GLYPHOSATE:
UNSAFE ON ANY PLATE

FOOD TESTING RESULTS AND SCIENTIFIC REASONS FOR CONCERN

REPORT BY **FOOD DEMOCRACY NOW!** AND **THE DETOX PROJECT**

GLYPHOSATE: UNSAFE ON ANY PLATE

ALARMING LEVELS OF MONSANTO'S GLYPHOSATE FOUND IN POPULAR AMERICAN FOODS

"For the first time in the history of the world, every human being is now subjected to contact with dangerous chemicals from the moment of conception until death...These chemicals are now stored in the bodies of the vast majority of human beings, regardless of age. They occur in the mother's milk, and probably in the tissues of the unborn child."[1]

—RACHEL CARSON, *SILENT SPRING*

"Glyphosate was significantly higher in humans [fed] conventional [food] compared with predominantly organic [fed] humans. Also the glyphosate residues in urine were grouped according to the human health status. Chronically ill humans had significantly higher glyphosate residues in urine than healthy humans"[2]

—MONIKA KRUGER, *ENVIRONMENTAL & ANALYTICAL TOXICOLOGY*

"Analysis of individual tissues demonstrated that bone contained the highest concentration of [14C] glyphosate equivalents (0.3–31ppm). The remaining tissues contained glyphosate equivalents at a concentration of between 0.0003 and 11 ppm. In the bone and some highly perfused tissues, levels were statistically higher in males than in females."[3]

—PESTICIDE RESIDUES IN FOOD, *JOINT FAO/WHO MEETING 2004*

1 Rachel Carson, Silent Spring, (Houghton Mifflin, 1961), Elixirs of Death, 15-16.

2 Krüger M, Schledorn P, Schrödl W, Hoppe HW, Lutz W, et al. (2014) Detection of Glyphosate Residues in Animals and Humans. J Environ Anal Toxicol 4: 210

3 Residues in Food, 2004, Evaluations Part II, Toxicological, Joint FAO/WHO Meeting on Pesticide Residues. http://apps.who.int/iris/bitstream/10665/43624/1/9241665203_eng.pdf

CONTENTS

WHAT IS IN THIS REPORT?

Findings: *The first ever independent, FDA-registered laboratory food testing results for glyphosate residues in iconic American food brands finds alarming levels of glyphosate contamination and reveal the inadequacy of current food safety regulations relating to allowable pesticide residues.*

What's at Stake and What the Science Actually Says About Glyphosate Safety

PART I

Executive Summary 1

A Brief History of Glyphosate 2

Why Are We Being Exposed to Increasing Amounts of Glyphosate? 3

- Glyphosate Exposure Has Skyrocketed since Roundup Ready GMO Crops Were Adopted 3

Glyphosate Food Testing Results: (in parts per billion – ppb) 5

The Laboratory 7

Method for Food Testing 7

Where Else Has Glyphosate Been Found? 7

- Glyphosate Residues Found in Food, Urine, Breast Milk, Rainwater, Rivers, Tap Water and Tampons – But FDA Has Never Done Proper Testing 7

Pure Science: Glyphosate Damage by the Numbers (in parts per billion) 8

What Do These Numbers Mean? 9

PART II

Reasons for Concern: Glyphosate Risks to Human Health 10

Where Do Claims of "Safe Levels" Come From? 12

Reasons for Concern: Allowed Levels of Glyphosate Are Unlikely to be Safe 12

What Have U.S. Food Safety Regulators Done to Protect Us? 13

- Obama Administration Raised Glyphosate Residue Levels at Monsanto's Request 13
- Acceptable Daily Intake (ADI) or How Much Pesticide Residue You May Eat in a Day 13
- Changes in Daily Exposure Based on Industry Science, at Monsanto's Request and a History of Scientific Fraud 14
- U.S. Acceptable Daily Intake for Glyphosate Originally Set by EPA at 0.1 ppm 14
- Current Scientific Research Calls for Much Lower Allowable Glyphosate Residues for Human Food Products 15
- Monsanto and EPA Claim Roundup and Glyphosate are Perfectly Safe: Science Says Otherwise 17
- Roundup Formula 125 Times More Toxic than Glyphosate Alone 17

Glyphosate Bio-Accumulates in Major Organs and Bones 17

Peer-Reviewed Science on Glyphosate 18

How To Avoid Glyphosate 21

Call to Action 22

- Demand Immediate Release of Industry Science Data; End of Pre-Harvest Spraying on Wheat, Oats, Barley and other Food Crops 22
- Urgent Need for Fundamental Reforms of Scientific Review Process 22

Media Contacts 22

Executive Summary

A leading FDA-registered food safety testing laboratory has found extremely high levels of the pesticide glyphosate in some of America's most popular food products.

Glyphosate, the active ingredient in Monsanto's Roundup, is the most heavily used chemical weedkiller in food and agricultural production in human history, as a result of the widespread adoption of genetically engineered crops now grown on more than 175 million acres in the United States (U.S.) and more than 440 million acres around the globe.[1]

New scientific evidence shows that probable harm to human health could begin at ultra-low levels of glyphosate e.g. 0.1 parts per billions (ppb). Popular foods tested for glyphosate measured between 289.47 ppb and at levels as high as 1,125.3 ppb.

The testing and analysis was performed by Anresco Laboratories, San Francisco, an FDA registered laboratory that has performed expert food safety testing since 1943. The laboratory found that well-known products tested for glyphosate, Original Cheerios, for example, measured levels as high as 1,125.3 ppb. Other high levels of glyphosate were found in familiar products such as Oreos, Doritos, and Ritz Crackers, among 29 foods tested.

Currently, U.S. regulators allow a very high level of daily glyphosate residue in America's food. The acceptable daily intake (ADI) limit is set at 1.75 milligrams per kilogram of bodyweight per day (written 1.75 mg/kg bw/day) in the U.S., versus a more cautious 0.3 mg/kg bw/day in the European Union. Tolerances have been set through the submission of corporate-sponsored studies and industry influence on the regulatory process.

New research shows that Roundup causes liver and kidney damage in rats as reflected in changes in the functions of 4,000 genes at only 0.05 parts per billion (ppb) glyphosate equivalent indicating damage.[2] Additional studies have found that levels as low as 10 ppb can have toxic effects on the livers of fish[3] and cause significant damage to the livers and kidneys of rats at 700 ppb,[4] which is the allowable level of glyphosate found in U.S. drinking water.[5]

Credible independent, peer-reviewed scientific evidence now shows that the levels of harm to human health could begin at the ultra-low levels of 0.1 parts per billion (ppb) of glyphosate.

These groundbreaking new findings that one of the most iconic cereals in U.S. contains levels as high as 1,125.3 ppb should be a wake-up call for all Americans regarding unacceptable levels of pesticide residues in our nation's food. These findings are especially troubling, considering that the latest independent scientific evidence, during which a team of international scientists re-evaluated the same data previously used by regulators, calls for a much lower ADI to be set at 0.025 mg/ kg of bodyweight per day or "12 times lower than the ADI"[6] currently set in Europe and 70 times lower than the level currently allowed by the EPA in the United States.

It's important for individuals and parents to understand that glyphosate contamination cannot be removed by washing and is not broken down by cooking or baking. Glyphosate residues can remain stable in food for a year or more, even if the foods are frozen or processed.

The testing and analysis was performed at the request of FOOD DEMOCRACY NOW!, in coordination with THE DETOX PROJECT, which gathered additional scientific evidence from around the world and included a compendium of independent research on glyphosate that contains Anresco Laboratory's findings.

Based on this new information, FOOD DEMOCRACY NOW! is calling for a federal investigation into the likely harmful effects of glyphosate on human health and the environment and is also seeking an investigation into the relationships between the regulators and the regulated industries, which has resulted in the public being exposed to levels of glyphosate which scientific studies show can be damaging to human health.

A Brief History of Glyphosate

Glyphosate was Originally Patented to Clean Pipes, Like Drano – 1964

Glyphosate is the presumed active ingredient of Monsanto's Roundup weedkiller and other commercial glyphosate-based herbicide formulations. However, it was first patented in 1964 by Stauffer Chemical Company in Westport, Connecticut as a chelator[7], for **removing unwanted mineral deposits from metal pipes** like Drano.

Monsanto Discovers Weed-killing Properties – 1974

A few years later, glyphosate was also found to be an effective herbicide by Monsanto's John E. Franz[8] and brought to market by the St. Louis-based company in 1974 as a non-selective, water-soluble herbicide with a specific mechanism of action: the directed interruption of plant development through metabolic poisoning.

Today, generic glyphosate formulations are produced by at least 100 manufacturers and can be found in more than 750 products worldwide, with Monsanto still dominating the market with more than $4.75 billion in sales in 2015 alone.[9]

Glyphosate, Nutrients and Disease

As with the original pipe cleaning patent, glyphosate also binds (chelates) vital nutrients such as iron, manganese, zinc, and boron in the soil, preventing plants from taking them up.[10 11 12 13] This could have serious implications for humans, farm animals and pets that consume genetically engineered Roundup Ready crops, as it could negatively affect the nutritional value of food.

GMO soy plants treated with glyphosate have lower levels of essential nutrients and reduced growth, compared with GMO and non-GMO soy controls not treated with glyphosate.[14] Lower nutrient uptake may partly account for the increased susceptibility of GMO soy to disease,[15] as well as its lower yield. Additionally, glyphosate use has been linked to higher levels of soil borne pathogens, like the Fusarium fungus and sudden death syndrome in Roundup Ready GMO soybeans.[16]

A German-Egyptian team of researchers found that all cows tested from Danish dairy farms excreted glyphosate in their urine. Unexpectedly low levels of manganese and cobalt were observed in all animals, which the authors said could be explained due to the strong metal chelating effect of glyphosate. Potential signs of liver and kidney toxicity were also found in the cows, which the authors noted were consistent with the findings of rodent feeding studies with GMO glyphosate-tolerant plants.[17]

Monsanto Receives Antimicrobial Patent – 2010

In addition to mineral chelation and herbicidal modes of action or treatment, in 2003, Monsanto applied for a patent regarding the potential antibiotic or antimicrobial activity of glyphosate. The patent, finally awarded in 2010,[18] has led to renewed concern from scientists that low levels of glyphosate could have an antimicrobial effect and negative impact on human health. Emerging scientific evidence suggests that glyphosate can alter human and animal intestinal flora and may lead to a harmful imbalance in the stomach's microbiome, thus causing a decrease in beneficial gut bacteria and a rise in more toxic or harmful bacteria like it does in the soil.

Why Are We Being Exposed to Increasing Amounts of Glyphosate?

Glyphosate Exposure Has Skyrocketed since Roundup Ready GMO Crops Were Adopted

Glyphosate (N-phosphonomethylglycine) is the most heavily used chemical weedkiller in food and agricultural production in human history. Since glyphosate-based herbicides were first introduced in 1974, glyphosate use has skyrocketed more than 300-fold, leading to more than 3.5 billion pounds being sold in the United States during this time. In the past decade alone, more than 2.4 billion pounds have been applied to farmers' fields - or 67% of all glyphosate ever sold in the U.S - as a result of the widespread adoption of genetically engineered crops.[19]

As the main active ingredient in Monsanto's bestselling herbicide Roundup, each year more than 300 million pounds of glyphosate-based herbicides are sprayed on food crops, lawns and home gardens across the country.[20]

In the past 20 years, there's been a massive increase in glyphosate use directly linked to the introduction of Monsanto's Roundup Ready genetically engineered crops[21], such as GMO corn, soybeans, cotton, sugar beets and canola plants that have been specifically manipulated to survive being sprayed with glyphosate-based herbicides.[22]

According to U.S. Department of Agriculture (USDA) data, 93% of all soybeans and 89% corn and cotton planted by farmers in the U.S. are genetically engineered to be Roundup Ready or glyphosate tolerant.[23]

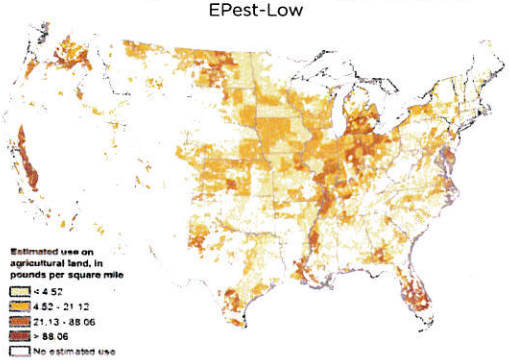
In one form or another, whether as refined sugars such a high fructose corn syrup or beet sugar, oils, vitamins or binding agents, ingredients from these genetically engineered plants are included in 75 to 80% of the processed foods sold in grocery stores across the country. Along with the increased exposure risks due to Roundup's use as a pre-harvest drying agent in wheat, oats, barley and other crops, Americans now face a continual exposure to glyphosate residues in our most popular foods.

Today the levels of Roundup and other glyphosate-based herbicides used by American farmers are so high that the U.S. Geological Survey (USGS) has found glyphosate in more than 75 percent of rain and rainwater samples across the Midwest.[24] This means that when farmers spray Roundup on their crops, the chemicals not only run off into local rivers and streams, but glyphosate also evaporates into the air, into local cloud cover, where it can then rain on communities downwind even hundreds of miles from the original source of application.

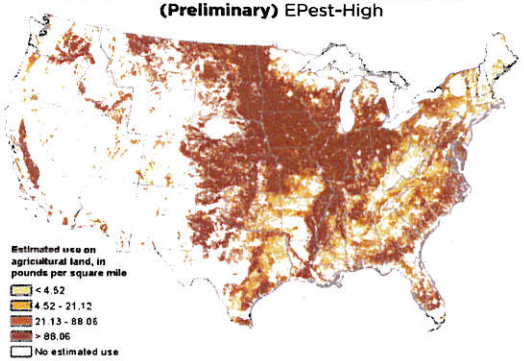
Overall, researchers at the USGS detected glyphosate in 60 to 100% of both the air and rain samples collected in Iowa, Mississippi and Indiana. When glyphosate is sprayed on farmers' fields it moves widely into the environment and further downstream from where the chemical was intended for agricultural use.[25]

The USGS estimates glyphosate accounted for 53.5% of total agricultural herbicide use in 2009.[26] Each year, due to the increasing growth of weeds resistant to glyphosate-based herbicides, farmers are forced to spray more toxic weedkillers on their fields to combat newly evolving superweeds. Today, more than 80 million acres of U.S. farmland are covered with glyphosate-resistant superweeds. Now, with the approval new GMO crops designed to be resistant to additional herbicides like 2,4-D and dicamba, consumers will be exposed to more toxic combinations of persistent pesticide residues in their food.[27]

Estimated Agricultural Use for Glyphosate, 1992
EPest-Low



Estimated Agricultural Use for Glyphosate, 2014 (Preliminary) EPest-High



In addition to finding high levels of glyphosate in tested food products, a small number of the foods tested by Anresco Laboratories were also contaminated with aminomethylphosphonic acid (AMPA), a metabolite of glyphosate, which is considered a weak organic acid with a phosphonic acid group and is one of the primary degradation products of glyphosate. Regulators claim that gylphosate and AMPA have similar toxicological profiles, but more research is needed to confirm AMPA's potential toxic impacts.

With an increasingly steady diet of processed foods, the American public is being primed for massive and previously unanticipated pesticide residue levels in our food, which will only continue to go up with the continued adoption and USDA approval of new herbicide-tolerant GMO crops.

In addition to on-farm use, Roundup and glyphosate-based herbicides are also sprayed widely in parks, public spaces, lawns, home gardens, on roadsides, in forestry management, and used as a pre-harvest drying agent on certain food crops, including oats, wheat, barley and edible dry beans.[28]

With the widespread increase in glyphosate use over the past 20 years and the fact that independent science has confirmed low level exposure to Roundup causes liver and kidney damage at only 0.05 ppb glyphosate equivalent, as reflected by changes in function of over 4000 genes, the American public should be concerned about glyphosate residues on their food. Additional research points to harmful impacts at levels between 10 ppb and 700 ppb. Considering these shocking new scientific test results, regulators must take the below findings into account during any re-authorization of glyphosate.

Glyphosate Food Testing Results: (in parts per billion – ppb)

Full laboratory reports for this food testing can be found here. A searchable database of results can be found here.

General Mills		
Cheerios	Original Cheerios	Glyphosate - 1,125.3 ppb AMPA – 26.4
Honey Nut Cheerios	Honey Nut Cheerios	Glyphosate – 670.2 ppb AMPA – 14.5
WHEATIES	Wheaties	Glyphosate – 31.2 ppb
Trix	Trix	Glyphosate - 9.9 ppb
Annie's	Gluten Free Bunny Cookies Cocoa & Vanilla	Glyphosate – 55.13* ppb
Kellogg's		
Kellogg's CORN FLAKES	Corn Flakes	Glyphosate – 78.9 ppb
Kellogg's Raisin Bran	Raisin Bran	Glyphosate – 82.9 ppb
Kashi	Organic Promise**	Glyphosate - 24.9 ppb
Kellogg's Special K	Special K	Glyphosate - 74.6 ppb
Kellogg's FROSTED FLAKES	Frosted Flakes	Glyphosate - 72.8 ppb
CHEEZ-IT	Cheez-It (Original)	Glyphosate – 24.6 ppb
CHEEZ-IT	Cheez-It (Whole Grain)	Glyphosate – 36.25* ppb
Kashi	Soft-Baked Cookies, Oatmeal Dark Chocolate	Glyphosate – 275.58* ppb
Nabisco		
RITZ	Ritz Crackers	Glyphosate – 270.24 ppb
Triscuit	Triscuit	Glyphosate – 89.68 ppb
OREO	Oreo Original	Glyphosate – 289.47* ppb

Nabisco (continued)		
	Oreo Double Stuf Chocolate Sandwich Cookies	**Glyphosate – 140.90* ppb**
	Oreo Double Stuf Golden Sandwich Cookies	**Glyphosate – 215.40* ppb**
PepsiCo		
	Stacy's Simply Naked Pita Chips (Frito-Lay)	**Glyphosate – 812.53 ppb**
	Lay's: Kettle Cooked Original	**Glyphosate – 452.71* ppb**
	Doritos: Cool Ranch	**Glyphosate – 481.27* ppb**
	Fritos (Original) (100% Whole Grain)	**Glyphosate - 174.71* ppb**
Campbell Soup Company		
	Goldfish crackers original (Pepperidge Farm)	**Glyphosate – 18.40 ppb**
	Goldfish crackers colors	**Glyphosate – 8.02 ppb**
	Goldfish crackers Whole Grain	**Glyphosate – 24.58 ppb**
Little Debbie		
	Oatmeal Creme Pies	**Glyphosate – 264.28* ppb**
Lucy's		
	Oatmeal Cookies Gluten Free	**Glyphosate – 452.44* ppb**
Whole Foods		
	365 Organic Golden Round Crackers**	**Glyphosate – 119.12* ppb**
Back to Nature		
	Crispy Cheddar Crackers	**Glyphosate – 327.22* ppb**

Limit of Quantitation: 5 ppb

*These samples exhibit very low recovery and/or response. The above amounts found are rough estimates at best and may not represent an accurate representation of the sample.

** Widespread contamination in food supply — even organic farmers are having their crops/ our food contaminated.

The Laboratory

Anresco Laboratories was founded by Dr. Sylvan Eisenberg in 1943, with the goal of ensuring food quality. Their food safety analyses span a variety of areas, including Pesticides, Microbiology and Nutritional Labeling. Since 1980, Anresco has been focused on pesticide and herbicide testing. They perform routine testing on imported samples detained by the FDA, samples to be exported, as well as domestic samples for many major US companies. In addition to foods, they have also tested herbal products, water and soil.

LC/MS/MS is the method used for testing for glyphosate levels in food products. LC/MS/MS stands for liquid chromatography tandem mass spectrometry (LC-MS/MS), which "has been well recognized by regulators and scientists worldwide as the "gold standard" for both quantification and semi-quantitative screening of food contaminants, such as pesticide residues." [29]

Their instrumentation includes Gas Chromatography (GC-FID, GC-FPD, GC-TSD, GC-ECD, GCMS, GCMSMS) and Liquid Chromatography (LC-FD, LC-UV, LC-RID, LC-MSMS).

The laboratory is an independent, ISO-17025 accredited, FDA-registered private laboratory headquartered in San Francisco, U.S.A.

Anresco Laboratories Co-laboratory Director Vu Lam says, "We use LC/MS/MS to detect Glyphosate and AMPA. With our modifications to various methods, we are able to detect many levels of contaminants in food products at levels as low as 5 ppb, and even lower."

Method for Food Testing

The sample is extracted using water and methanol. Extract is further cleaned and concentrated on an ion-exchange column. The extract is then derivatized using 9-fluorenylmethylchloroformate and filtered prior to LC-MS/MS analysis.

Derivatized glyphosate and its metabolite AMPA are injected onto the LC-MS/MS and separated using a C18 column with a gradient elution of ammonium acetate buffer and acetonitrile as mobile phases. Ionization is achieved using an electrospray ionization source operating in negative mode. Analytes are detected using multiple reaction monitoring with isotopically-labeled analytes as internal standards. This method allows detection and quantification down to 2 ng/g (ppb) for food and soil samples with recoveries between 70-90%.

LC/MS/MS testing is the best method currently available for glyphosate testing in food, soils, urine and water – please see more information on this here.[30] Other methods that do not use mass spectrometry are not recognized by regulators worldwide.

Anca-Maria Tugulea, a chemist in the Exposure and Biomonitoring Division of Health Canada stated:

> *"ELISA has high false positive and false negative results.... It is usually used as a screening tool and any positive results will have to be confirmed by a chromatographic (e.g. LC/MS/MS) method to be usable in risk assessment."* [31]

Where Else Has Glyphosate Been Found?

Glyphosate Residues Found in Food, Urine, Breast Milk, Rainwater, Rivers, Tap Water and Tampons – But the FDA Has Never Conducted Proper Widespread Testing

While the U.S. government has never released proper glyphosate residue tests on popular American food products to the public before, this past year on February 17, 2016, the FDA announced that it would finally begin testing glyphosate residues in certain food products "for Fiscal Year 2016 to measure glyphosate in soybeans, corn, milk, and eggs, among other potential foods."[32]

Because glyphosate is absorbed into the plant's cellular structure in order to kill weeds or unwanted plants, the chemical cannot be removed from GMO crops and other plants by washing, peeling, baking or brewing grains. In recent years, a growing number of studies have found glyphosate in common foods, human urine,[33] breast milk,[34] beer[35], 85% of tampons[36] and even a group of elected officials in Germany at alarming levels.[37]

Despite the increased exposure to the American public and citizens around the world, inadequate regulatory testing exists on glyphosate residues in common food products.

According to a U.K. Food Standard Agency test conducted in October 2012, glyphosate residues were found in 27 of 109 samples of bread sold in England at .2 ppm (parts per million).[38] While

limited testing conducted by the USDA in 2011 found glyphosate residues on 90.3% of 300 soybean samples tested and 95.7% of AMPA, a metabolite of glyphosate, at concentrations of 1.9 ppm and 2.3 ppm respectively.[39]

Pure Science: Glyphosate Damage by the Numbers (in parts per billion):

While regulators at the EPA determined in the 1990s that 1.75 mg per kilogram of bodyweight per day is the safe allowable daily intake level in the U.S., the EPA's own website lists glyphosate under "Regulated Drinking Water Contaminants." The EPA warns people that long-term exposure to glyphosate at only 700 ppb can cause "problems with their kidneys or reproductive difficulties" and states that drinking water exposure exists due to "Runoff from herbicide use."[40]

Glyphosate/Roundup Damage by the Numbers (ppb)

0.1 ppb: Roundup (0.05 ppb glyphosate) altered the gene function of over 4,000 genes in the livers and kidneys of rats.[41]

0.1 ppb: Roundup (0.05 ppb glyphosate) severe organ damage in rats.[42]

0.1 ppb: Permitted level for glyphosate and all other herbicides in EU tap water.[43]

10 ppb: Toxic effects on the livers of fish.

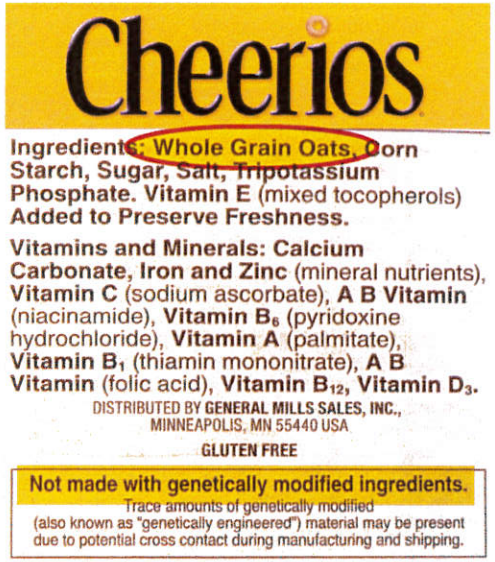
700 ppb: Alterations of kidneys and livers in rats.[44]

700 ppb: Permitted level for glyphosate in U.S. tap water.[45]

1,125.3 ppb (1.1253 mg/kg): Level found in General Mills' Cheerios.

Unfortunately, as a result of the combination of exposures through drinking water and a regular diet of processed food, total exposure is much greater than industry scientists and U.S. regulators ever anticipated. **With this new information, it's time for the EPA to dramatically reduce the acceptable daily intake level of glyphosate and ban the practice of pre-harvest spraying of all food crops, especially wheat, oats and barley, immediately.**

Alarming Levels of Glyphosate Found Due to Pre-Harvest Spraying



Non-GMO Cheerios (Yellow box) **1,125.3 ppb**

INGREDIENTS: Enriched Wheat Flour (Wheat Flour, Niacin, Reduced Iron, Thiamin Mononitrate, Riboflavin, Folic Acid), Sunflower Oil and/or Canola Oil, Sea Salt, Whole Wheat Flour, and Less than 2% of the Following: Organic Cane Sugar, Oat Fiber, Yeast, Malted Barley Flour, Rosemary Extract (Antioxidant), and Ascorbic Acid (Antioxidant).

CONTAINS WHEAT INGREDIENTS.

Stacy's Pita Chips (Simply Naked) **812.53 ppb**

NON GMO Project VERIFIED **Less Than 0.9% GMO, But Contains Glyphosate**

What Do These Numbers Mean?

To understand what the above numbers mean to the average consumer, consider the fact that the acceptable daily intake (ADI) level is currently set at 1.75 milligrams per kilogram of bodyweight per day by the EPA. This means that over the course of a day, an individual would have to combine all the residue levels found on their meals and snacks and consistently be below this supposedly "safe" level.

According to the old theory "the dose makes the poison", any individual whose daily exposure is at or below this level over the course of their lifetime should not have any negative health impacts. The current ADI level was determined using industry funded studies from the 1970s, and 1980s and according to the latest advances in scientific research is woefully out of date.

Harmful Effects of Chemicals at Low Levels and the Flawed Logic Behind "the Dose Makes the Poison"

Revelations from the latest scientific research finds that chemicals can have damaging effects at very low levels. In fact, since Roundup and glyphosate were originally approved and declared "safe", a whole new body of research finds that chemicals with endocrine (or hormone) disrupting capabilities, turns the "dose makes the poison" logic on its head, finding that low level doses or exposures to certain chemicals can have much larger negative impacts on health and human development than previously understood.

For more than two decades, research has shown that low level exposures to certain chemicals, at levels previously considered safe, can alter the release and reception of vital hormones in the body.

Significant scientific evidence points to the fact that low levels exposure to endocrine disrupting chemicals can cause reproductive problems, reduced fertility, miscarriage and that changes in hormone levels can result in the early onset of puberty, obesity, diabetes, behavioral problems, including attention deficit/hyperactivity disorder (ADHD), impaired immune function and certain types of cancers.[†]

And today, while glyphosate has not been definitively declared an endocrine disruptor (or hormone hacker), new and emerging evidence suggests that it may be and independent scientists are finding an increasing number of significant harms from glyphosate at very low levels previously declared "safe" by the EPA.

Our current regulatory system relies on outdated notions of risk and exposure by relying on safety assessments that only call for high-dose exposure studies, which are used to determine "safe" exposure levels. With the emergence of science proving endocrine disrupting chemicals are pervasive in our food and environment, critics of the current system signed a consensus statement that "The very low-dose effects of endocrine disruptors cannot be predicted from high-dose studies, which contradicts the standard 'dose makes the poison' rule of toxicology."[‡]

Real World Glyphosate Exposure at Detected Levels

To calculate real world exposure levels from glyphosate contamination in our food, consider the Cheerios' results, since they're the highest and are also regularly consumed by children, a chemically vulnerable population.

For a 1-year old child, at roughly 20 pounds (9 kg), General Mills recommends a serving size of 16 grams or .56 ounces.

Based on OLD SCIENCE: Acceptable Daily Intake (ADI) set by government regulators: 1.75 milligrams / kilogram of bodyweight / per day (1.75 mg / kg bw / day)

Daily Intake from Cheerios (DI) based on 1 serving of 16 grams containing 0.018 mg glyphosate equals 0.002 mg /kg bw/day for a 20lb (9kg) child.

So, for a 20-pound child:

NEW SCIENCE says that harm may happen when you eat glyphosate at ONLY 0.001 mg/kg bw/day (**1,750 times LOWER than what the EPA at the moment says is safe.**) So, New Science shows that a 20lb (9kg) child can ONLY safely eat 0.001 mg x 9kg = **0.009mg glyphosate in a day**.

Thus, ingesting a recommended serving of Cheerios (16 grams or .56 ounces) for a 20-pound (9kg) child means exposure to **0.018 mg of glyphosate per day** from Cheerios alone. This is nearly double the level that is potentially harmful to human health and it is important to note that a 1-year old child is likely to be exposed to many other sources of glyphosate on a daily basis.

† Fürst P (October 2006). "Dioxins, polychlorinated biphenyls and other organohalogen compounds in human milk. Levels, correlations, trends and exposure through breastfeeding". Mol Nutr Food Res. 50 (10): 922–33. doi:10.1002/mnfr.200600008. PMID 17009213.

‡ Collaborative on Health; the Environment's Learning; Developmental Disabilities Initiative (2008-07-01). "Scientific Consensus Statement on Environmental Agents Associated with Neurodevelopmental Disorders", Institute for Children's Environmental Health. Retrieved 2009-03-14.

Part II

Reasons for Concern: Glyphosate Risks to Human Health

1. Cancer

Despite repeated claims from Monsanto that glyphosate is perfectly safe, even "safer than table salt," an increasing number of independent peer-reviewed studies are finding troubling links to a growing number of diseases in humans, including cancer.

In March 2015, leading cancer experts from the World Health Organization's International Agency for Research on Cancer (IARC) declared that glyphosate is a "probable human carcinogen." IARC reached its decision based on the research of 17 top cancer experts from 11 countries, who met to assess the carcinogenicity of 5 pesticides. The IARC review of glyphosate has led to the European Parliament calling for a complete ban on non-commercial public use of glyphosate and serious restrictions on agricultural use.[46]

Already, multiple class action lawsuits[47] and a wrongful death lawsuit[48] have been filed in the U.S. against Monsanto, based on the finding that glyphosate is a probable cancer-causing agent used with regularity by farmers, farm workers, pesticide applicators and others exposed to the chemical through routine use. There are specific concerns[49] over the following cancers:

- Non-Hodgkin's Lymphoma
- Bone Cancer
- Colon Cancer
- Kidney Cancer
- Liver Cancer
- Melanoma
- Pancreatic Cancer
- Thyroid Cancer

For More Information on Glyphosate and Cancer: http://detoxproject.org/glyphosate/cancer/

2. Endocrine Disruption and Hormone Hacking Capabilities

A growing body of peer-reviewed scientific evidence shows that glyphosate also acts as an endocrine disruptor at levels that the human population is routinely exposed to in America through the consumption of unlabeled GMO foods and foods that have been sprayed with glyphosate as a pre-harvest drying agent.

Incredibly, the potential harm to human reproductive capability as a of result glyphosate's toxicity has never been studied by regulators or the chemical industry at levels that the human population in the U.S. is being exposed to (under 3 mg/kg body weight/day) on a daily basis. **This is a huge hole in the global risk assessment of glyphosate,** as there is evidence suggesting that low levels of some chemicals may hack hormones more than at mid and high levels, according to independent science – in other words, a higher dose does not necessarily make a more toxic, hormone disruptive effect.

A study from March 2015 stated that the health costs to the European Union of just some endocrine disrupting hormone-hacking chemicals, in connection with a subset of illnesses known to be linked to hormone interference, is over €150 billion (Euros) per year.[50] The study stated that lower IQ, adult obesity and 5% or more of autism cases are all linked to exposure to endocrine disruptors.

For More Information on Glyphosate and Endocrine Disruption or Hormone Hacking: http://detoxproject.org/glyphosate/hormone-hacking/

3. Binding of vital nutrients

Glyphosate binds (chelates) vital nutrients[51] such as iron, manganese, zinc, and boron in the soil, preventing plants from taking them up, which could mean loss of basic minerals and nutrients in food crops and soil as a result. This has implications for humans, livestock and pets that eat glyphosate-tolerant GMO crops, as it affects nutritional value.

For More Information on How Glyphosate Binds with Vital Nutrients: http://detoxproject.org/glyphosate/glyphosate-chelating-agent/

4. Antibiotic or Biocidal Properties Cause Concern

Glyphosate is also patented as an antibiotic or biocide, meaning that beyond its use as an herbicide to kill weeds it in most likelihood has a significant harmful effect on humans and farm animals by killing beneficial microorganisms in the gut. In 2010 Monsanto was awarded a patent by the U.S. patent office, which it originally applied for in 2003, in order to use glyphosate to kill "protozoan parasites." In their patent application Monsanto is very clear about the chemical's ability to kill parasites.

From Monsanto's U.S. Patent #7,771,736 Glyphosate formulations and their use for the inhibition of 5-enolpyruvylshikimate-3-phosphate synthase:

> *"Importantly, the growth of these parasites can be inhibited by the herbicide glyphosate, suggesting that the shikimate pathway will make a good target for the development of new anti-*

parasite agents. The present invention discloses the use of the herbicidal agent glyphosate in combination with the polyvalent anion oxalic acid for the prevention and therapy of these pathogenic infections."

While Monsanto continues to deny any possible harmful health impacts, new research points to growing concerns from independent scientists and medical professionals regarding glyphosate's likely antimicrobial effects on human and animal health. Evidence suggests that glyphosate can alter the balance of the gastrointestinal microbiome, or beneficial gut bacteria, and create a harmful imbalance in human and animal gut flora while increasing pathogenic species that can lead to multiple negative health outcomes, including gluten-intolerance and irritable bowel syndrome.

In the first such research in the world, a team from the University of Canterbury in New Zealand found in 2015 that commonly used herbicides, including Roundup (glyphosate-based), can cause bacteria to become resistant to antibiotics.[52]

Not surprisingly, this study was picked up by U.S. cardiologist Dr. William Davies, *the New York Times* bestselling author of Wheat Belly, which details the alarming rise in gluten sensitivity and intolerance in the American public, who noted the study's details on his website:

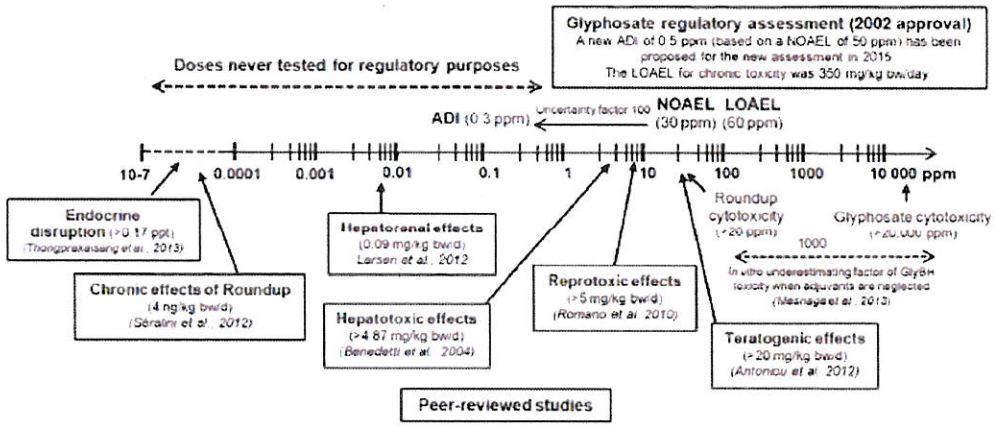
"Animal model data demonstrates that glyphosate selectively kills beneficial bacteria, such as Enterococcus faecalis, Enterococcus faecium, Bacillus badius, Bifidobacterium adolescentis and Lactobacillus species, while allowing the proliferation of undesirable, even disease-causing, species such as Salmonella enteritidis, Salmonella gallinarum, Salmonella typhimurium, Clostridium perfringens and Clostridium botulinum." [53]

In 2012, a team of German scientists investigated the rise in botulism disease in cattle in the past 10–15 years found that glyphosate and Roundup were toxic to beneficial gut bacteria that inhibit the growth of the botulism-causing bacterium Clostridium botulinum, but non-toxic to the botulism-causing bacteria themselves. In short, glyphosate and Roundup favored the growth of botulism-causing Clostridium botulinum bacteria. The authors concluded that ingestion of Roundup residues in cattle feed could predispose cattle to falling ill with botulism.[54]

In a separate in vitro study on strains of bacteria found in the gut of poultry, most of the pathogenic bacteria tested were highly resistant to Roundup, but most of the beneficial gut bacteria tested were found to be moderately to highly susceptible. The researchers documented the antibiotic damage done to beneficial bacteria in the gut by very low concentrations of Roundup, which allowed the overgrowth of serious pathogens such as Clostridium botulinum, Salmonella spp, and E. coli. These would otherwise be kept in check by the beneficial bacteria that were wiped out by the Roundup residues in feed.[55]

The authors concluded that the ingestion of Roundup-contaminated feed could be a significant factor predisposing poultry to diseases caused by Clostridium botulinum. It could also explain the now widespread contamination of poultry products with pathogenic Salmonella and E. coli strains of bacteria, which can make human consumers ill.

Peer-Reviewed Studies on Low Doses of Glyphosate / Roundup



Source: Mesnage, 2015 http://dx.doi.org/10.1016/j.fct.2015.08.012

Antibiotic resistance is a serious and growing problem for human and animal health. New antibiotics are hard to find and can take decades to become available.

Further studies are now needed to see how glyphosate affects the gut microbiome in humans and to see if glyphosate at the actual doses ingested is a cause of antibiotic resistance in humans.

Where Do Claims of "Safe" Glyphosate Levels Come From?

Industry and regulators have often claimed that harmful effects caused by glyphosate and Roundup in animal studies do not matter because the public is only exposed to "safe" levels that do not cause such effects.

Currently, regulators in the U.S. and Europe only set safety limits for exposure to glyphosate based on data from industry's own toxicity studies on laboratory animals. The results of these industry tests, which are conveniently classified as commercial secrets and kept hidden from the public and the independent scientific community, are presented to expert panels in government or food safety agencies based in various countries or regions.

Unfortunately, the U.S. EPA and the European Food Safety Authority (EFSA) refuse to release the list of all the chemical ingredients used in the most common pesticide mixes, once again siding with industry lobbyists and hiding these toxic chemicals from the American public, all in the name of "trade secrets."

Reasons for Concern: Allowed Levels of Glyphosate Are Unlikely to be Safe

There are several reasons to doubt the validity of the current Acceptable Daily Intake (ADI) levels for glyphosate, including:

- The so-called safe levels of glyphosate exposure have never been tested directly to determine if indeed they are really safe to consume over the long term. Instead the "safe" levels are extrapolated from higher doses tested in industry studies.
- Industry toxicity study protocols are massively out of date. All toxicity tests conducted by industry for regulatory purposes are based on the old adage, "The dose makes the poison," – that is, the higher the dose, the greater the degree of toxicity. **However, in some cases, low doses corresponding to human exposures can be more toxic than the higher doses tested in laboratory animals in industry studies.** This is especially true for chemicals that disrupt the hormonal system (endocrine disruptors).[56]
- Safe levels of these endocrine disrupting chemicals cannot be extrapolated from effects at higher doses. Evidence from in vitro[57] and animal[58] experiments shows that **glyphosate may be an endocrine disruptor at levels permitted in tap water in the EU and the U.S**.
- Findings that glyphosate and its commercial formulations may be endocrine disruptors imply that the standard industry long-term animal studies are seriously inadequate.
- Hormones are vital regulators of fetal development. A subtle hormonal effect during early life can modify organ morphology and function for the rest of the life, as well as potentially leading to chronic diseases such as cancer and neurological and reproductive dysfunction in adults[59].
- Even worse, the complete glyphosate herbicide formulations as sold and used contain additives (adjuvants), which are more harmful in their own right and/or increase the toxicity of glyphosate.[60] Safety limits are set for the isolated ingredient glyphosate, but the whole formulations, which can be generally more toxic, are never tested to determine long-term effects. This limitation of the regulatory process applies to all pesticides in all countries worldwide. Studies in rats confirm that the complete glyphosate herbicide formulations are toxic at levels deemed by regulators to be safe or have no adverse effect for the isolated ingredient glyphosate.[61 62 63] Other feeding studies in pigs[64] and rats[65] directly comparing the toxicity of formulations with glyphosate alone found that the formulations were far more toxic.
- Industry tests on glyphosate alone revealed toxic effects, notably birth defects[66 67], below the levels that regulators claimed showed no toxic effect – but these results were ignored or dismissed by regulators in setting the supposedly safe ADI.[68]
- Independent studies have found toxic effects of glyphosate and its commercial formulations at environmentally realistic levels, which have never been tested by regulators. Effects include oxidative stress on liver and kidneys[69] and endocrine disrupting effects.[70]
- Glyphosate, which was claimed to be "as safe as table salt"[71] by Monsanto for over 40 years, was classified as a probable human

carcinogen by the World Health Organization in 2015. **Glyphosate has never been tested during sensitive periods of life (such as fetal development) at environmentally relevant levels of exposure.** In addition, the fact that Monsanto's commercial formulations have never been tested for regulatory purposes for more than one month in rats, and that without any blood testing, raises further doubt as to the validity of current ADI values.

These findings, taken as a whole, suggest that the levels of Roundup or glyphosate the American public are exposed to are not safe over the long term.

What Have U.S. Food Safety Regulators Done to Protect Us?

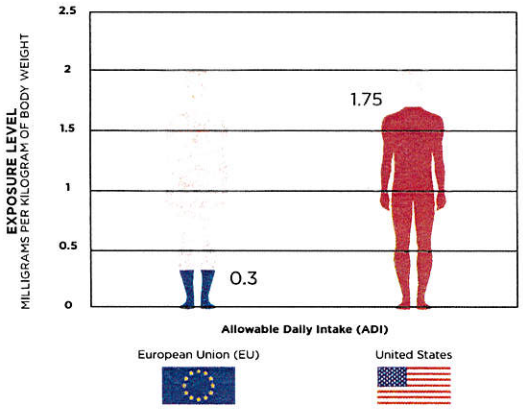
Obama Administration Raised Glyphosate Food Residue Levels at Monsanto's Request

Rather than call for increased oversight and monitoring of glyphosate in popular American foods, in 2013, the U.S. Environmental Protection Agency, under the direction of the Obama administration, actually increased the allowed tolerance pesticide exposure levels on glyphosate residues based on a petition to the agency submitted by Monsanto.[72 73 74]

These latest increases in glyphosate food residues in the U.S. raised allowable levels in oilseed crops, which include sesame, flax, and soybean, from 20 parts per million (ppm), to 40 ppm.

Under the Obama administration, the EPA also increased allowable glyphosate contamination levels for sweet potatoes and carrots from 0.2 ppm to 3 ppm for sweet potatoes and 5 ppm for carrots. That's 15 and 25 times the previous levels, respectively. [75]

U.S. Government Allows Nearly 6 Times More Glyphosate in Our Food than Europe



An independent, peer-reviewed study conducted in 2014 on Roundup Ready soybeans found "extreme levels" of glyphosate residue in 7 out of the 10 GMO soy samples tested when compared to organic and conventionally raised soybeans.[76 77]

If these facts weren't troubling enough, recent testing commissioned by the Organic Consumers Association in coordination with The Detox Project at the University of California San Francisco (UCSF), **found glyphosate in 93% of Americans tested** at an average level of 3.096 parts per billion (ppb). Children had the highest levels with an average of 3.586 ppb.[78 79]

Acceptable Daily Intake (ADI) or How Much Pesticide Residue You May Eat Every Day

Real concerns about glyphosate residue levels are growing in the U.S. and around the world, not only due to Monsanto's long-standing reputation for producing toxic chemicals that cause severe harm to human health and the environment, e.g. Agent Orange, DDT and PCBs, but also because of the persistence of glyphosate in food crops, which this study helps to confirm.

A 2014 study found that high levels of glyphosate exposure in animals and humans were correlated with an increase in chronic illness. The authors discovered that:

> *"Glyphosate residues in urine were grouped according to the human health status. Chronically ill humans had significantly higher glyphosate residues in urine than healthy humans."*[80]

In order to limit threats to human health, federal regulatory agencies set limits on acceptable exposures based on a safety threshold, also called the Acceptable Daily Intake (ADI).[81] To assess whether or not an exposure is a health risk, the ADI or safety threshold for a given chemical is an estimate of the amount of a substance in food or drinking water, expressed on a body mass basis, that can be ingested daily over a lifetime by humans without appreciable health risks.

This calculation of Allowable Daily Intake for pesticide residues is based on the lowest dose considered non-toxic in animal feeding trials (i.e. 30mg/kg bw/d) sponsored by industry.

Accordingly, based on Monsanto's own private lab testing and consulting with scientists at different regulatory agencies around the world, the ADI value for glyphosate differs from country to country.