

PESTICIDE HAZARD vs. RISK

TOPIC FACT SHEET

How are hazards and risks different?

A hazard is something that can cause harm. You can think of it as whether something is dangerous. Risk is how likely it is that something might hurt us. For example, cars may cause accidents, which can be a serious hazard to someone involved in one. Cars can be very dangerous, but we may drive every day for our entire lives without an accident.

This is because context also matters. Even though cars are dangerous, if your car is sitting in your driveway, your risk of having an accident in your car is very low. A car accident where cars are going 20 miles per hour is not good, but an accident with cars going 70 miles per hour is potentially deadly. Risk is the chance that a hazard or danger could actually harm us. Our outcome depends on the situation and our exposure to a hazard.

We can lower the risk of having an accident by making sure that our car is working properly, following the rules of the road, and paying attention to what we are doing while we are driving. There is still a potential for harm, but we have lowered the risk.

Pesticide hazards and risks

In the case of pesticides, a pesticide's toxicity is its hazard. The hazard posed by a pesticide product depends on several factors. How toxic is the **active ingredient**? How much of that active ingredient is in the product? How toxic are the **other ingredients**? All of these factors affect the toxicity. The signal word on the product tells us the toxicity of the contents. For more information see our fact sheet about **signal words**.

Pesticides pose hazards either to human health or the environment based on their toxicity, but similar to speed in a car, context matters. **Pesticides pose risks** to people and other non-target living beings based on if and how exposure occurs. We might be exposed if we apply or handle pesticides. We could get some of the pesticide on our skin, breathe in vapors, or eat or smoke before washing our hands after using a pesticide. If a pesticide is in an intact closed container and we do not open it, the pesticide can't easily harm us. It is a lot like the car parked in the driveway. The risk is very low. If we come into contact with a pesticide, however, there is greater risk.

An exposure to a pesticide that is higher in toxicity may be worse than having the same exposure to a less toxic pesticide. Also, your risk may be higher if you are exposed to more of a pesticide or for a longer period. Some pesticides are more toxic by one route of exposure than another. For example, there may be worse health effects if you breathe in a product than if you get it on your skin. Therefore, the risk of harm is different depending on how you come in contact with it. The **formulation** of a product can also affect its toxicity and the way we could be exposed to it.

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Risk assessments versus hazard assessments

We know that hazard and risk are related. Both are important factors in protecting people, pets, and the environment from pesticides. So, what's the difference between a risk assessment and a hazard assessment for the same pesticide?

The U.S. EPA does a risk assessment on every pesticide registered in the United States. Other federal agencies such as the U.S. Fish and Wildlife Service also look at pesticide risks in some cases. Risk assessments follow a four-step process.

1. The first step is identifying the hazard. **How is it harmful?**
2. The second step is estimating dose-response. **How much is needed to cause harm?**
3. The third step is estimating exposure. **Will I be exposed, how much could I be exposed, and how often?**
4. The last step is describing expected risk.¹ **What is my risk?**

Identifying the hazard involves determining if a pesticide could cause harm. In other words, how toxic is it and when would people or nontarget plants or animals be likely to come into contact with it?

Estimating the dose-response looks at what happens as exposure increases. The EPA considers single exposures as well as repeated exposure over time.

Estimating exposure is based on how the pesticide is expected to be used.

Finally, the U.S. EPA looks at all of the **information gathered** in the first three steps. It evaluates the potential risks for each pesticide use. This process may allow a toxic pesticide to be **registered**, if the pesticide's use is not expected to lead to enough exposure to cause harm.

What if new information becomes available?

The EPA regularly reviews information on pesticide accidents and reports of adverse effects. The information may lead to an updated risk assessment or new restrictions to reduce risk. If there is enough evidence that risks are greater than expected, the EPA may make changes before a scheduled review. Risks might be greater than expected because the hazard was not well understood, or the exposure was underestimated. There may have been ways to be exposed that were not recognized, or more exposure occurred than expected.

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Some agencies place more weight on hazard than risk. For example, the International Agency for Research on Cancer (IARC) works to identify the causes of cancer in humans.² By only identifying the potential for harm, it does not consider risks to individuals in terms of both hazard and exposure. It is similar to recognizing that a car is a hazard, without exploring how the car is being used. Only identifying a hazard ignores that the risks could be reduced or even minimized.

Risk management balances drawbacks and benefits from pesticide use. We recognize cars as hazards but avoiding the risk of using one could have high costs. The U.S. EPA is responsible for determining what risks are acceptable for proposed benefits.

Where can I get more information?

For more detailed information about pesticide hazards and risks, call the National Pesticide Information Center, Monday - Friday, between 8:00am - 12:00pm Pacific Time (11:00am - 3:00pm Eastern Time) at 800-858-7378, or visit us on the web at npic.orst.edu. NPIC provides objective, science-based answers to questions about pesticides.

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References:

1. *Overview of Risk Assessment in the Pesticide Program*; U.S. Environmental Protection Agency, Office of Pesticide Programs . <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/overview-risk-assessment-pesticide-program> (accessed December 6, 2020).
2. IARC's Mission: Cancer research for cancer prevention; International Agency for Research on Cancer, World Health Organization. <https://www.iarc.who.int/about-iarc-mission/> (accessed December 6, 2020).

