

# Potential Health Effects of Chemical Controls for *Phragmites Australis*

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## *GBH- Glyphosate- Based Herbicides*

**Glyphosate** is a non-selective herbicide, which inhibits amino acid biosynthetic pathways, necessary for plant growth.

**1961:** First patent for Glyphosate-based herbicide.

**1987:** Glyphosate was registered in the U.S. (Roundup); Currently owned by Monsanto Corp.

**1987:** ~6- 8 million pounds (~2.72–3.62 million kilograms) were applied by U.S. farmers and ranchers

**1996:** First year genetically engineered (GE), glyphosate-tolerant crops were planted commercially in the U.S., **glyphosate accounted for just 3.8% of the total herbicide applied in agriculture**

**2007:** ~180–185 million pounds (~81.6–83.9 million kilograms)(~50% of all herbicides)

**2014:** 240 million pounds (~108.8 million kilograms)

American Chemical Abstracts Service SciFinder: 17,000 papers have been written about the chemical itself over the period of its use since patent of 1961.



# DNA Damage and Methylation Induced by Glyphosate in Human Peripheral Blood Mononuclear Cells (in Vitro Study)

*Food and Chemical Toxicology, Volume 105, 2017*

Findings:

- Glyphosate induced DNA lesions, which were effectively repaired.
- PBMCs (leucocytes) were unable to repair completely DNA damage induced by glyphosate.

**Summary: “To sum up, we have shown... that glyphosate (at high concentrations from 0.5 to 10 mM) may induce DNA damage in leucocytes and cause DNA methylation in human cells.”**



# Differential Effects of Glyphosate and Roundup on Human Placental Cells and Aromatase

*Environmental Health Perspectives, Volume 113, June 2005*

## Findings:

- Glyphosate is **toxic to human placental JEG3 cells** within 18 hrs with concentrations lower than those found with agricultural use
- **Effect increases with concentration and time or in the presence of Roundup adjuvants.** Roundup is always more toxic than its active ingredient.
- **Disrupts aromatase activity** (synthesis of estrogen) and mRNA levels (transfer of DNA to proteins)

**Conclusion: Endocrine and toxic effects of Roundup, not just glyphosate, can be observed in placental cells of humans at low levels of exposure. Suggest that the presence of Roundup adjuvants enhances glyphosate bioavailability and/or bioaccumulation.**

## **Glyphosate Induces Human Breast Cancer Cells Growth via Estrogen Receptors**

*Food and Chemical Toxicology, Volume 59, September 2013*

- **Glyphosate exerted proliferative effects only in human hormone-dependent breast cancer (estrogen receptive), T47D cells, but not in hormone-independent breast cancer**
- **Glyphosate also altered both ER $\alpha$  and  $\beta$  expression. These results indicated that low and environmentally relevant concentrations of glyphosate possesses estrogenic activity.**



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# **Glyphosate Biomonitoring for Farmers and Their Families: Results from the Farm Family Exposure Study**

**Environ Health Perspect 112:321–326 (2004)**

**-Sixty percent of farmers had detectable levels of glyphosate in their urine on the day of application (GM 3ppb, max 233 ppb).**

**-Farmers who did not use rubber gloves had higher GM urinary concentrations than did other farmers (10 ppb vs. 2.0 ppb).**

**-For spouses, 4% had detectable levels in their urine on the day of application. Their maximum value was 3 ppb.**

**-For their children, 12% had detectable glyphosate in their urine on the day of application, with a maximum concentration of 29 ppb.**

**“None of the systemic doses estimated in this study approached the U.S. Environmental Protection Agency reference dose for glyphosate of 2 mg/kg/day. Nonetheless, it is advisable to minimize exposure to pesticides, and this study did identify specific practices that could be modified to reduce the potential for exposure.”**



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## The World Health Organization's (WHO) International Agency for Research on Cancer (IARC)

- IARC identifies chemicals, drugs, mixtures, occupational exposures, lifestyles and personal habits, and physical and biological agents that cause cancer in humans; 1000 agents evaluated since 1971.
- Monographs are written by ad hoc Working Groups (WGs) of international scientific experts over a period of about 12 months ending in an eight-day meeting
- Evaluates all publicly available scientific information on each substance; decides on the degree to which the scientific evidence supports that substance's potential to cause or not cause cancer in humans.

**2015: The IARC WG (17 members) concluded that glyphosate is a 'probable human carcinogen', putting it into IARC category 2A due to *sufficient evidence* of carcinogenicity in animals, *limited evidence* of carcinogenicity in humans and *strong evidence* for two carcinogenic mechanisms.**





**The European Food Safety Authority (EFSA)**  
*The Lancet Oncology, Volume 17, June 2016*



EFSA: The primary agency of the European Union for risk assessments regarding food safety.

**October 2015:**

EFSA reported<sup>4</sup> on their evaluation of the Renewal Assessment Report<sup>5</sup> (RAR) for glyphosate that was prepared by the German Federal Institute for Risk Assessment (BfR).

**EFSA concluded that ‘glyphosate is unlikely to pose a carcinogenic hazard to humans and the evidence does not support classification with regard to its carcinogenic potential’.**



# Glyphosate Issue Paper: Evaluation of Carcinogenic Potential

## *EPA's Office of Pesticide Programs- September 12, 2016*



In EPA's 2005 Guidelines for Carcinogen Risk Assessment, five classification descriptors are provided:

- **Carcinogenic to Humans**
- **Likely to be Carcinogenic to Humans**
- **Suggestive Evidence of Carcinogenic Potential**
- **Inadequate Information to Assess Carcinogenic Potential**
- **Not Likely to be Carcinogenic to Humans**



# Glyphosate Issue Paper: Evaluation of Carcinogenic Potential For Glyphosate

*EPA's Office of Pesticide Programs- September 12, 2016*



- “For cancer descriptors, the **available data and weight-of-evidence clearly do not support** the descriptors “carcinogenic to humans”, “likely to be carcinogenic to humans”, or “inadequate information to assess carcinogenic potential”.
- “**For the ‘suggestive evidence of carcinogenic potential’ descriptor, considerations could be looked at in isolation;** however, following a thorough integrative weight-of-evidence evaluation of the available data, the database would not support this cancer descriptor. **The strongest support is for “not likely to be carcinogenic to humans” at doses relevant to human health risk assessment.**

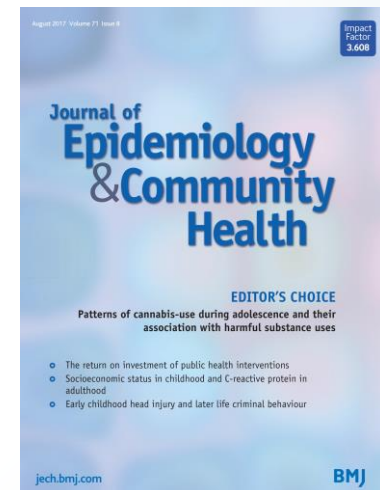


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# Differences in the Carcinogenic Evaluation of Glyphosate Between the International Agency for Research on Cancer (IARC) and the European Food Safety Authority (EFSA)

*Journal of Epidemiology & Community Health, Volume 70, Issue 8, March 3, 2016*

- The IARC WG found an association between Non-Hodgkins Lymphoma (NHL) and glyphosate based on the available human evidence.
- The IARC WG found significant carcinogenic effects in laboratory animals for rare kidney tumors and hemangiosarcoma in two mouse studies and benign tumors in two rat studies.
- The IARC WG concluded that there was **strong evidence from *publicly available, peer reviewed research* of genotoxicity and oxidative stress for glyphosate, including findings of DNA damage in the peripheral blood of exposed humans.**



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## Differences in the Carcinogenic Evaluation of Glyphosate Between the International Agency for Research on Cancer (IARC) and the European Food Safety Authority (EFSA), *Journal of Epidemiology & Community Health*, Volume 70, Issue 8, March 3, 2016

- **EFSA**<sup>4</sup> classified the human evidence as ‘very limited’; dismissed any association of glyphosate with cancer without clear explanation or justification.
- **EFSA** dismissed evidence of renal tumors in three mouse studies, hemangiosarcoma in two mouse studies and malignant lymphoma in two mouse studies
- **EFSA** regarded all findings of glyphosate-induced cancer in animals as chance occurrences.
- **EFSA** ignored key laboratory and human mechanistic evidence of genotoxicity.
- **EFSA** confirmed that glyphosate induces oxidative stress but then dismissed this finding on the grounds that oxidative stress is not sufficient for carcinogen labelling.
- **Minimal weight given to studies from the published literature; heavy reliance on non-publicly available industry-provided studies.**

# Concerns Associated with Exposures: a Consensus Statement Over the Use of Glyphosate-based Herbicides and Risks

*Environmental Health, February 17, 2016*

- **Statement of Concern** issued by group of research scientists directed to scientists, physicians, and regulatory officials around the world.
- Document highlights **changes (increases) in the scope and magnitude of risks to humans and the environment stemming from applications of glyphosate-based herbicides (GBHs).**
- **Increased detection of glyphosate and its metabolites in foods;**
- Recent scientific studies that **reveal possible endocrine system-mediated and developmental impacts of GBH exposures**
- Complications for farmers due to emergence of glyphosate-resistant crops and weeds, and resultant use of multiple herbicides in mixtures, both of which **increase the risk of human and environmental harm.**



## ***Environmental Health News, July 7, 2017***

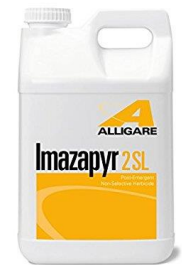
- July 7, 2017: California EPA represents first U.S. state to list Glyphosate as a known carcinogen marks a milestone in what has been years of debate over the safety of the pesticide called glyphosate.
- Officials with **California's Office of Environmental Health Hazard Assessment (OEHHA)** have until April 2018 to work out guidelines for glyphosate product warnings before requirements for such warnings take effect in July 2018.
- **Why?** California state law Proposition 65 requires CA to add a chemical to a list of known cancer-causing substances if it garners such a classification by IARC. The law then requires businesses to notify Californians about significant amounts of listed chemicals in products or released into the environment.
- **OEHHA** currently involved in a court challenge from Monsanto Co., which introduced glyphosate more than 40 years ago.





# IMAZAPYR

- Registered by American Cyanamid in 1985; First applied to corn in 1998; Acquired by BASF in 2000. Imazapyr, however, is now off-patent; 18 formulations have become available (*Arsenal* Most Prevalent).
- All of the 7 imidazolinone herbicides share a common mechanism of herbicidal action which involves the inhibition of enzyme synthesis which is important for plant growth.
- **Evidence for Carcinogenicity:**  
Cancer Classification: Group E Evidence of Non-carcinogenicity for Humans [USEPA Office of Pesticide Programs, Health Effects Division, Science Information Management Branch: "Chemicals Evaluated for Carcinogenic Potential" (April 2006)]
- Dietary risks, residential handler dermal and inhalation risks, residential post-application risks, aggregate risks all below levels of concern
- IARC Evaluation (not listed in 2016 or previous cycles).



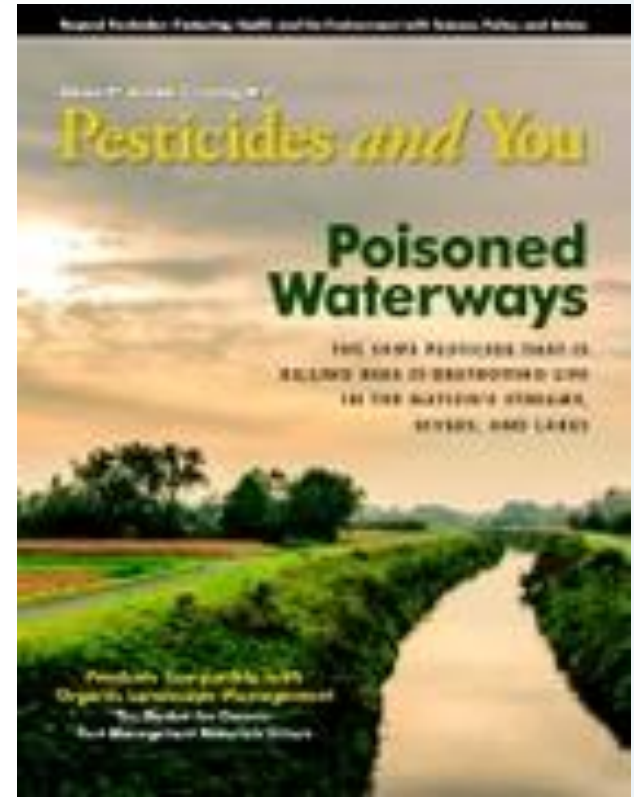


# IMAZAPYR

## Health and Environmental Effects

- Cancer: Not documented
- Endocrine Disruption: Not documented
- Reproductive Effects: Not documented
- Neurotoxicity: Not documented
- Kidney/Liver Damage: Not documented
- Sensitizer/ Irritant: **Yes** (8)
- Birth/Developmental: Not documented
- Detected in Groundwater: **Yes** (8)
- Potential Leacher: **Yes** (8)
- Toxic to Birds: Not documented
- Toxic to Fish/Aquatic Organisms: **Yes** (43)
- Toxic to Bees: **Yes** (43)

from [www.beyondpesticides.org](http://www.beyondpesticides.org)



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# *Questions, Comments*



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