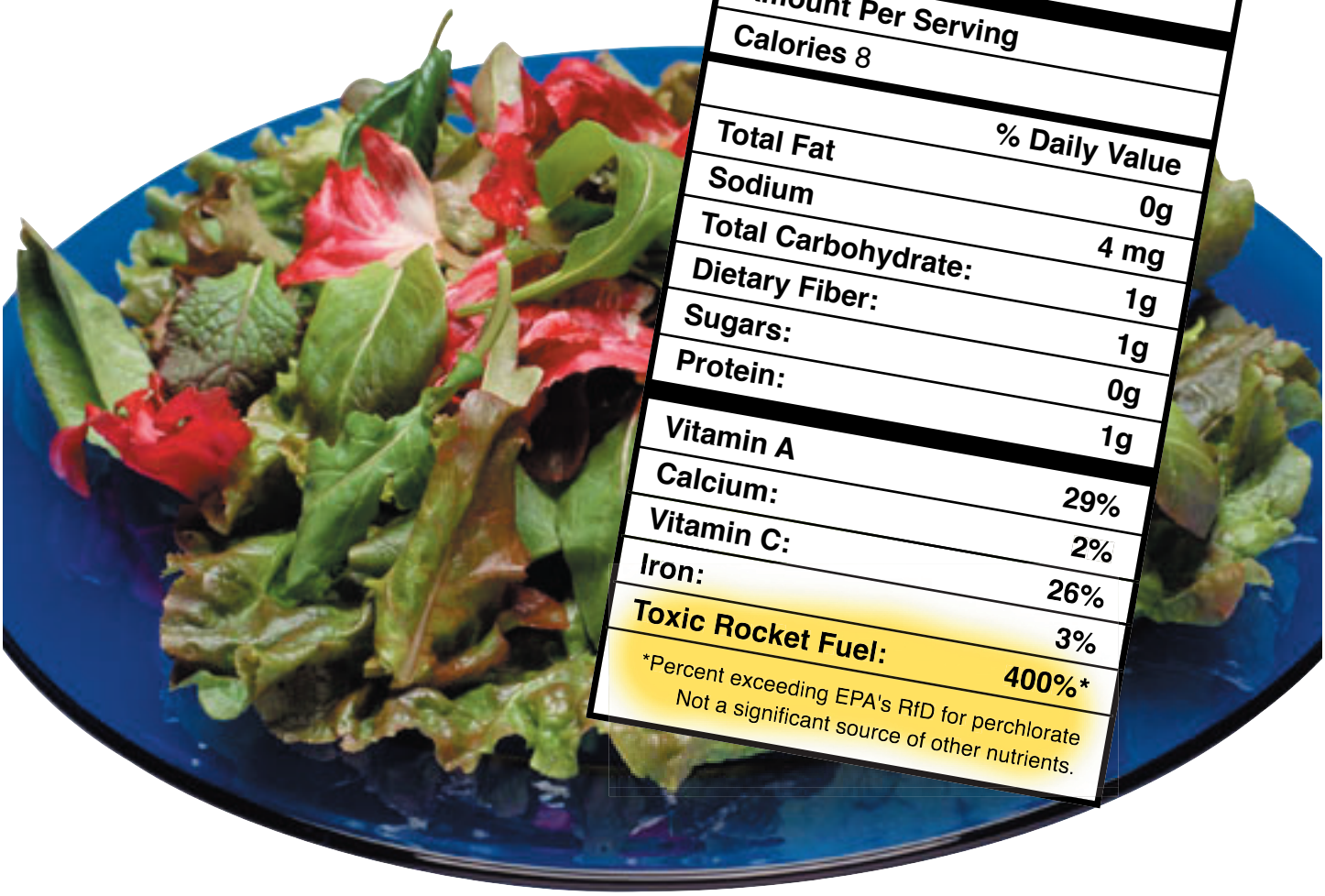
Suspect Salads

Toxic Rocket Fuel Found in Samples of Winter Lettuce



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ENVIRONMENTAL WORKING GROUP

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ENVIRONMENTAL WORKING GROUP

EWG is a nonprofit research organization with offices in Washington, DC and Oakland, CA. EWG uses the power of information to educate the public and decision-makers about a wide range of environmental issues, especially those affecting public health.

Executive Summary

Lettuce grown in the fall and winter months in Southern California or Arizona may contain higher levels of toxic rocket fuel than is considered safe by the U.S. Environmental Protection Agency, according to independent laboratory tests commissioned by Environmental Working Group (EWG).

In the first-ever tests of perchlorate in supermarket produce, 18 percent of lettuce samples contained detectable levels of perchlorate, and an average serving of these contaminated samples contained 4 times more than the EPA says is safe in drinking water. EWG estimates that by eating lettuce, 1.6 million American women of childbearing age are exposed daily during the winter months to more perchlorate than the EPA's recommended safe dose. EWG's findings of perchlorate in retail produce confirm previous tests on greenhouse-grown lettuce seedlings by the EPA and field-grown vegetables by a San Bernardino, Calif. farm whose irrigation water supplies were contaminated by defense contractor Lockheed Martin's abandoned rocket-testing facility.

Perchlorate, the explosive component of rocket and missile fuel, can affect the thyroid gland's ability to make essential hormones. For fetuses, infants and children, disruptions in thyroid hormone levels can cause lowered IQ, mental retardation, loss of hearing and speech, and motor skill deficits. Currently there are no enforceable perchlorate safety standards but EWG argues that a national safety standard should be no higher than one-tenth the EPA's currently recommended level.

Perchlorate contaminates more than 500 drinking water sources in 20 states, serving well over 20 million people. Among contaminated sources is the Colorado River, which not only provides drinking water for Los Angeles, Phoenix, Las Vegas and other cities, but also irrigates 70 percent of the nation's lettuce grown from October to March.

Recommendations

- Perchlorate contamination of Lake Mead and the Colorado River must be cleaned up.

• The Food and Drug Administration and U.S. Department of Agriculture must move quickly to conduct a definitive study of perchlorate contamination in the American food supply, and make all results public.

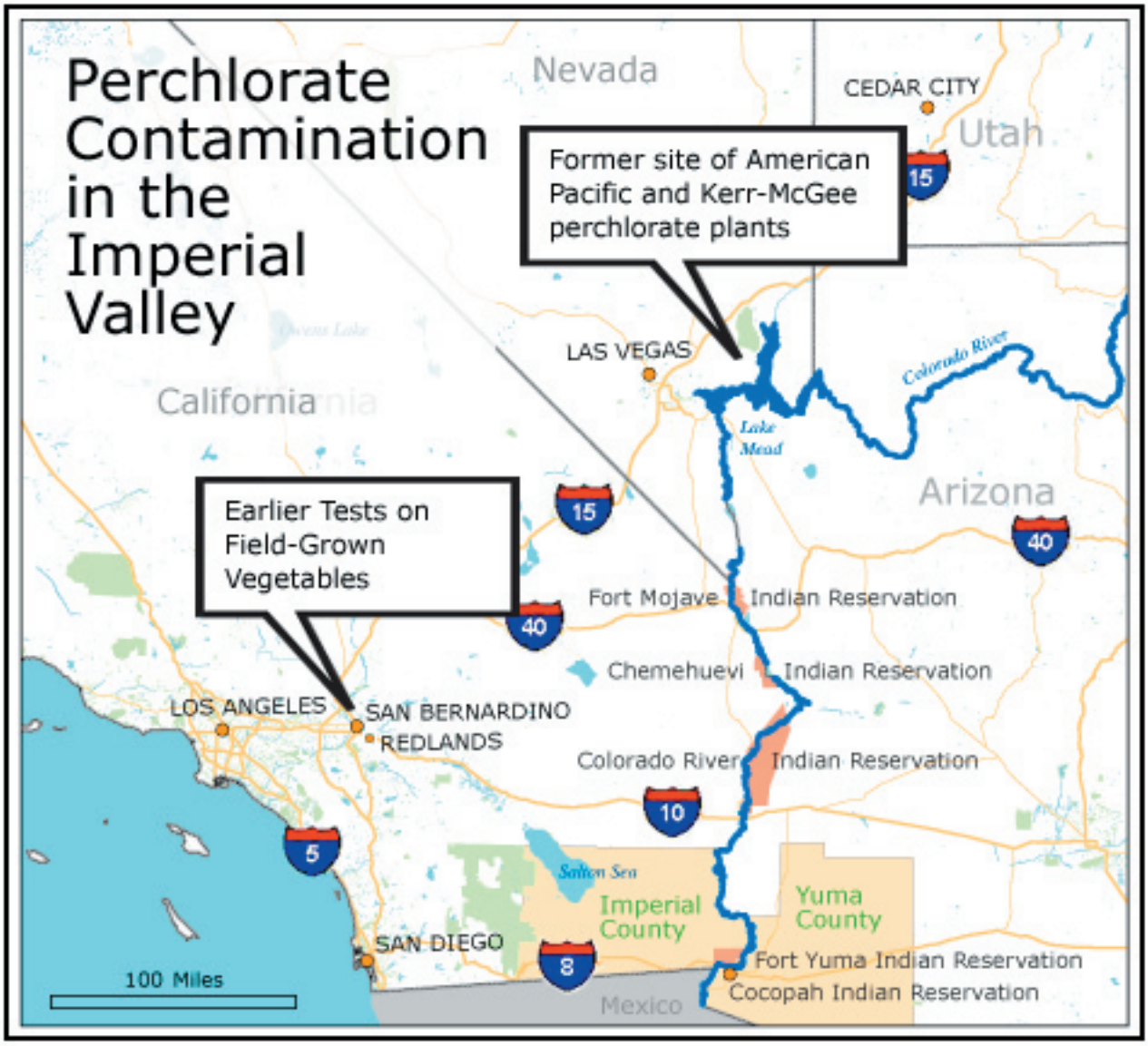
• All future drinking water standards must adequately reflect the potential for exposure through food.

• Farmers and landowners must be fully compensated for lost profits and property values.

• Irrigation water sources — not just drinking water sources — must be tested for perchlorate.

• The Bush Administration's current proposal to exempt Department of Defense sites from environmental regulations, including perchlorate cleanup, must not go forward.

Map. Winter lettuce is grown in the Imperial Valley region of California and Arizona



Suspect Salads: Toxic Rocket Fuel Found in First Tests of Grocery Store Lettuce

Lettuce grown in the fall and winter months in Southern California or Arizona may contain higher levels of toxic rocket fuel than is considered safe by the U.S. Environmental Protection Agency, according to independent laboratory tests commissioned by Environmental Working Group (EWG).

In the first tests ever conducted for perchlorate in supermarket produce, 18 percent of lettuce samples contained detectable levels of perchlorate, and an average serving of these contaminated samples contained 4 times more perchlorate than the EPA says is safe in a liter of drinking water. EWG's tests on retail lettuce confirm studies showing that vegetables grown with perchlorate-contaminated water or fertilizer can take up and concentrate the toxin. Based on our tests and federal dietary data, EWG estimates that by eating lettuce, 1.6 million American women of childbearing age - the population of greatest concern - are exposed daily during the winter months to more perchlorate than the EPA's recommended safe dose. (Figure A.)

Perchlorate, the explosive main ingredient of solid rocket and missile fuel, can affect the thyroid gland's ability to take up the essential nutrient iodide and make thyroid hormones. For infants and children, small disruptions in thyroid hormones in utero or during early development can cause lowered IQ; larger disruptions can cause mental retardation, loss of hearing and speech, or deficits in motor skills. [1] There are no enforceable drinking water safety standards at either the state or federal level, but EWG's analysis of the latest scientific studies, showing harmful health effects from very low doses, argues that a national perchlorate safety standard should be no higher than one-tenth the EPA's currently recommended level. [2]

Perchlorate in the Colorado River

Sampling by state and federal officials has confirmed perchlorate contamination in more than 500 drinking water sources in 20 states, serving well over 20 million people in California, Arizona and Nevada, and unknown millions elsewhere. Among contaminated sources is the lower Colorado River - not only a major source of drinking water for thirsty, fast-growing cities

including Los Angeles, San Diego, Phoenix and Las Vegas, but a 300-mile-long irrigation channel for a major part of the nation's winter vegetable crop. [3,4] Because perchlorate sampling nationwide is spotty -in some states not a single sample has been taken - it is possible that other regionally or nationally significant farming regions are unknowingly using perchlorate-contaminated water.

In January and February 2003 EWG bought 22 commercial lettuce samples for analysis by scientists at Texas Tech University. The samples included pre-packaged and head lettuces, adult and baby greens, organic and conventional lettuces, from several different distributors. Four samples contained measurable levels of perchlorate. The average amount in the contaminated samples was 70 parts per billion (ppb), meaning a typical one-cup serving would contain 4 micrograms (ug) of perchlorate. (Table A.) The EPA's provisional reference dose (RfD) for perchlorate in drinking water is 1 microgram per liter. [1]

Table A. Four of 22 Samples Tested Had Measurable Levels of Perchlorate*

Type of lettuce sampled	Perchlorate concentration (ppb wet weight**)	Micrograms perchlorate in 2 oz. serving (about 1 cup)
Conventional Adult Butter Lettuce and Radicchio	60 to 100 ppb	3.4 to 5.7
Conventional Adult Romaine Lettuce and Radicchio	30 to 60 ppb	1.7 to 3.4
Conventional Adult Head of Iceberg Lettuce	30 to 55 ppb	1.7 to 3.2
Mixed Organic Baby Greens	121 ppb	6.7
Average perchlorate level in these four samples	**72 ppb**	**4.1**

*The level of detection varied by the type of lettuce analyzed, but is estimated to be 30 to 40 ppb perchlorate.

**ppb = nanograms per gram (ng/g) lettuce wet weight

We can't be certain where the lettuces were grown, or the level of perchlorate in the water used to grow them. But based on the purchase season and location, the samples most likely came from Imperial County, Calif., or Yuma County, Ariz. These two counties, on either side of the Colorado, grow 88 percent of the lettuce sold in the U.S. in January and February.

Virtually all of the Imperial-Yuma cropland is irrigated by the Colorado River, contaminated by waste from a now-closed perchlorate manufacturing plant near Las Vegas. [5] Between 500 and 900 pounds of perchlorate a day flow from the site into Lake Mead and down the river. Perchlorate concentrations of 4 to 16 ppb have been measured in the lake and river, and concentrations of 3 to 6 ppb have been measured near irrigation intakes in Yuma County. [6]

It should be emphasized that in this small sample, no relationship can be established between perchlorate levels and the variety of lettuce, the way it was packaged, or whether it was grown using organic vs. conventional methods. In other words, it is a coincidence that our sample of organic baby greens had the highest perchlorate levels of the four contaminated samples. Our study and earlier tests clearly show that perchlorate contamination is not limited to the type of lettuce, but that any lettuce grown in area where the irrigation water is contaminated may itself be contaminated.

1.6 Million Women a Day Consume Excessive Perchlorate in Lettuce

To estimate how much perchlorate exposure women of childbearing age get from lettuce, EWG analyzed data from the U.S. Department of Agriculture (USDA) on the actual lettuce consumption, adjusted for body weight, of more than 2,400 women. [7] Our analysis shows that of women between the ages of 15 and 44 who ate lettuce with the average level of perchlorate found in the contaminated samples, 57 percent would consume more than the EPA's provisional RfD for drinking water. Thirty-seven percent would get twice as much. (Figure B.) Women of child-bearing age are the most important population to consider because fetuses are much more susceptible to harm from perchlorate exposure than adults.

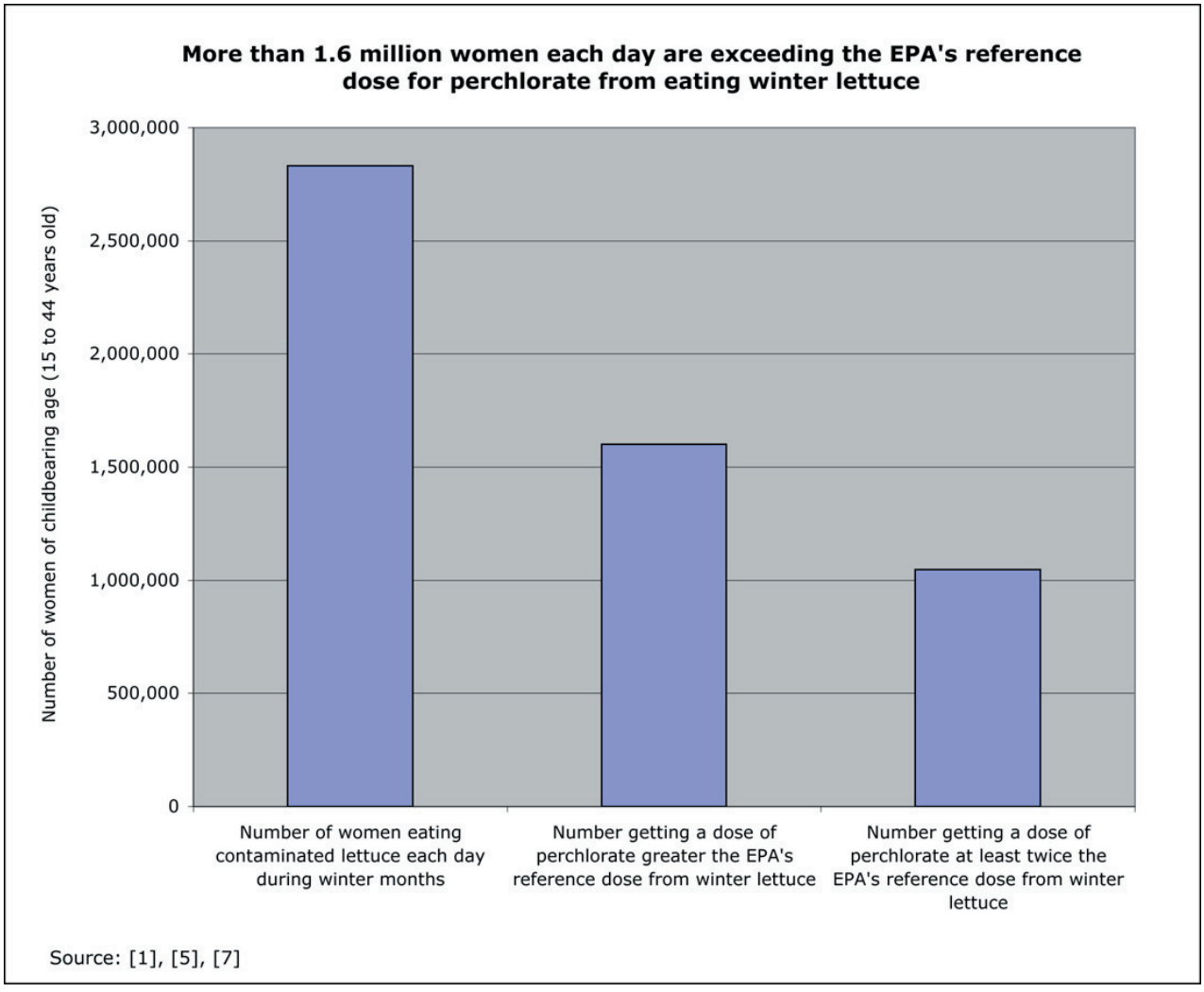
One-fourth of the women in the USDA database ate lettuce on a given day, and 18 percent of the winter lettuce samples tested had measurable perchlorate. Therefore, EWG estimates that more than 2.8 million women of childbearing age in the United States

are eating perchlorate-contaminated lettuce each day during the winter months. About 1.6 million of these women are getting a dose of perchlorate that is greater than the EPA's proposed reference dose, and more than 1 million are getting a dose at least twice the RfD. Based on lettuce production statistics for Yuma and Imperial Counties, which account for 70 percent of the national crop from November to March, about half as many women would be exposed in the fall months. [5] (Figure C.) In spring and summer, very little lettuce is grown in areas irrigated by the Colorado River.

Urgent Need for Action

EWG's findings have broad implications not just for the safety of produce, but also for current efforts to set perchlorate safety standards. If the perchlorate levels in our samples are

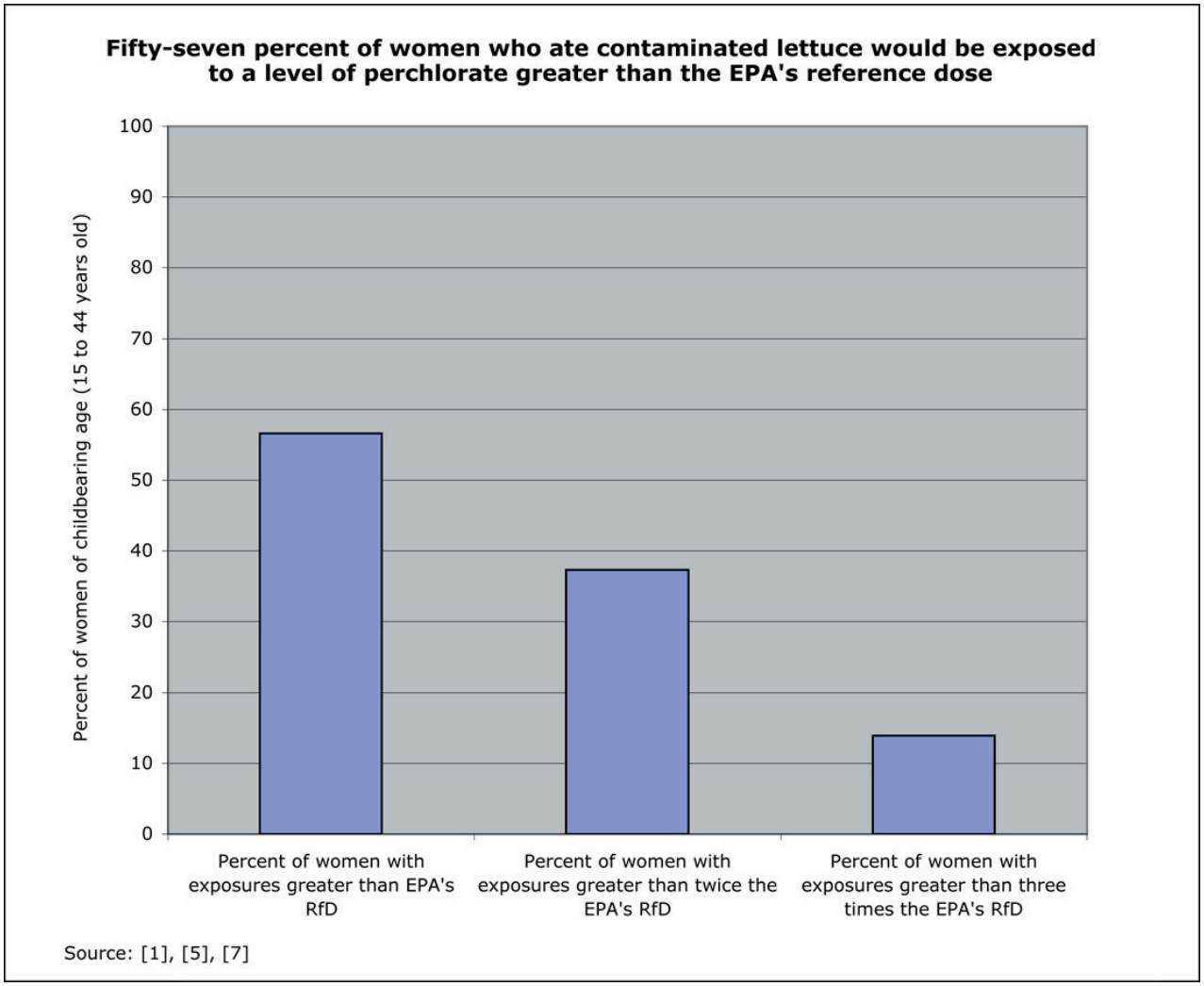
Figure A.



representative, exposure is not just a problem for people in areas where the water is contaminated, but a national concern for everyone who buys winter lettuce at the grocery store.

If these levels are confirmed by further testing, immediate action is needed to reduce perchlorate in lettuce and other vegetables. We urge the U.S. Food and Drug Administration to immediately begin testing lettuce and other crops irrigated by the Colorado River for perchlorate, and make the results public as soon as they are confirmed. Commercial produce grown in all other areas where water supplies are contaminated with perchlorate must also be tested. Any growers adversely affected by perchlorate contamination should be fully compensated for crop losses and damage to property values.

Figure B.



EWG's Lettuce Tests and Dietary Analysis

During the weeks of January 20 and February 10, 2003, EWG purchased 22 samples of lettuce from the shelves of seven different grocery stores in Northern California and sent them to be analyzed for perchlorate by scientists at Texas Tech University, which has emerged as a major center for perchlorate-related research. The samples included pre-packaged and head lettuces, adult and baby greens, organic and conventional lettuces, from several different distributors.

Four samples were found to contain perchlorate at levels that ranged from 30 to 121 ppb and averaged 70 ppb. [Note: ppb = nanograms per gram (ng/g) lettuce wet weight.] There was no relationship between the results and the type or brand of lettuce tested. Because the detection limit for perchlorate in lettuce is relatively high (30 to 40 ppb in lettuce, compared to 1 to 4 ppb in water), it is possible that some of the other samples tested also contained perchlorate at concentrations lower than the detection limit.

Although there are no safety standards for perchlorate in food, EPA has been working for more than a decade toward establishing a safe drinking water standard. In 2002, EPA proposed a reference dose for perchlorate of 0.00003 milligrams per kilogram of body weight per day, which is the dose at which no adverse effect would be expected. [1] Based on an average adult body weight of 70 kilograms, and not counting exposures from food, EPA calculated that a safe level for perchlorate in drinking water is 1 ppb, or 1 microgram of perchlorate per liter of water.

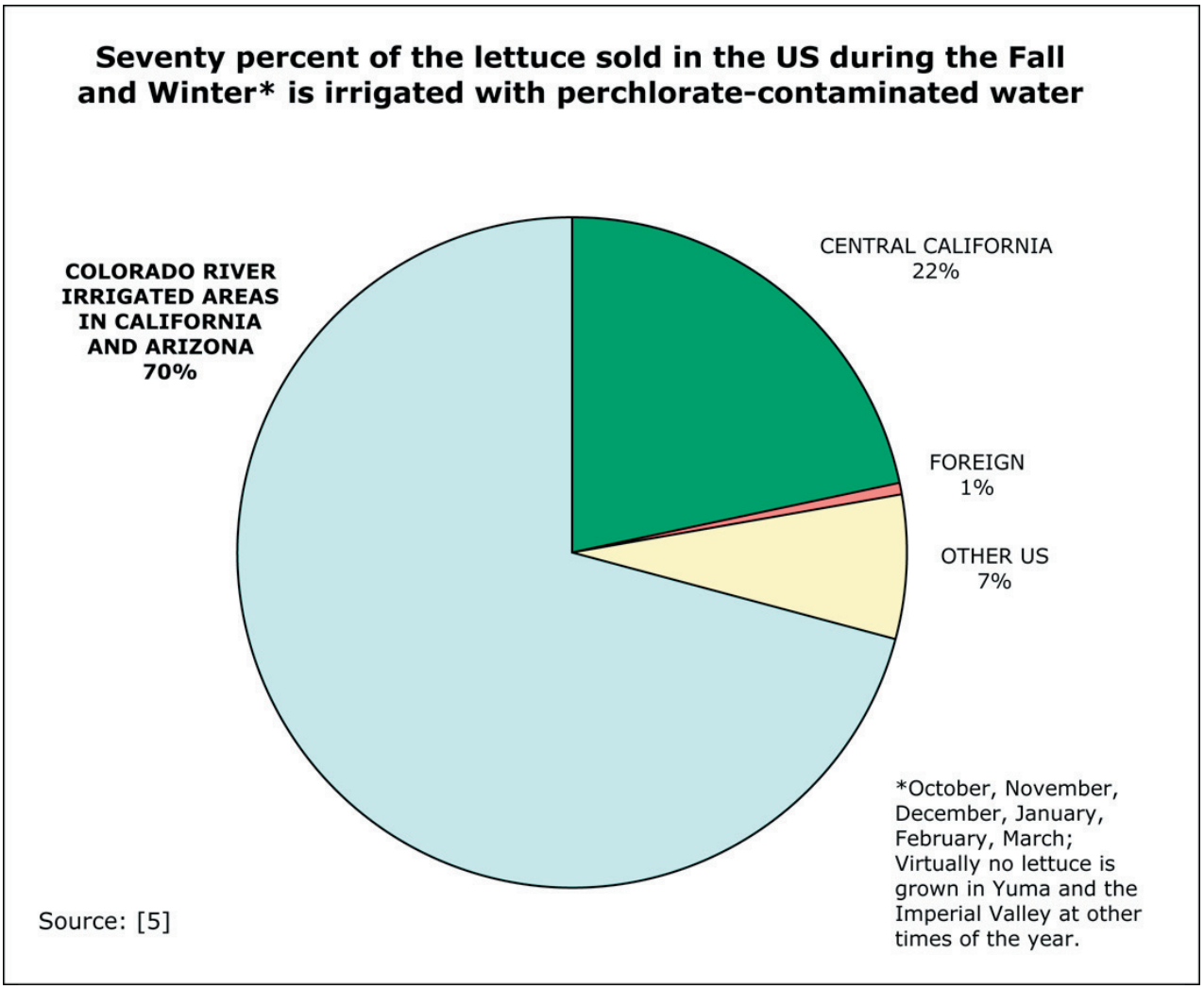
Provisional Standard 10x Too High

The provisional RfD indicates the latest and best assessment of a chemical's safe consumption level. A final, enforceable drinking water standard could be higher or lower than the proposed RfD. Sen. Barbara Boxer, D-CA, has introduced legislation requiring EPA to set an enforceable drinking water standard by July 1, 2004, but the agency says it can't meet that deadline. To provide the margin of safety needed to protect the most sensitive

populations, EWG has urged the EPA to set a safety standard of 0.1 ppb, or one-tenth the provisional RfD. [2]

EWG analysis shows that a one-cup (two-ounce) serving of the contaminated lettuce samples would contain, on average, 4 micrograms of perchlorate. This is four times what the EPA says is safe to drink in a liter of water. The most contaminated sample contained 7 micrograms of perchlorate per one-cup serving. But women's eating habits vary greatly - some eat very little lettuce; others may eat a large salad twice a day. Women's body weights also vary. These variances have important implications for risk analysis because they show that some women can have much higher exposures to perchlorate than others.

Figure C.



To better assess the health risks of perchlorate in lettuce, EWG analyzed USDA's 1994-1996 Continuing Survey of Food Intakes by Individuals database, which monitors the food consumption of thousands of ordinary Americans. [7] The database contained information on 2,453 women of childbearing age (15 to 44) who measured their lettuce consumption over two days. One-fourth of the women ate lettuce on a given day, with 2 ounces the typical serving. But some ate up to 10 times as much in a given day. No differences were found in lettuce consumption by women who were pregnant or breastfeeding, compared to others of child-bearing age.

Using this consumption data and adjusting for body weight, EWG calculated the percentage of women who would exceed EPA's provisional RfD under different scenarios. If the lettuce eaten contained the average amount of perchlorate found in the contaminated samples, 57 percent of the women would get a dose higher than the RfD, and 37 percent would get at least twice as much. If the woman with the highest lettuce consumption in the USDA database ate lettuce with the highest amount of perchlorate in our samples, she would get a dose that is 44 times the provisional RfD, based on her body weight.

One-fourth of women in the USDA database ate lettuce on a given day and 18 percent of the winter lettuce samples tested had measurable levels of perchlorate. From those values, EWG estimates that more than 2.8 million American women of childbearing age eat perchlorate-contaminated lettuce daily during the winter months. Approximately 1.6 million of these women get a daily dose of perchlorate greater than the EPA's proposed reference dose, and more than 1 million of them get a daily dose at least twice the RfD.

Health Risks for Children and Adults

Women of child-bearing age are the most important population to consider when assessing the risks of perchlorate consumption because the developing fetus is much more susceptible to injury from perchlorate exposure than adults. Perchlorate interferes with normal thyroid function by blocking iodide uptake, a necessary building block of thyroid hormones, and can lead to hypothyroidism. In adults, hypothyroidism is associated with a variety of adverse symptoms such as fatigue, depression, anxiety, unexplained weight gain, hair loss and low libido. [2]

Although these symptoms can be serious, especially if left untreated, the consequences of depressed thyroid hormone levels on developing fetuses and infants can be devastating: In a

developing fetus or infant, even temporary disruption of thyroid hormones can lead to permanent defects in the developing organism. [1] Numerous studies on laboratory animals have shown that perchlorate affects the developing fetus at much lower levels than it affects exposed adults. [8,9] Unlike adults, infants and fetuses do not have large stores of thyroid hormones which would enable them to buffer changes in iodide availability and thyroid hormone levels in the body. [10]

Moreover, recent research has shown how remarkably sensitive the developing fetus can be to small disturbances in thyroid hormone level. One study found that women whose levels of a particular thyroid hormone measured in the lowest 10 percent of the population during the first trimester of pregnancy were more than 2.5 times as likely to have a child with an IQ of less than 85 and five times as likely to have a child with an IQ of less than 70. This was true whether or not these women were clinically hypothyroid, and many women in this group had thyroid hormone levels considered to be in the normal range. [11] This is important because it means that perchlorate does not have to alter women's thyroid hormone levels dramatically to have critical effects.

There is also evidence to suggest that perchlorate can have effects even at low doses. An epidemiological study of newborns in Arizona, for example, found that babies born to mothers who drank contaminated Colorado River water during pregnancy had significantly different thyroid hormone levels than infants of mothers who drank uncontaminated water. [12] An epidemiological study of thousands of California infants born in 1996 had similar findings, with significant differences in infant thyroid hormone levels of infants whose mothers drank water contaminated with perchlorate levels at just 1 to 2 ppb. (the study is from 2001, the data is from 1996) [13]

Localized Contamination, Nationwide Implications

Until now, contamination of drinking water supplies with perchlorate has been considered largely a regional concern - most serious in California, Arizona and Nevada, with hot spots in dozens of other states. But finding rocket fuel in grocery store lettuce means consumers across America are unknowingly getting doses of perchlorate equal to the levels in some drinking water supplies. Lettuce is the second-most consumed vegetable in the U.S. The average American consumed 33 pounds of lettuce in 2000, and the Imperial-Yuma crop accounted for 40 percent of year-round production. [14]

Decades of neglect at the now-abandoned perchlorate manufacturing facility near Las Vegas, formerly operated by Kerr-McGee of Oklahoma City, have polluted Lake Mead and the Colorado River with perchlorate at levels that typically range between 4 and 16 ppb. [1] But concentrations vary widely, depending on rainfall, the time of year, and how well the Kerr McGee facility's treatment system is working. From 1997 to 2000, for instance, the average perchlorate level in Lake Mead was 9 ppb, but reached 24 ppb in November 2000, and was measuring 14 ppb in January 2003. [15] Although perchlorate levels in the river tend to decrease farther from the Kerr-McGee site, testing near irrigation intakes near Yuma - more than 250 miles downstream - have found perchlorate concentrations ranging from 3 to 6 ppb. [1]

Water from the Colorado River irrigates more than 1.4 million acres of cropland in California and Arizona. [16] It is unlikely that lettuce is the only crop that takes up and concentrates perchlorate, but lettuce is of particular concern because its cultivation uses so much water, the edible portions have a high water content, and so much of the nation's lettuce is grown with contaminated water. In 2001, almost 70,000 acres in Yuma County and more than 22,000 acres in Imperial County were planted with lettuce. [17,18] At the peak of production last winter, 374 truck loads of lettuce were shipped each day from Yuma and Imperial Counties. [5]

Because we purchased lettuce from grocery stores rather than picking it from specific fields, for most of the 22 samples little is known about where the crops were grown. However, given the perishability of lettuce (about a week) and the time of year the samples were purchased (January and February), it is highly likely that most if not all of the samples were grown in Yuma or Imperial County. Eighty-eight percent of the winter lettuce eaten in the U.S. (i.e., grown from December to March) is grown in these two counties. [5]

Lettuce Concentrates the Perchlorate in Water

If the irrigation water was contaminated with 3 to 6 ppb of perchlorate, as measured near irrigation gates in Yuma County, the levels detected in the samples would mean the lettuce concentrated the chemical by a factor of 5x to 40x. More research is urgently needed to answer this and other questions about the prevalence of perchlorate in the American food supply.

Unfortunately, the Colorado River is not the only source of agricultural water that is polluted with perchlorate. Looking only at commercially harvested lettuce, USDA data show that perchlorate contamination of water or soil is known or suspected in 10 of the 15 leading lettuce-producing counties in the U.S. [19] (Table B.) For example, in late 2002, a perchlorate plume from an abandoned highway flare factory was discovered in the San Martin area of Santa Clara County, Calif., contaminating almost 300 public and private wells. [20] Santa Clara is the 15th-ranking lettuce-producing county in the nation, with more than 1,200 acres commercially harvested in 1997. All but two of the top lettuce-producing counties are in California, where perchlorate contamination has been most widely documented.

The EPA says there are sites of known perchlorate use in more than 40 states - but the exact number of states is unknown, as some military locations are confidential [21] - and has stated that sampling is expected to confirm contamination at every site where perchlorate is or has been produced, handled or used. [46] So far, nationwide sampling has been spotty and in some states not a single sample has been taken, including many locations where perchlorate contamination is likely. [3] It is therefore possible that there are other regionally or nationally important farming regions unknowingly relying on perchlorate-contaminated water.

Table B. Perchlorate contamination of water or soil is a known or suspected problem in 10 of the 15 top lettuce-growing counties in the U.S.

County	State	Acres of Lettuce Harvested, 1997	Known or Suspected Source of Perchlorate Contamination
Monterey	California	129,259	
Yuma	Arizona	65,470	Colorado River (a)
Imperial	California	25,365	Colorado River (a)
Santa Barbara	California	13,452	Vandenburg Air Force Base (b)
Fresno	California	10,413	Fresno Air National Guard Base (c)
Ventura	California	9,109	Rocketdyne (a); Pt. Mugu Naval Weapons Air Station (a)
San Benito	California	8,394	Whitaker Ordinance (a); FMC (b)
Santa Cruz	California	8,224	
San Luis Obispo	California	6,502	
Riverside	California	5,651	Colorado River (a); Lockheed Martin (a); Wyle Laboratories (a)
Kern	California	4,445	Edwards Air Force Base (a)
Cumberland	New Jersey	1,693	
Cochise	Arizona	1,331	Apache Powder Co. (b)
Merced	California	1,293	
Santa Clara	California	1,264	Olin Corp. (a); United Technologies (a)

(a) Known perchlorate contamination
(b) Known perchlorate user, contamination status unknown
(c) Suspected perchlorate handler, contamination status unknown.

Source: [3], [19], [42]

EWG's Tests Confirm Previous Research

EWG's study was the first to test produce from grocery store shelves. Although the findings are unsettling, they were not unexpected: Previous research on perchlorate uptake by vegetation clearly indicates the potential for widespread contamination of lettuce and other crops.

The first known tests of field-grown vegetables were conducted in 1997 by Lucky Farms of San Bernardino, Calif., after the grower learned that its wells had been polluted with perchlorate from a former Lockheed Martin rocket-testing facility. This plume of Lockheed rocket fuel has polluted dozens of drinking water sources in San Bernardino County, and the five wells on Lucky Farms property have concentrations of perchlorate ranging from 20 to 130 ppb, averaging 40.1 ppb. [4]

Lucky Farms tested eight samples of otherwise unidentified "leafy vegetables" and "vegetable matter." Four samples of "leafy vegetables" averaged 4,490 micrograms of perchlorate per kilogram (ug/kg, which is essentially equivalent to ppb), with a maximum concentration of 6,900 ug/kg. Perchlorate levels in the "vegetable matter" were lower, averaging 213 ug/kg with a high of 420 ug/kg. Overall, the vegetables were found to have an average of more than 2,600 micrograms per kilogram - thousands of times higher than the 1 ppb EPA considers to be safe in a liter of water. [4]

Because we don't know which wells were used to irrigate which Lucky Farms samples, it is difficult to calculate exactly how much each of the tested vegetables concentrated perchlorate, but using average figures for the amount of perchlorate found in the wells and the vegetables, EWG analysis shows that the vegetables concentrated perchlorate by a factor of 65x. This means that perchlorate levels in the vegetables were on average 65 times higher than the levels in the water. This information came from documents that were subpoenaed in a lawsuit against Lockheed Martin by 800 San Bernardino-area residents who say drinking perchlorate-contaminated water caused a variety of illnesses, including thyroid cancer. [4]

Tribes Raised Concerns Earlier

However, as long ago as 1998, Native American tribes, who are among the major producers of Colorado River lettuce, were raising serious questions posed by the recently discovered contamination of the Colorado River. At a public forum in Henderson, Nev., the environmental manager for the Yuma, Ariz., Quechan tribe stated:

"Irrigation is a way of life for our people. We have 13,000 acres dedicated to the production of lettuce. We produce annually eight heads of lettuce for every man, woman and child [in the U.S.]. That food is produced from Colorado River water and 23 million people derive their water supply from the lower Colorado River in three states and two countries. That's how big this problem is." [22]

The tribes urged the government to conduct a study of crops grown with Colorado River water and examine their perchlorate concentration. At an "eco-summit" convened by the EPA in April 1999, this type of "market basket" study was given top priority. [23] The attendees included the Air Force, major perchlorate manufacturers and users (including Lockheed Martin) and five Indian tribes who produce winter vegetables irrigated by the Colorado River. Unfortunately, although the Department of Defense pledged $650,000 to fund this and other studies, and EPA, USDA and the Food and Drug Administration developed an extensive protocol for the study, and neither this nor any other "real world" study was ever conducted. Defense Department representatives later stated that they had postponed the study indefinitely because it was too expensive. [4]

The Defense Department did fund a set of studies on hydroponically-grown greenhouse lettuce seedlings. The first study, conducted in 1999 by the EPA's National Exposure Research Lab, found that "perchlorate was accumulated in the leaves to significant levels" - factors of 100x or more. [24] This extraordinarily high rate of bioaccumulation would mean that lettuce grown in water with even low levels of perchlorate could deliver large doses of the toxin to consumers - doses far higher than the EPA's provisional drinking water standard.

Yet the EPA discounted the results of the 1999 study because the water used was contaminated with concentrations of perchlorate much higher than are typically found in water supplies, the lettuce seedlings were harvested before maturity, and the seedlings were grown in greenhouses rather than typical field conditions. A second, longer greenhouse study was later conducted, but aside from a brief summary that indicates an "accumulation of perchlorate into the green tissue," results have never been made public. [1] In October 2002, at a perchlorate

conference in Ontario, Calif., when a Department of Defense spokesperson was asked publicly when the data would be released, he replied: "Someone walked away with the data." EPA officials have since indicated that they plan to release the results within the next few months. [4]

Perchlorate in Other Plants and in Fertilizer

Additional studies have also pointed to the potential for crop uptake of perchlorate when contaminated fertilizer or irrigation water is used. Several lab studies, for example, have found that a variety of non-crop plants can concentrate perchlorate, with a wide range of concentration factors - from 7.5x to 25x in one study, from 0 to 330x another, and from 30 to 10,000 in yet another. [1, 25-27] Additional studies examining the potential of different kinds of plants to bioremediate contaminated areas also found perchlorate accumulation in vegetation, with some species taking up 95 percent of the perchlorate in the irrigation water. [29-31] All of these studies have found that perchlorate tends to accumulate in the leaves of plants rather than the stems or roots, an important finding for the safety of vegetable crops.

Moreover, recent greenhouse experiments at Texas Tech University have also demonstrated that not only lettuce plants, but other crop plants such as cucumbers, alfalfa and soybeans* can quickly take up and concentrate perchlorate to high levels when grown with contaminated water. [27] These findings, as well as another study which found perchlorate in blackberries growing in a contaminated area in Texas, are particularly important. They indicate that although lettuce has been of greatest concern with regards to perchlorate contamination of food plants, the problem is potentially much larger. [27] [*Perchlorate was found in several parts of the soybean plant, but not in the soybean seeds themselves.]

The recent experiments on crop plants have also yielded several important insights: Nitrogen levels in the soil affected the rate of perchlorate uptake but not the final concentration; plants grown for in sand dosed with perchlorate during both the first and fourth week of growth continued to take up perchlorate during all eight weeks of the experiment; and perchlorate concentrations in vegetation were found to decrease with washing. [27] Further research at Texas Tech is under way to examine how multiple generations of rodents exposed to perchlorate-contaminated food may be affected - including survival and reproduction, thyroid structure and thyroid hormone levels - but no data are yet available. [32]

Studies of perchlorate accumulation are not just limited to controlled laboratory experiments. Researchers have found high levels of perchlorate in plants and animals living in contaminated areas such as the Alleghany Ballistics Laboratory in West Virginia, the Long Horn Army Ammunition Plant in Texas, the McGregor Naval Weapons Industrial Reserve plant in Texas - not far from President Bush's ranch - and the Lake Mead Recreation Site in Nevada. Species with documented perchlorate concentration include blackberries, salt cedar, crabgrass, goldenrod, crickets, as well as fish, mice, rats, raccoons, birds and frogs. [27, 32-35] These field studies have found concentration factors in vegetation ranging from 1.5x to 80x. [1]

High levels of perchlorate have also been found in the leaves of field-grown tobacco plants where Chilean saltpeter, which is used as a nitrogen source and is naturally high in perchlorate, had been added to the soil. [1, 36] The concentration factors in this study exceeded 40x. Chilean saltpeter is preferred by farmers for growing tobacco in many regions, and EPA researchers have found perchlorate in six of seven brands of cigarettes, cigars and chewing tobacco tested. [36, 37] Citrus farmers, at least in some regions of the country, are also known to prefer Chilean saltpeter fertilizer, but so far no studies have been conducted on citrus juice. [1, 32]

Overall, however, contaminated fertilizer is not considered to be a major source for perchlorate in the environment or in food crops. Chilean fertilizer, the only known source of perchlorate in fertilizer, currently makes up only 0.1 percent of the U.S. fertilizer market. [1] Furthermore, the company that distributes Chilean saltpeter has made processing modifications to decrease the concentration of perchlorate in the final product sold. After much study, there is now "a consensus among researchers from the EPA, the fertilizer industry, and other federal and state laboratories that currently used fertilizers are negligible contributors to environmental perchlorate contamination." [1] The studies that have been done on perchlorate uptake from fertilizer are significant, however, because they provide more evidence that plants can take up and concentrate perchlorate - wherever it might be coming from.

EPA: "No Question That Plants Absorb Perchlorate"

In its 2002 report documenting the provisional RfD of 1 ppb in drinking water, EPA reviewed the numerous studies on plant uptake of perchlorate and concluded: "There can be no question that at least some vascular plants absorb perchlorate from their local environments." [1] This is important because the agency's

policy in setting drinking water standards is that, once an RfD is established, "any burden posed by exposure routes other than potable water necessarily requires that the contaminant's concentration in a water supply be lowered by an equivalent amount." [1] In other words, if food is found to contain perchlorate, the drinking water safety standard must be set lower to account for this additional exposure.

Yet despite knowing that the Colorado River is a major source of irrigation water, despite the clear evidence that plants take up and concentrate perchlorate, and despite the lack of data on how much perchlorate might be in U.S. or imported produce, the EPA concluded that "the available information . . . suggests that foods do not contribute to the body burden." [1]

The California EPA's Office of Environmental Health Hazard Assessment (OEHHA), which is working towards a state drinking water standard for perchlorate, did consider perchlorate exposure through food in its March 2002 proposed public health goal (PHG). [38] OEHHA assumed that 60 percent of perchlorate exposure was coming from water and 40 percent was coming from food. Yet under intense pressure from the chemical and defense industries, the state's scientists retreated: In a revised PHG draft released in January 2003, OEHHA assumes that only 20 percent of a pregnant woman's perchlorate exposure comes from food. [39]

Although EWG's tests of grocery store lettuce do not constitute a definitive study and further research is needed, the results clearly show that food is an important exposure pathway for perchlorate. All future drinking water standards must adequately reflect this fact.

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