

## IARC Monographs Volume 112: evaluation of five organophosphate insecticides and herbicides

**Malathion** is currently used in agriculture, public health, and residential insect control. It continues to be produced in substantial volumes throughout the world. Workers may be exposed during the use and production of malathion. Exposure to the general population is low and occurs primarily through residence near sprayed areas, home use, and diet.

**Diazinon** has been applied in agriculture and for control of home and garden insects. Production volumes have been relatively low and decreased further after 2006 due to restrictions in the USA and the European Union. Only limited information was available on the use of these pesticides in other countries.

**Glyphosate** currently has the highest global production volume of all herbicides. The largest use worldwide is in agriculture. The agricultural use of glyphosate has increased sharply since the development of crops that have been genetically modified to make them resistant to glyphosate. Glyphosate is also used in forestry, urban, and home applications. Glyphosate has been detected in the air during spraying, in water, and in food. The general population is exposed primarily through residence near sprayed areas, home use, and diet, and the level that has been observed is generally low.

### What do Groups 2A and 2B mean?

Group 2A means that the agent is *probably carcinogenic to humans*. This category is used when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. *Limited evidence* means that a positive association has been observed between exposure to the agent and cancer but that other explanations for the observations (called chance, bias, or confounding) could not be ruled out. This category is also used when there is limited evidence of carcinogenicity in humans and strong data on how the agent causes cancer.

Group 2B means that the agent is *possibly carcinogenic to humans*. A categorization in Group 2B often means that there is convincing evidence that the agent causes cancer in experimental animals but little or no information about whether it causes cancer in humans.

### Why did IARC evaluate these pesticides?

The IARC Monographs Programme has evaluated numerous pesticides, some as recently as 2012 ([anthraquinone](#), [arsenic and arsenic compounds](#)). However, substantial new data are available on many pesticides that have widespread exposures. In 2014, an international [Advisory Group](#) of senior scientists and government officials recommended dozens of pesticides for evaluation. Consistent with the advice of the Advisory Group, the recent IARC meeting provided new or updated evaluations on five organophosphate pesticides.

### How were the evaluations conducted?

The established procedure for Monographs evaluations is described in the Programme's [Preamble](#). Evaluations are performed by panels of international experts, selected on the basis of their expertise and the absence of real or apparent conflicts of interest. For Volume 112, a Working Group of 17 experts from 11 countries met at IARC on 3–10 March 2015 to assess the carcinogenicity of **tetrachlorvinphos**, **parathion**, **malathion**, **diazinon**, and **glyphosate**. The in-person meeting followed nearly a year of review and preparation by the IARC secretariat and the Working Group, including a comprehensive review of the latest available scientific evidence. According to [published procedures](#), the Working Group considered "reports that have been published or accepted for publication in the openly available scientific literature" as well as "data from governmental reports that are publicly available". The Working Group did not consider summary tables in online supplements to published articles, which did not provide enough detail for independent assessment.

### What are the implications of the IARC evaluations?

The Monographs Programme provides scientific evaluations based on a comprehensive review of the scientific literature, but it remains the responsibility of individual governments and other international organizations to recommend regulations, legislation, or public health intervention.

Media inquiries: please write to [com@iarc.fr](mailto:com@iarc.fr). Thank you.