APCO staff who manage the Council on Water Quality include Jose Hermocillo, Nancy Heffernan and Bill Romanelli. On the APCO Website, Nancy Heffernan and Bill Romanelli¹⁰⁸ list "The Council on Water Quality" as a client they have worked for, despite the fact that the Council on Water Quality is not an actual incorporated entity.¹⁰⁹

APCO: Architects of Tobacco-Funded PR Campaigns

APCO was founded in 1984 as a spin-off of Arnold and Porter, a large D.C. law firm employed by Philip Morris.¹¹⁰ APCO evolved into a sophisticated public, media and government relations organization, fueled by its ties with tobacco. (See "APCO's Services, As Pitched to Potential Clients" on page 19.)

Philip Morris relied upon APCO to create credible and seemingly independent "third party" organizations to advance the tobacco giant's anti-liability agenda.

APCO was involved in two separate strategies on behalf of Philip Morris. APCO organized state-level coalitions supporting "tort

reform," legislative changes that would make it harder for the affected public to sue Philip Morris for knowingly selling a product that causes cancer.¹¹¹

APCO also organized a national coalition focused on creating and fostering an anti-regulatory environment, ostensibly promoting the use of "sound science" in public policy decisions.¹¹² The organization, called "The Advancement of Sound Science Coalition" or TASSC, served as a resource Philip Morris would be able to call upon "as a tool in targeted legislative battles."¹¹³

The public launching of the organization, featuring former New Mexico Governor Garrey Carruthers as the official spokesperson, was intended to "establish TASSC as a credible source for reporters when questioning the validity of scientific studies; encourage the public to question the validity of scientific studies;" and to "raise the awareness level of the use of unsound science in public policy decision-making among target audiences."¹¹⁴

Several features of the TASSC campaign are apparent in the activities of the Council on Water Quality. In both cases, APCO has hired a high-profile former government official as a spokesperson to promote the use of "sound science"—frequently research that benefits APCO's clients; criticized independently-funded research efforts; and injected political campaign tactics into the scientific debate.

James Strock: A Prominent Spokesperson for the Perchlorate Study Group

Instead of a former governor, APCO recruited James Strock, a former Secretary of the California Environmental Protection Agency (Cal /EPA) and former chief law enforcement officer of EPA, to speak for the PSG. Dave Puglia at APCO Worldwide in Sacramento recruited Strock to work on perchlorate in August 2003.¹¹⁵

In 2003 and 2004, APCO coordinated public appearances by James Strock in the news media and at public meetings, including hearings held by the National Academy of Sciences. In 2004, the PSG paid Strock \$216,000 (through APCO worldwide) to act as the spokesperson for

the Council on Water Quality.¹¹⁶

Strock delivered messages that benefited rocket fuel companies. Similar to the message of TASSC, Strock emphasized the need for “sound science” in regulatory decisions on perchlorate. For example, he said or wrote:

- “It’s critical that the best, most credible scientific information be used as a basis for regulatory decision-making relating to perchlorate.”¹¹⁷
- “When regulations are based on science, our environment and health are best protected.”¹¹⁸
- “The bottom line is that the drinking-water standard for perchlorate should be based on the best available scientific information.”¹¹⁹

However, Strock referred only to industry-funded studies as the best science. He said, “Credible scientific studies indicate that adverse human health effects are highly unlikely from exposures to low levels of perchlorate.”¹²⁰ Whether intentional or not, such comments, when presented without reference to concerns raised by independent scientists, have the result of distorting the public’s perceptions of the true state of scientific knowledge about perchlorate. His comments, like the Council on Water Quality Website, downplayed scientific controversy over the risks of perchlorate exposure.

APCO’s Services, as Pitched to Potential Clients

The Legacy Tobacco Document Archive—a large collection of documents made public after tobacco companies were successfully sued for knowingly damaging public health—contains a brochure (dated 1995) describing the political support services offered by APCO.¹²¹ The brochure, meant for potential clients but not for public consumption, clearly describes APCO as a sophisticated public, media and government relations company that stealthily and efficiently delivers results for corporate clients:

- “We use political campaign tactics to create an environment in support of our client’s legislative and regulatory goals.”
- “We know that it is not enough to prepare a good strategy or implement the best tactics—the objective is winning. You know that and so do we.”
- “You won’t read about APCO on the front page of a newspaper talking about our work, but that doesn’t mean that our work isn’t making the front page.... We’re proud of our record, and we’re even prouder that the comments below are about our campaigns and their results—not us.”
 - “Opponents of legal reform credit the business community, led by the American Tort Reform Association (ATRA) in Washington, for mounting a successful public relations campaign across the country to convince most people that the legal system is in need of fundamental repair.”
 - Christian Science Monitor
 - “It is fitting ... that there is a new organization on the scene to represent this fresh sense of caution. If [The Advancement of Sound Science Coalition] does nothing else, it may provide a much needed balance to the public debate that often surrounds disputed areas of science.”
 - The Denver Post
- “In light of the nature of our work, client references and case studies are available only upon request.”

The PSG Attempted to Influence a National Academy of Sciences Panel to Downplay the Risks of Perchlorate

In 2002, EPA issued a review of the available evidence on perchlorate along with a recommendation for limiting perchlorate exposure above a “safe dose” equivalent to 1 ppb in drinking water. In response, the PSG and its allies in the federal government lobbied to stop the process.

In 2003, the EPA, the Department of Defense, NASA and the Department of Energy asked the National Academy of Sciences (NAS) to review the EPA recommendation.¹²² The announcement took some veteran EPA staff who had been working on the issue by surprise, according to communications obtained by the Natural Resources Defense Council (NRDC).¹²³ An EPA memo circulated before the announcement had indicated that EPA would issue the final toxicity assessment within a few months.¹²⁴

A Freedom of Information Act request by NRDC indicated that staff from the White House, the Department of Defense, and the perchlorate industry worked to limit the scope of the National Academy of Sciences’ inquiry, select the panelists, and influence the panel to downplay the hazards of the chemical.¹²⁵

The charge to the panel included many of the PSG’s criticisms of the EPA recommendation.¹²⁶ The panel included at least four members with direct financial ties to Lockheed Martin, the PSG consulting firm Toxicology Excellence in Risk Assessment, or other industry consulting firms.¹²⁷ Members of the PSG provided talking points to the Department of Defense for use in lobbying the White House on the role of the National Academy panel.¹²⁸

Documents obtained by Environment California Research & Policy Center from the internal files of participants in the PSG suggest that the PSG worked to pressure the National Academy panel to downplay the risks of rocket fuel exposure. PSG representatives attended outside meetings and conferences where panel members were likely to be in attendance and presented the conclusions of an industry-organized conference to the panel as impartial. The PSG also delivered published and unpublished research directly to the panel members—an email discussing this research suggests that its purpose was to influence the panel to deliver a weak recommendation.

Influencing the Panel Through the American Thyroid Association

Many of the National Academy panelists were part of the American Thyroid Association, a medical organization dedicated to issues related to the thyroid—the target organ for perchlorate. PSG consultants interacted with the American Thyroid Association in two ways: issuing statements favoring industry from within the Thyroid Association itself, and presenting industry research at Thyroid Association events.

While acting as a consultant for the PSG, Dr. Steven Lamm became a member of the Public Health Committee at the American Thyroid Society, during the Society’s 2003–2004 fiscal year.¹²⁹ During his tenure, the Thyroid Society issued two formal statements favorable to the industry position on perchlorate.¹³⁰ Neither of the statements disclosed that Dr. Lamm was working for the

perchlorate industry at the time, and also did not disclose that most of the research discussed was funded by the PSG or its members.

The first statement, entitled “The Question of Perchlorate Exposure and Potential Effects on the Thyroid,” included many arguments used by the PSG and the Council on Water Quality to argue that rocket fuel exposure was not harmful. It cited 13 different scientific studies as support for its position—10 of which were funded by the PSG. Dr. Lamm himself was an author of several of the studies. The second was a press release entitled “Various Levels of Perchlorate Exposure Found Not to Be Harmful to Newborns, Pregnant Women, and Other Adults.” It discussed three studies presented at the American Thyroid Association annual meeting in 2004—all funded by the PSG or member companies, and carried out by researchers with a history of consulting for industry. APCO Worldwide announced both statements as evidence that a strong cleanup standard was not necessary.¹³¹

Dr. Lamm also presented PSG-funded research at meetings of the American Thyroid

Association, where NAS panel members were likely to be present. Dr. Lamm requested \$25,000 from the PSG to attend the American Thyroid Association annual meeting in 2004.¹³² He justified this request in an August 2004 email to Michael Girard of Aerojet:

All of this concerns PSG funded work. The session is chaired and hosted by a member of the NAS committee and this will probably be the last opportunity before the finalization of the NAS report for a PSG presentation to be observed by the many NAS panel members who are part of that panel...

Dr. Lamm has frequently presented the opinion that even high levels of perchlorate exposure are not harmful (See “Dr. Steven Lamm and Science that Favors Industry over Public Health” on page 22). Dr. Lamm is also an author of five of the seven studies that use a misleading design, as discussed on pages 22–24. Given the nature of Dr. Lamm’s research, his note appears to demonstrate that he wanted to attend the American Thyroid Association Meeting in order to influence panel members to downplay the potential risks of perchlorate exposure.

The PSG’s 2004 budget gives a concise picture of how many resources rocket fuel manufacturers were putting into different activities. The budget includes federal policy, state policy (California), funding for research and science consultants like Intertox and TERA, and public relations.

| Perchlorate Study Group Budget, 2004¹³⁷ | |
|---|--------------------|
| Federal Policy | |
| EOP [The EOP Group, a lobbying firm in Washington, D.C.] | \$799,200 |
| Rick Belzer Support [Anti-Regulatory Economist] | \$60,000 |
| State Policy | |
| Kahl Pownall [Kahl-Pownall Advocates, a lobbying firm in Sacramento, CA] | \$610,800 |
| Perchlorate Study Group | |
| PSG Budget Status 2004 [Including funding for research and technical consultants] | \$1,264,536 |
| Public Relations | |
| APCO Worldwide | \$554,000 |
| James Strock Support | \$216,000 |
| TOTAL | \$3,504,536 |

Perchlorate Study Group Science and Dr. Steven Lamm

The 2004 budget of the PSG (see page 21) allocates \$1.26 million for science activities—which includes fees paid to a team of scientists-for-hire who represent the industry in technical and regulatory debates.¹³³ Dr. Steven Lamm is one of those scientists. He runs a consulting business called Consultants in Epidemiology and Occupational Health.

Dr. Lamm is highly visible in the field of perchlorate health effects. He co-authored nine studies addressing the health effects of perchlorate exposure or lowered thyroid hormone levels in scientific journals between 1999 and early 2005. All of these studies were funded by the PSG or its members. (See Appendix).

While Dr. Lamm consults for the PSG, he simultaneously holds several faculty positions: at the Bloomberg School of Public Health at Johns Hopkins University, at the Department of Pediatrics in Georgetown University's School of Medicine, and at the School of Medicine of Uniformed Services University for the Health Sciences (the medical school for the U.S. military).

Dr. Lamm regularly submits testimony to regulatory agencies and speaks at conferences. In March 2004, he met with staff from the office of U.S. Senator Dianne Feinstein (CA), delivering the message that perchlorate below 240 parts per billion in water is not a concern.¹³⁴ The Council on Water Quality uses his research to argue that adverse effects do not occur with water contamination levels below 14,000 parts per billion.¹³⁵ These messages benefit the PSG position.

In 2004, Dr. Lamm wrote an email to members of and consultants for the PSG discussing a scientific paper reviewing the vulnerability of embryo and child to environmental toxicants. He wrote:¹³⁶

"I bring the attached article to your attention. At one point, perchlorate was proposed for entry on the list. Dr. Brent chose not to place it in the article based on the presentations of the Chile and Nevada studies that PSG had presented to the Teratology Society a few years ago.

See, benefits do accrue."

This statement implies that PSG-funded research convinced a scientist not to draw attention to perchlorate as a potential health threat, and that Dr. Lamm considered this to be positive. However, the studies Lamm refers to were of the type that are pre-disposed toward finding no effect—meaning that the researcher may have been led to the wrong conclusion.

PSG Research—Meant to Influence the National Academy Panel

In July 2004, Dan Guth of Boeing wrote an email to other members of the PSG discussing a research project being carried out by Jeff Fisher at the University of Georgia.¹³⁸ He wrote:

Regarding the timing of the product of this work and the value vis-à-vis the NAS, we agreed at our earlier meeting that presentation at the ATS [American Thyroid Society] would be a good timeframe and a good objective since many of the NAS panel is likely to be there (late Sept)... I don't think it is too late to affect the NAS conclusions if a paper is submitted by mid Sept. Even if it is too late, the model will give us a valuable tool to support and 'validate' the NAS conclusions if they conclude that perchlorate up to several hundred ppb are not a risk.

This email suggests that the PSG was preparing research aimed at the National Academy of Sciences panel, that the research

was intended to "affect the NAS conclusions," and that the research would support the idea that perchlorate exposure at levels under debate are not a problem—discounting the concerns of EPA scientists.

The Perchlorate Study Group Paid a Consulting Firm to Organize a One-Sided Scientific Conference

PSG consultants organized a one-sided scientific conference and then submitted a report to the National Academy of Science panel, without disclosing the depth of industry involvement.

In the fall of 2003—as the National Academy panel was beginning its work—a group of perchlorate stakeholders gathered for a conference at the University of Nebraska called the "Perchlorate State of the Science

Symposium.” According to the Website announcing the conference, “the Perchlorate State of the Science Symposium (PS3 2003) will provide a review of five fundamental science issues related to the potential health risks from low-level exposure to perchlorate. Researchers who performed the most important recent scientific studies will present their work. Leading scientific experts will evaluate these studies and develop consensus reports on the state-of-the-science as of 2003.”

The conference included four sections, each of which directly addressed a question contained in the charge to the National Academy of Sciences panel, which was already framed around PSG criticisms of the EPA’s work.¹³⁹

The Planning Committee of the conference, (including PSG consultants Dr. Richard Pleus of Intertox and Dr. Richard Belzer, an anti-regulatory economist who is listed as a source on the Council for Water Quality Website) sent a final report to the chair of the National Academy of Science panel, Dr. Richard Johnston.¹⁴⁰ The report states that the symposium “was designed to be an independent and impartial review...” The report acknowledged that “External sponsorship and funding was provided in equal shares from federal agencies and the PSG.”

However, the sponsors listed on the conference Website contain no mention of the PSG or its member companies.¹⁴¹ Instead, the site lists the University of Nebraska, the U.S. Department of Defense, the Society for Risk Analysis and the Nebraska Health and Human Services System as the main sponsors.

The report to the National Academy of Sciences also claimed that “External sponsors did not participate in the selection of critical studies to review or expert panelists, or crafting the Charge to reviewers.”

However, the PSG paid Intertox to plan and organize the conference, as revealed by an invoice from Intertox.¹⁴² Intertox, with funding from the PSG, selected experts, recruited researchers and created participant materials. Intertox billed the PSG \$128,901.28 for services related to the symposium during August and September 2003.¹⁴³

Altogether, eight Intertox employees and a set of subcontractors, including Richard Belzer,

were involved in organizing the event. The invoice sent from Intertox to the PSG listed the following tasks:¹⁴⁴

- Event planning
- Website development
- Coordination of venue
- A “review of experts, credentials, etc.”
- Gathering background info on potential new experts
- Contacting speaker/experts; coordination
- Contacting and reviewing lists of experts, facilitators, researchers, etc.
- Development of expert speaker, moderator and participant materials
- Discussions with UNMC, staff members on contract language, letters for various experts, etc.
- Reviewing letters to people including Annie Jarabek at EPA
- Invitation letters for State Agency Scholarships
- Identification and recruitment of state officials
- Preparing participant bios
- Participation in symposium

Richard Belzer charged close to \$30,000 for tasks including “expert recruitment, attendance, participation, onsite management, development of charge to experts, etc.”¹⁴⁵

The list of research presenters includes many experts on the payroll of companies belonging to the PSG. Research presenters included Dr. Steven Lamm (a PSG consultant), Dr. John Gibbs (the Corporate Medical Director for Kerr-McGee Chemical Corporation), and Dr. Pleus of Intertox.¹⁴⁶

According to an article in the Wall Street Journal by Peter Waldman, conference documents from the University of Nebraska show that “Intertox chose the format and agenda and selected the experts who would appear.”¹⁴⁷ Another university memo revealed in the article said that “Intertox preferred to be a ‘silent’ player in the planning process.”¹⁴⁸ Waldman also revealed that Intertox drafted most of the symposium correspondence, which was then distributed on University letterhead.

Finally, the Waldman article reveals

that a press release issued by the university after the symposium was actually written by a “Sacramento, Calif., public-relations firm that works for users of perchlorate.” (This description is consistent with the Sacramento office of APCO Worldwide.) The message from the press release includes a summary of “consensus reports” of “leading scientists” that directly answer the questions contained in the charge to the National Academy panel. The press release:¹⁴⁹

- “questions the basic assumptions of a number of recent and influential government efforts to assess the safe level of perchlorate exposure”
- Criticizes studies involving animals, which were part of the EPA analysis, alleging that “The results are invalid and the conclusions of these studies should not be used in any way”
- Alleges that “human studies offer greater insight than animal studies into the affects of perchlorate at high doses (doses that are far higher than what is found in U.S. drinking water supplies)” and

- Declares that the effect of perchlorate exposure, the inhibition of iodide uptake, “clearly is not an adverse effect but is instead a mundane biochemical event.”

The PSG, through its contractors, left the National Academy of Sciences without all the information they would need to decide if the conference actually was objective and impartial. The conference resulted in conclusions that downplay the risks of perchlorate. The conference report failed to fully disclose the role of PSG and its consultants. Without this information, the National Academy panel might have been led to believe that impartial scientists, free of any conflict of interest, agreed with industry that the risks associated with perchlorate exposure were minimal, and that the concerns of EPA scientists were unfounded.

The Perchlorate Study Group Also Pays Lobbyists to Directly Influence Government Agencies

The PSG has hired major lobbying firms to deliver its message to the state and federal government in Washington D.C. The messages of these firms are closely coordinated with those of the Council on Water Quality and the contract scientists working for the PSG, much like in an effective political campaign.¹⁵⁰

The 2004 budget of the PSG allocated \$610,000 for Kahl-Pownall Advocates, a lobbying firm based in Sacramento.¹⁵¹ The largest contributors to this line item were Aerojet, Lockheed, Kerr-McGee and Goodrich.

According to his sworn testimony, James Strock spent one-third of his time on perchlorate issues working as a consultant for a team of lobbyists, including Eric Newman and Jeff Sickenger at Kahl-Pownall Advocates, Tom Umberg at Morrison and Foerster (now a member of the California Assembly) and others.¹⁵² Strock used to run the California EPA and directed enforcement at EPA. Because of his intimate experience with these agencies, two of the major centers of decision-making on perchlorate, Strock was likely able to provide the lobbyists with detailed knowledge of how the regulatory process works and improve their ability to advocate on behalf of the PSG.

This activity may be part of what Intertox refers to in invoices as the “California Strategy.”¹⁵³

The 2004 budget of the PSG also allocates \$800,000 for the EOP group, a lobbying firm in Washington D.C. The PSG was by far the largest client of this firm in 2004.¹⁵⁵ Also involved was Jim Rollins of Policy Navigation Group—a firm with no recorded lobbying income before 2004 and who appeared to work solely for PSG Members.¹⁵⁶ According to the Center for Public Integrity’s Lobby Watch Database, PSG members paid Policy Navigation Group \$180,000 to lobby 10 different offices of the federal government, including the Senate, the House, the White House, NASA and the Food and Drug Administration in 2004.

Rocket Fuel Cleanup Standards Should Be Based on Independent Science

State and federal regulatory decisions affecting rocket fuel spills will directly dictate what the corporate members of the PSG will have to pay to clean up rocket fuel spills. As a result, the PSG has a clear motivation to corrupt the regulatory process.

The facts raised in this report lead to serious questions about the objectivity of research funded by perchlorate users or manufacturers facing potential liability; and serious doubts about the intentions driving these companies to participate in the ongoing debate over how to address rocket fuel pollution.

Actors with a clear financial stake in decisions that could affect the health of millions of people across California and the U.S. should

not be allowed to influence the regulatory process. Rocket fuel manufacturers should not play any role in crafting scientific standards meant to protect public health against the effects of their products.

California's public health goal (and other state and federal regulatory standards for perchlorate) should reflect the findings of independent science, not bought-and-paid-for science. Cleanup decisions should be made independently of considerations of how much it will cost for members of the PSG to comply.

People in California and across the country have the right to clean water and food free of rocket fuel contamination.

Appendix

A Comparison of PSG Recommendations with Recommendations from Other Agencies

| Table 1: PSG Recommendations for a Safe Level of Perchlorate and Recommendations from Other Agencies | | | | | | |
|--|--|--|-------------------------|-----------------------|-------------------|------------------------------|
| Year | Perchlorate Study Group ¹⁵⁷ | TERA (a PSG Consultant) ¹⁵⁸ | U.S. EPA | California EPA | Massachusetts DEP | National Academy of Sciences |
| 1992 | | | 3.5 ¹⁵⁹ | | | |
| 1995 | 42,000 | | 3.5–17.5 ¹⁶⁰ | | | |
| 1997 | 350 | | | 18 ¹⁶¹ | | |
| 2002 | | | 1 ¹⁶² | 2 to 6 ¹⁶³ | | |
| 2003 | | | | | | |
| 2004 | 200 | 70 | | 6 ¹⁶⁴ | 1 ¹⁶⁵ | |
| 2005 | | | | | | 24.5 ¹⁶⁶ |
| 2006 | | | 24.5 ¹⁶⁷ | | 2 ¹⁶⁸ | |

Studies Directly Addressing the Health Effects of Perchlorate Exposure and Their Funding Sources

New Analysis by Environment California Research & Policy Center shows that PSG or its members funded more than half of all studies directly addressing the health effects of perchlorate exposure that were published between 1996 and January 2005, when the National Academy of Sciences issued a report on perchlorate. Independent sources like the National Institutes of Health funded less than 10 percent of the research. In some cases, PSG research appears to have deliberately employed an experimental approach that was inappropriate to the task.

Studies were identified in the PubMed database maintained by the National Library of Medicine. We looked at research published from 1996 to January 2005 in peer-reviewed scientific journals directly addressing the issue of the health effects of perchlorate exposure. In the next section, we list additional research published after January 2005.

Studies funded by the Perchlorate Study Group or an entity affiliated with the Department of Defense are listed in bold.

| Table 2: Studies Published Between 1996 and January 2005 | | | | |
|---|---|--|--|---|
| Year | Funding Source | Study Title | Authors | Journal |
| 1998 | Perchlorate Study Group | Evaluation of a population with occupational exposure to airborne ammonium perchlorate for possible acute or chronic effects on thyroid function | JP Gibbs, R Ahmad, KS Crump, DP Houck, TS Leveille, JE Findley and M Francis | Journal of Occupational and Environmental Medicine 40 1072-1082 |
| 1999 | Perchlorate Study Group | Has Perchlorate in Drinking Water Increased the Rate of Congenital Hypothyroidism? | SH Lamm, M Doemland. | Journal of Occupational and Environmental Medicine 41: 409-411 |
| 1999 | Perchlorate Study Group | Thyroid Health Status of Ammonium Perchlorate Workers: A Cross-Sectional Occupational Health Study | Lamm SH, Braverman LE, Li FX, Richman K, Pino S, Howearth G | Journal of Occupational and Environmental Medicine 41: 248-260 |
| 2000 | Perchlorate Study Group (Kerr-McGee Chemical) | Does Perchlorate in Drinking Water Affect Thyroid Function in Newborns or School-Age Children? | C Crump et al. | Journal of Occupational and Environmental Medicine 42: 603-612 |
| 2000 | Perchlorate Study Group (American Pacific) | Neonatal Thyroxine Level and Perchlorate in Drinking Water | Z Li et al, including SH Lamm. | Journal of Occupational and Environmental Medicine 42: 200-205 |
| 2000 | Perchlorate Study Group | Neonatal Thyroid-Stimulating Hormone Levels and Perchlorate in Drinking Water | FX Li et al, including SH Lamm. | Teratology 62: 429-31 |
| 2000 | Department of Defense with PSG involvement | A 90-Day Drinking Water Study in Rats of the Environmental Contaminant Ammonium Perchlorate | JC Siglin, DR Mattie, DE Dodd, PK Hildebrant, WH Baker | Toxicological Science 57: 61-74. |
| 2000 | Perchlorate Study Group | The Effect of Short-Term Low Dose Perchlorate on Various Aspects of Thyroid Function | JE Lawrence, SH Lamm, S Pino, K Richman, LE Braverman | Thyroid 10: 659-663 |
| 2000 | State of Arizona | Ammonium Perchlorate Contamination of Colorado River Drinking Water is Associated with Abnormal Thyroid Function in Newborns in Arizona | RJ Brechner et al. | Journal of Occupational and Environmental Medicine 42: 777-782 |

Table 2: Studies Published Between 1996 and January 2005 (continued)

| Year | Funding Source | Study Title | Authors | Journal |
|------|--|--|--|--|
| 2001 | Perchlorate Study Group | The Effect of Short-Term Low Dose Perchlorate on Various Aspects of Thyroid Function | JE Lawrence, SH Lamm, S Pino, K Richman, LE Braverman | Thyroid 10: 659-663 |
| 2001 | Perchlorate Study Group | Ammonium Perchlorate Contamination of Colorado River Drinking Water is Associated with Abnormal Thyroid Function in Newborns in Arizona | RJ Brechner et al. | Journal of Occupational and Environmental Medicine 42: 777-782 |
| 2001 | Perchlorate Study Group | Oral (drinking water) developmental toxicity study of ammonium perchlorate in New Zealand White rabbits | RG York, WR Brown, MF Girard, JS Dollarhide | International Journal of Toxicology 20: 199-205 |
| 2002 | Perchlorate Study Group and the National Institutes of Health | Health Effects Assessment for Environmental Perchlorate Contamination: The Dose Response for Inhibition of Thyroidal Radioiodine Uptake in Humans | MA Greer, G Goodman, RC Pleus, SE Greer. | Environmental Health Perspectives 110: 927-937 |
| 2002 | Department of Defense—Strategic Environmental Research and Development Program (SERDP) | Effects of in utero and lactational ammonium perchlorate exposure on thyroid gland histology and thyroid and sex hormones in developing deer mice (<i>peromyscus maniculatus</i>) through postnatal day 21 | KA Thuett, EH Roots, LP Mitchell, BA Gentles, T Anderson, RJ Kendall, EE Smith | Journal of Toxicology and Environmental Health Part A, 65: 2119-2130 |
| 2002 | The Natural Sciences and Engineering Research Council of Canada | KClO ₄ inhibits thyroidal activity in the larval lamprey endostyle in vitro | RG Manzon, JH Youson. | General and Comparative Endocrinology 128: 214-223 |
| 2002 | Department of Defense (SERDP) | In utero and lactational exposure to ammonium perchlorate in drinking water: effects on developing deer mice at postnatal day 21 | KA Thuett, EH Roots, LP Mitchell, BA Gentles, T Anderson, EE Smith | Journal of Toxicology and Environmental Health Part A, 65: 1061-1076 |
| 2002 | A non public-health branch of the U.S. government (ie Department of Defense) | Environmentally relevant concentrations of ammonium perchlorate inhibit thyroid function and alter sex ratios in developing <i>Xenopus laevis</i> | WL Goleman, JA Carr, TA Anderson | Environmental Toxicology and Chemistry 21: 590-597 |
| 2002 | A non public-health branch of the U.S. government (ie Department of Defense) | Environmentally relevant concentrations of ammonium perchlorate inhibit development and metamorphosis in <i>Xenopus laevis</i> | WL Goleman, LJ Urquidi, TA Anderson, EE Smith, RK Kendall, JA Carr | Environmental Toxicology and Chemistry 21: 424-430 |
| 2003 | Perchlorate Study Group | “Primary Congenital Hypothyroidism, Newborn Thyroid Function, and Environmental Perchlorate Exposure Among Residents of Southern California | MA Kelsh et al. | Journal of Occupational and Environmental Medicine 45: 1116-27 |

Table 2: Studies Published Between 1996 and January 2005 (continued)

| Year | Funding Source | Study Title | Authors | Journal |
|------|--|---|--|---|
| 2003 | Perchlorate Study Group (American Pacific) | Pediatric neurobehavioral diseases in Nevada counties with respect to perchlorate in drinking water: An ecological inquiry | S Chang, C Crothers, S Lai, and SH Lamm | Birth Defects Research Part A: Clinical and Molecular Teratology 67: 886-92 |
| 2003 | Perchlorate Study Group | Oral (drinking water) developmental Toxicity Study of Ammonium Perchlorate in Sprague-Dawley Rats | RG York, KA Funk, MF Girard, D Mattie, JE Strawson | International Journal of Toxicology 22: 453-464 |
| 2003 | Department of Defense and U.S. Geological Survey (USGS) | Effects of ammonium perchlorate on the reproductive performance and thyroid follicle histology of zebrafish. | R Patino, MR Wainscott, EI Cruz-Li, S Balakrishnan, C McMurry, VS Blazer, TA Anderson | Environmental Toxicology and Chemistry 22: 1115-1121. |
| 2003 | A non public-health branch of the U.S. government (ie Department of Defense) | Changes in cross-fostered Sprague-Dawley rat litters exposed to perchlorate | DA Mahle, KO Yu, L Narayanan, DR Mattie, JW Fisher | International Journal of Toxicology 22: 87-94 |
| 2004 | Nation Institutes of Health | In Utero and Lactational Exposure of Long-Evans Rats to Ammonium Perchlorate (AP) Disrupts Ovarian Follicle Maturation | MG Baldrige et al., | Reproductive Toxicology 19: 155-161 |
| 2004 | A non public-health branch of the U.S. government (ie Department of Defense) | A rat neurodevelopmental evaluation of offspring, including evaluation of adult and neonatal thyroid, from mothers treated with ammonium perchlorate in drinking water. | RG York, J Barnett, WR Brown, RH Garman, DR Mattie, D Dodd. | International Journal of Toxicology 23: 191-214. |
| 2004 | Department of Defense (SERDP) | Does Thyroid Function in Developing Birds Adapt to Sustained Ammonium Perchlorate Exposure? | FM McNabb, DA Jang and CT Larsen | Toxicological Sciences 82: 106-113 |
| 2004 | The Perchlorate Study Group (Lockheed Martin) | Interspecies differences in susceptibility to perturbation of thyroid homeostasis: a case study with perchlorate | TA Lewandowski, MR Seeley, BD Beck. | Regulatory Toxicology and Pharmacology 39: 348-362 |
| 2004 | Department of Defense (SERDP) | Ammonium perchlorate effects on thyroid function and growth in bobwhite quail chicks. | FM McNabb, CT Larsen, PS Pooler | Environmental Toxicology and Chemistry 23: 997-1003 |
| 2004 | Perchlorate Study Group | The Effect of Perchlorate, Thiocyanate, and Nitrate on Thyroid Function in Workers Exposed to Perchlorate Long-Term | LE Braverman, X He, M Cross, B Magnani, SH Lamm, MB Kruse, A Engel, KS Krump, JP Gibbs | Journal of Clinical Endocrinology and Metabolism 90: 700-6 |
| 2004 | Department of Defense with PSG involvement | A Neurobehavioral Developmental Study, Including Evaluation of Adult and Neonatal Thyroids, of Ammonium Perchlorate Administered Orally in Drinking Water to Rats | RG York, J Barnett, WR Brown, RH Garman, DR Mattie, D Dodd | International Journal of Toxicology 23:1-24 |
| 2004 | U.S. Air Force, U.S. Navy and NASA | PBPK model for radioactive iodide and perchlorate kinetics and perchlorate-induced inhibition of iodide uptake in humans | E.A. Merrill et al. | Toxicological Sciences 83: 25-43 |

The pattern of funding after the publication of the National Academy of Sciences perchlorate health assessment continues to be heavily influenced by perchlorate industry and Department of Defense dollars.

| Table 3: Studies Published After 2005 | | | | |
|--|---|--|--|--|
| Year | Funding Source | Study Title | Author | Journal |
| 2005 | AstraZeneca Pharmaceuticals, UK Natural Environment Research Council | Effects of Ammonium Perchlorate on Thyroid Function in Developing Fathead Minnows, <i>Pimephales promelas</i> | HM Crane, DB Pickford, TH Hutchinson and JA Brown | Environmental Health Perspectives 113: 396-401 |
| 2005 | Texas Tech, the National Institutes of Health, and Dionex Corp. | Perchlorate and iodide in dairy and breast milk. | AB Kirk, PK Martinelango, K Tian, A Dutta, EE Smith, PK Dasgupta | Environmental Science and Technology 39: 2011-2017 |
| 2005 | Perchlorate Study Group | Long-term environmental exposure to perchlorate through drinking water and thyroid function during pregnancy and the neonatal period. | Tellez et al. | Thyroid 15: 963-975 |
| 2005 | U.S. Department of Agriculture | Fate of dietary perchlorate in lactating dairy cows: Relevance to animal health and levels in the milk supply | A.V. Capuco et al. | Proceedings of the National Academy of Sciences 102: 16152-16157 |
| 2005 | Perchlorate Study Group | Benchmark calculations for perchlorate from three human cohorts | Kenny Crump and John Gibbs | Environmental Health Perspectives 113: 1001-1008 |
| 2006 | Unknown | Estimates of exposures to perchlorate from consumption of human milk, dairy milk, and water, and comparison to current reference dose | C. Baier-Anderson et al. | Journal of Toxicology and Environmental Health 69: 319-330 |
| 2005 | Department of Defense (SERDP) | Uptake and elimination of perchlorate in eastern mosquitofish | C.M. Bradford et al. | Chemosphere, published online on 19 November 2005. |
| 2005 | Non-U.S. Government (Likely the PSG, since Michael Girard is a co-author) | Refining the effects observed in a developmental neurobehavioral study of ammonium perchlorate administered orally in drinking water to rats. I. Thyroid and reproductive effects. | R.G. York et al. | International Journal of Toxicology 24: 403-418 |
| 2005 | Non-U.S. Government (Likely the PSG, since Michael Girard is a co-author) | Refining the effects observed in a developmental neurobehavioral study of ammonium perchlorate administered orally in drinking water to rats. II. Behavioral and neurodevelopmental effects. | R.G. York et al. | International Journal of Toxicology 24: 451-467 |
| 2005 | Unknown, Researchers from the U.S. National Research Council, Health Canada and Reproductive Toxicology | A mixture of ammonium perchlorate and sodium chlorate enhances alterations of the pituitary-thyroid axis caused by the individual chemicals in adult male F344 rats. | MA Khan et al. | Toxicology and Pathology 33: 776-783 |

Table 3: Studies Published After 2005 (continued)

| Year | Funding Source | Study Title | Author | Journal |
|------|---|--|-----------------------------------|---|
| 2005 | Department of Defense (SERDP) | Monitoring perchlorate exposure and thyroid hormone status among raccoons inhabiting a perchlorate-contaminated site | P.N. Smith et al. | Environmental Monitoring and Assessment 102: 337-347 |
| 2005 | Department of Defense (SERDP) | Effects of perchlorate exposure on resting metabolism, peak metabolism, and thyroid function in the prairie vole (<i>Microtus ochrogaster</i>) | JP Isanhart, FM McNabb, PN Smith. | Environmental Toxicology and Chemistry 24: 678-684 |
| 2005 | U.S. EPA | Metamorphic inhibition of <i>Xenopus laevis</i> by sodium perchlorate: effects on development and thyroid histology. | J.E. Tietge et al. | Environmental and Toxicological Chemistry 24: 926-933 |
| 2005 | Department of Defense (SERDP) | Novel biomarkers of perchlorate exposure in zebrafish. | S. Mukhi et al. | Environmental and Toxicological Chemistry 24: 1107-1115 |
| 2005 | Department of Defense (SERDP) | Perchlorate affects thyroid function in eastern mosquitofish (<i>Gambusia holbrooki</i>) at environmentally relevant concentrations. | C.M. Bradford et al. | Environmental Science and Technology 39: 5190-5195 |
| 2005 | Department of Defense (SERDP) | Evaluation of adult quail and egg production following exposure to perchlorate-treated water. | A. Gentles et al. | Environmental and Toxicological Chemistry 24: 1930-1934 |
| 2005 | U.S. Centers for Disease Control and Prevention | Genetic factors that might lead to different responses in individuals exposed to perchlorate. | F. Scinicariello et al. | Environmental Health Perspectives 113: 1479-1484 |
| 2006 | Not Published | Thyroid endocrine disruption in stonerollers and cricket frogs from perchlorate-contaminated streams in East-central Texas. | C.W. Theodorakis et al. | Ecotoxicology 15: 31-50 |
| 2006 | Department of Defense (SERDP) | The thyroid endocrine disruptor perchlorate affects reproduction, growth, and survival of mosquitofish. | J.W. Park et al. | Ecotoxicology and Environmental Safety 63: 343-352 |

Endnotes

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- ³ Ibid.
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- ⁵ Ibid.
- ⁶ Leslie DeGroot, Endocrine Education, Inc., “Diagnosis and Treatment of Graves’ Disease: Anti-Thyroid Drug Therapy,” Chapter 11 of *The Thyroid and its Diseases*, updated 20 June 2005, available at www.thyroidmanager.org.
- ⁷ Reviewed in Travis Madsen and Sujatha Jahagirdar, Environment California Research and Policy Center, *Perchlorate and Children’s Health: The Case for a Strong Cleanup Standard for Rocket Fuel in Drinking Water*, March 2005.
- ⁸ K Takata. Letter from Chief, Superfund Programs Branch, to Don Hawkins, CDC Regional Representative, *Request for CDC Assistance Regarding Potential Health Effects of Perchlorate Contamination at the San Gabriel Valley Superfund Sites*, 23 December 1985. Doc. 2649., as cited in Jennifer Sass, “U.S. Department of Defense and White House Working Together to Avoid Cleanup and Liability for Perchlorate Pollution,” *International Journal of Occupational and Environmental Health*, 10:330–334, 2004.
- ⁹ California Department of Health Services, *Perchlorate: Early Findings and Subsequent Monitoring Results*, 19 January 2006, downloaded from www.dhs.ca.gov.
- ¹⁰ Bryan Ehlers and Kip Wiley, California Senate Office of Research, *Addressing Perchlorate Contamination of Drinking-Water Sources in California*, January 2004.
- ¹¹ Wells with two or more detections: See Note 9
- ¹² Andrea Kirk et al, “Perchlorate and Iodide in Dairy and Breast Milk,” *Environmental Science and Technology*, ASAP Article 10.1021/es048118t S0013-936X(04)08118-0, 22 February 2005.
- ¹³ See note 10; Peter Waldman, “Perchlorate Runoff Flows to Water Supply of Millions: A Fuel of Cold War Defenses Now Ignites Health Controversy” *Wall Street Journal*, 16 December 2002; and see the remainder of this chapter.
- ¹⁴ In 1996, members of the PSG included AeroJet, Alliant Techsystems, Atlantic Research Corporation, Kerr-McGee Chemical Corporation, Thiokol Corporation, United Technologies Chemical Systems, and Western Electrochemical Company [American Pacific]. Superior Court of the State of California for the County of Sacramento, Daphne Adams, et al., Plaintiffs, vs. AeroJet-General Corporation, et al., Defendants, *Deposition of Michael Girard*, Sacramento, California, 15 November 2004, Volume 2, Exhibit 35: AeroJet-General Corporation, *AeroJet Global Settlement Overview*, 19 April 1996, prepared for negotiation of modifications to Settlement Agreement in ASBCA No. 40309. Lockheed Martin, Boeing and B.F. Goodrich appear as contributors in the PSG 2004 budget: Superior Court of the State of California for the County of Sacramento, Daphne Adams, et al., Plaintiffs, vs. AeroJet-General Corporation, et al., Defendants, *Deposition of Michael Girard*, Sacramento, California, Volume 2, 15 November 2004, Exhibit 52: email from Paul Hancock to Michael Girard, Subject: Draft Perchlorate Budget Worksheet 2-12-042.xls, Bates Stamp AEROJET-PSG-00013314, 26 February 2004.
- ¹⁵ U.S. Environmental Protection Agency, *Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization Based on Emerging Information*, Washington D.C., 1998; U.S. Environmental Protection Agency, Office of Research and Development, *Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization (External Review Draft)*, Washington, D.C., NCEA-1-0503, 2002; M Anba, S Guttman, Z Lewitus, “The Mode of Action of Perchlorate Ions on the Iodine Uptake of the Thyroid Gland,” *International Journal of Appl. Radiat. Isotopes*, 7:87-96, 1959.
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- ²² Western Electrochemical Company, soon merged into American Potash and Chemical Company (AMPOT), operated the facility under contract to the U.S. Military in the 1950s. In 1967, AMPOT merged into Kerr-McGee Chemical Corporation, which manufactured perchlorate until 1998. U.S. Department of Justice, *Defendant’s Statement of Undisputed Material Facts in Support of Motion for Summary Judgment as to Second Amended Complaint*, Kerr-McGee Chemical LLC vs. the United States of America, U.S. District Court for the District of Columbia, Case No. 1:00CV01285 EGS, 31 March 2005, Facts 4, 10, 11, 12.
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