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January 19, 2020

WI DNR Pesticide Use Advisory Team

This Pesticide Assessment was conducted at the request of the Wisconsin Department of Natural Resources (WI DNR). The Department Pesticide Use Team requested that Dr. Mark Renz (University of Wisconsin Professor and Extension Weed Specialist) review and summarize aspects of active ingredients commonly used for unwanted plant control in forests and natural areas and provide his **professional opinion** on the risks and value of this active ingredient compared to other commonly used practices. For more detailed information about this active ingredient, please consult the US Environmental Pesticide Agency or National Pesticide Information Center. Pesticide labels are the law and must be followed.

Per your request, I am providing information to consider when determining if glyphosate should continue to be listed as a general pesticide for use on Wisconsin Department of Natural Resources lands. My comments are related to the specific assessment considerations that you wanted me to consider. All of my toxicological information is taken directly from the US EPA or the National Pesticide Information Center unless otherwise noted. I have listed links to these resources at the end of this letter.

Glyphosate is a non-selective herbicide providing control of a range of broadleaf and grass weeds and brush in agriculture, forestry, industrial, lawn, garden, and aquatic environments. It is applied to foliage of plants that are actively growing and directly to cut surfaces. It has been registered for use since 1974 and is currently the most widely used pesticide in the world. It is used by Wisconsin DNR for agricultural weed control, maintaining bare ground areas (rights of way/parking lot), and for invasive plant control (aquatic and terrestrial). While alternatives exist to this product its effectiveness on a wide range of species (especially perennials) in combination with its limited bioavailability after application make this an herbicide with high utility. It is also inexpensive. Many (> 200) different products are available which use three main formulations: technical grade glyphosate (acid), glyphosate isopropylamine, and glyphosate ammonium salts. Of these, the isopropylamine salt is most commonly used in formulated products.

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Assessment Considerations

1. What are the human health risks (applicator and the public)? Glyphosate has been found to have low acute toxicity to animals and humans. Studies have found acute toxicity (dermal, when ingested, inhalation) were similar or safer than caffeine. Chronic toxicity has been widely debated. Data, from animal toxicity implicate it to be potentially a carcinogen but the majority of research shows no linkage between glyphosate and cancer. The USEPA recently (2017) re-evaluated data and determined that glyphosate is "not likely to be carcinogenic to humans." Other country/regional pesticide agencies agree with this decision (e.g. European Union) but an international agency has classified it as a probable carcinogen (International Agency for Research on Cancer=IARC). A recent meta-analysis (2019) found a link between glyphosate exposure and increased risk to non-hodgkins lymphoma (Zhang et al. 2019). While this study agrees with IARC's classification they only used data from individuals who had high levels of glyphosate exposure in their analysis. Other reports have shown that these high exposures are consistent with individuals who do not wear protective equipment recommended on the label (Acquavella et al. 2004). While research continues to evaluate the risk of cancer from glyphosate exposure the current body of scientific information does not suggest health risks to applicators or the public if applied following the restrictions of the label and using the recommended personal protection equipment.

2. What are the potential negative environmental impacts and risks?

- **Environmental fate**: Glyphosate persists in the environment to varying degrees based on the environment. In soil, this molecule degrades by microbes with half-lives between 2 to 197 days depending on soil type, with typical half-life of 47 days. Longer persistence in soil is observed under anaerobic conditions. Glyphosate adsorbs tightly to the soil and is not bio-available in soil. Glyphosate breaks down in water with half-lives between 1-91 days. Longer persistence in water is associated with binding to sediments under anaerobic conditions. The primary pathyway for glyphosate degradation is from microbes which products AMPA and glyoxylic acid. These are further degraded to carbon dioxide. Glyphosate and degradates have low potential to leach and contaminate groundwater due to its high affinity to soil/organic matter. Potential for surface water contamination is present from aquatic uses of

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glyphosate but due to dilution and safety to wildlife it is unlikely to have any impacts. Volatilization of glyphosate is not expected due to its physical properties.

- **Risk to organisms:** glyphosate is practically non-toxic or slightly toxic to birds, freshwater fish, invertebrates, and estuary and marine organisms and practically non-toxic to honeybees and earthworms. Some formulated products that contain the surfactant POEA known as MON 0818 which is moderately toxic to very highly toxic to freshwater fish and frogs therefore these products contain the statement "This pesticide is toxic to fish" on the label and those products are not registered for use in aquatic systems. Formulations are available for aquatic environments that do not contain this surfactant. It is believed that terrestrial applications will be bound to the soil or organic matter or diluted to a degree if transported via surface water and not pose a risk to these species. Using buffer strips and limiting spray drift could further limit this impact.

In summary this product is widely used in Wisconsin and does persist in the environment but is rarely bio-available due to its high affinity to soils and organic matter. While widely studied, the current body of knowledge does not suggest that applicators or citizens are at risk from its use if label directions are followed (PPE and restricted entry intervals). While some wildlife are sensitive to formulations that contain the surfactant POEA, these products are only registered in areas that will limit exposure of these sensitive species. Given these facts and the limited use by WI DNR compared to nearby lands (agriculture) I am confident that, ***if the label is followed***, limited to no impacts to the environment will occur due to WI DNR use.

3. How effective is the proposed pesticide for the proposed target(s)? Glyphosate based herbicides are effective on a wide range of species. Due to its wide use in agriculture and urban environments and cost in combination with limited bioavailability make it an effective and flexible tool for WI DNR land managers compared to other products.

4. What is the specificity of the proposed pesticide to the proposed target(s)? Glyphosate is a non-selective herbicide that can be applied to foliage or directed to the stem. Its main use in natural areas is to control unwanted perennial and annual vegetation. Often applications are

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used to prepare a location for restoration events where desirable plants are established shortly after application.

5. Is there a need for a maximum application site frequency and/or area other than specified on the product label? No.

6. Is there another pesticide and/or Integrated Pest Management (IPM) technique that should be considered in-lieu of the proposed pesticide? Several other products exist that will provide similar results, but they often have a higher cost, environmental concerns, and/or greater non-target impacts. Details would be site and species specific. Other techniques to be considered include removal, grazing, burning, and repeated mowing. These techniques have positive and negative attributes which would need to be considered compared to herbicide use but most often these non-chemical treatments either result in a large amount of disturbance (removal) or need to be repeated multiple times to obtain similar levels of success as the use of glyphosate.

7. Other Considerations:None.

http://npic.orst.edu/factsheets/archive/glyphotech.html
https://www.regulations.gov/contentStreamer?documentId=EPA-HQ-OPP-2009-0361-2344&contentType=pdf

Acquavella JF, Alexander BH, Mandel JS, Gustin C, Baker B, Chapman P, and Bleeke M. 2004. Glyphosate biomonitoring for farmers and their families: results from the Farm Family Exposure Study. Journal of Environmental Health Perspective. 2004 Mar; 112: 321–326.

Zhang L, Rana I, Shaffer R, Taioli E., and Sheppard L. 2019. Exposure to glyphosate-based herbicides and risk for non-Hodgkin lymphoma: A meta-analysis and supporting evidence. *Mutation Research/Reviews in Mutation Research* 781:186-206.

Feel free to contact me if you have any specific questions with regards to this information.

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Sincerely,

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