

# Dosage is the Poison

By Bonnie Loving

“The dose makes the poison” is a phrase that is credited to Paracelsus that is intended to indicate a basic principle of toxicology. Paracelsus expressed the classic toxicology as “All things are poison and nothing is without poison; only the dose makes a thing not a poison.”

Let us look at some basic definitions:

**Chemical:** Any substance consisting of matter. Chemicals occur naturally and can be made artificially. Water is a chemical. Milk is a chemical. My saliva is a chemical. ‘Chemical’ is a very broad term.

**Poison:** A substance that is capable of causing the illness or death of a living organism when introduced or absorbed.

**Toxicity:** Toxicity is the degree to which a substance can damage an organism.

**Here are some signal words that the Environmental Protection Agency (EPA) uses to label based on their toxicity:**

**Poison:** Signal word based on oral, dermal, or inhalation toxicity of a chemical where a very low dose could kill a person (a few drops to 1 tsp).

**Danger:** Signal word used to describe a chemical that can cause corrosive-permanent or severe skin, eye, or respiratory damage.

**Warning:** Signal word used to describe a chemical that can cause moderate skin, eye, or respiratory damage. A small to medium dose could cause death, illness, or skin, eye, or respiratory damage.

**Caution:** Signal word used to describe a chemical that can cause mild skin, eye, or respiratory irritation. A medium to large dose could cause death, illness, or skin, eye, or respiratory damage (1 oz to 1 pt or 1 lb)

**Caution or no signal word:** Signal word used to describe a chemical that can cause slight concern for skin, eye, or respiratory injury.

No matter if the chemical is natural or artificial, ALL chemicals, if taken in a high enough dose, are toxic. Water can kill you, salt can kill you, caffeine can kill you, bleach can kill you, gasoline can kill you, etc... Any chemical can kill you with enough **dose**. Just because a chemical is harmful or carcinogenic at very high doses, does not necessarily mean that it will have any ill effects at the doses we experience. All of this information can be found on the Material Safety Data Sheets (MSDS).

All chemicals have a MSDS sheet, and on the MSDS you can go to the toxicity section and look at the LD50. LD50 refers to the lethal dose that will kill half the population. Depending on the studies it is typically

tested on rats. Following is a chart of different chemicals and their LD50's. The higher the toxicity the lower the LD50 value will be.

Substance	Animal, Route	LD50	LD50 unit	Lethal amts for 154 lb hu
Botox	human, oral	1	ng/kg	.0000000000001oz
Ricin (from Castor oil plant)	rate, oral	25	mg/kg	0.061 oz
Nicotine	human, oral	7	mg/kg	0.017 oz
Heroin	mouse, intravenous	21.8	mg/kg	0.054 oz
Vitamin D3	Rat, Oral	37	mg/kg	0.091 oz
Cocaine	mouse, oral	96	mg/kg	0.237 oz
Caffeine	Rat, Oral	192	mg/kg	0.474 oz
Ibuprofen	Rat, Oral	636	mg/kg	1.57 oz
Lactose (milk sugar)	Rat, Oral	1000	mg/kg	2.469 oz
Table Salt	Rat, Oral	3000	mg/kg	7.401 oz
Milestone	Rat, Oral	5000	mg/kg	12.3 oz
Tordon	Rat, Oral	5000	mg/kg	12.3 oz
Roundup Pro	Rat, Oral	5000	mg/kg	12.3 oz
Ethanol (Grain alcohol)	Rat, Oral	7060	mg/kg	17.432 oz
Glucose (blood sugar)	Rat, Oral	25800	mg/kg	63.704 oz
Sucrose (table sugar)	Rat, Oral	29700	mg/kg	73.333 oz
Water	Rat, Oral	90000	mg/kg	222.222 oz

Given the definition of a poison, every chemical should be considered a poison. If you use the word poison as loosely as its definition you need to use it for every chemical. Water has killed millions of people so we should probably call that poison as well, right? I'm drinking the poison right now...

My opinion and my plea for others is only use "poison" when it is highly toxic at a low dose. Use "poison" when the 'chemical' has a signal word on its label that says danger or poison. Because when we hear the word poison it should be serious.

I am going to relate this subject to my line of work now that hopefully we can get on the same page of when to use the term poison. I am the program director for Montezuma County Noxious Weed Program. The county weed program does not use any herbicides with the signal word poison; a vast majority of the herbicides we use have either a Caution or Warning signal word. As long as you use the herbicide in accordance to the label there will be no threat to the applicators health, animals, and or the environment. However, I like to accommodate for human error and unforeseen gusts of wind. I do not want to take the risk using an herbicide with the signal word poison because I like having a buffer of possible human error for any given herbicide. We also use rates that are lower than the recommended rates on the label to further establish that buffer of possible human error.

I also want to touch on DDT. This herbicide was used way before my time, and caused significant problems to human health, animal health, and environmental health. In the wake of DDT's destruction, the Environment Protection Agency (EPA) was created. The EPA has strict rules and it takes a given herbicide about 8 years to finish all the required tests to be approved, which can cause from \$152 to 256 million dollars for that one herbicide to be EPA approved. Another note is only 1 in 139,000 chemicals makes it from the chemists lab to the market. EPA does not take herbicide use lightly; they know what is at stake.

Last thing I want to touch on is if you do not want the county to manage noxious weeds with herbicides on county right-of-ways adjacent to your property we have an official no spray program. It is very easy, you fill out an agreement form saying that you will prevent noxious weeds from going to seed on that right-of-way you don't want sprayed. The county will then put up official no spray signs on each side of the right-of-way adjacent to your property, and we will no use herbicides there. However, if you fail to prevent noxious weed species from going to seed, the agreement can and will be voided, and the county will then continue managing the noxious weeds on that section of the right-of-way with herbicides. We respect landowner's opinions of herbicides and are willing to work with you as long as we can still manage the noxious weeds.