

## Is 2,4-D safe? Can it cause cancer?

Recently, a coalition of citizens, environmental groups, and various governmental and non-governmental agencies has been formed in Thunder Bay called CCAPUT (Citizens Concerned About Pesticide Use in Thunder Bay). One of their goals is to seek a ban here on the non-essential uses of “cosmetic” toxic synthetic chemicals. Not surprisingly, some lawn care companies are outraged, and claim that these chemicals must be safe, because they have been used for decades, and are registered with Health Canada. This sheet is a short summary of why Environment North is particularly concerned about 2,4-D.

On average, 1800 new chemicals are registered with the federal government each year and about 750 of these find their way into products, all with hardly any testing for health or environmental effects. It should not be a surprise to us when some of them cause a variety of adverse effects to human health or the environment.

One way to classify some chemicals is to call them “*pesticides*”, which literally means to kill (*'cide*) pests. Pesticides are further sub-classified into other *'cides*, including insecticides, fungicides, rodenticides... and herbicides (Literally *plant-killers*).

One of the most contentious herbicides is 2,4-D (which is the short name for 2,4-dichlorophenoxyacetic acid). For all of the contention about its safety, there have been surprisingly fewer solid scientific studies on 2,4-D than one would expect. This is in large part because it was registered legally many decades ago, when registration was very easy.

Before we review the safety data on 2,4-D, let's quickly review some of the key potential health effects for which pesticides are now tested before registration, in order to try to predict health effects to humans. We say effects, because there is no such thing as a “side effect”. There may be a variety of unintended effects... unexpected effects, hidden effects, wonderful effects, nasty effects, and deadly effects. But they are all the same: EFFECTS.

Safety is not a completely objective word or concept, in any situation from traffic control to contraception. In health terms, a reasonable basis for calling an herbicide “safe” could be a formulation that if reasonably used according to directions, would meet the following criteria:

- Is not likely to cause acute toxicity, and
- Is not toxic in chronic exposure.

Well, ok, but what do acute and chronic toxicity entail? We can define them to mean the following:

- Acute toxicity is toxic symptoms (immediate or deferred) resulting from a medium exposure, in a short period. This kind of exposure would likely occur to applicators, or from accidental exposure to spray programs.
- Chronic toxicity would be unintended effects resulting from a low dose, repeated or continuous, over a longer period.

A handy and widely used (but incredibly simplistic) means of gauging acute toxicity is to find or know the “LD<sub>50</sub>” of a chemical: the lowest dose that kills 50% of the test population of animals. LD<sub>50</sub> charts tell you nothing about non-lethal acute effects (e.g. blindness, paralysis, or psychological effects). LD<sub>50</sub> also tells you nothing about the likelihood of effects of chronic low doses, which through bio-accumulation of chemicals, or cumulative effects (or both), can be far more serious than acute toxicity. Effects can be as vague as headaches, rashes, or upset stomachs; they can be as dramatic as psychoses or progressive muscular neuropathy.

There are four classes of non-acute toxic effects that are or should be of particular concern to us all:

### **CHRONIC TOXIC EFFECTS IN ANIMALS**

#### **A) Developmental (teratogenic, i.e. birth defects, etc.)**

- 1) Malformations
- 2) Malfunctions
- 3) Growth retardation
- 4) Death of fetus (miscarriage)

#### **B) Reproductive Effects**

- 1) Rate of pregnancy
- 2) Number of embryos

#### **C) Genetic**

- 1) Mutations
- 2) DNA damage
- 3) Mitotic effects

#### **D) Carcinogenic (Cancer-causing)**

(Common myth: “If you eat enough of anything, it will give you cancer...”)

Carcinogenesis is a step-wise process requiring on the average about one quarter of a lifetime. Its stages are:

- 1) INITIATION: An almost immediate, irreversible change in the target cell’s way of processing information. This is a hit-run injury; the initiator need not remain long in the cell.
- 2) PROMOTION: Sequential additional changes, little understood, which convert the pre-malignant cell to a fully malignant one. Promoters can be more of the same chemical that initiated the injury, a different non-physiological chemical, or normal physiological influences such as hormones or obesity. The promoting factor must be present over a long

period of time. Promoting changes can be reversible in the absence of the initiating effect.

- 3) GROWTH: One malignant cell to a mass of cells, a tumour. This may not require any further stimulation.
- 4) PROGRESSION: Loss of normal gene function, allowing the malignant cells to metastasize, develop drug resistance, etc, through natural selection.

A substance either is a cancer initiator, or promoter (or both)... or it is not. Most cancers scientists believe that there is no threshold dose that poses no risk. The same is true for teratogens. There is no threshold below which they do not pose some risk of fetal deaths or defects.

O.K. Where does 2,4-D stand in all this? Surprisingly, relatively few solid studies have been done on this chemical that was synthesized and first used as a growth regulator many decades ago. Obtained test results are pretty clear, however. From them, we know that 2,4-D, or its contaminants, or its metabolites and degradation products:

- Can be absorbed rapidly, crossing both placental and blood/brain barriers.
- Have an LD<sub>50</sub> that ranges widely in published values, down to 100 mg/kg for dogs, and 80 mg/kg in humans (these show fairly high toxicity, at 80-100 parts per million of 2,4-D to body weight for 50% mortality).
- **Causes fetal malformations.**
- **Causes fetal malfunctions.**
- **Can cause fetal deaths.**

2,4-D:

- Has not been shown to cause lowering of reproductive rates.
- Does not appear to cause mutations in bacteria or fungi.
- **Does cause mutations in animal cell cultures *in vitro*.**
- Has been shown to be an **effective “promoter” of cancer cells. (In a human population where there is virtually universal exposure to cancer initiators, this is significant.)**
- **Together with 2,4-dichlorophenol, one of its contaminants and/or degradation products (a good cancer “initiator”), 2,4-D is a complete cancer producer.**

There have been contradictory studies on 2,4-D’s ability to damage DNA or interfere with cell division; some were positive.

TCDD (the dioxin contaminant found in 2,4,5-T) is not found in 2,4-D. However there is some suspicion that another dioxin (2,7-dichlorodibenzo-p-dioxin), a demonstrated teratogenic chemical, may be formed in high temperature storage, or when 2,4-D is burned.

**2,4-D damage to fetuses includes circulatory and skeletal malformations, hemorrhage into body cavities, edema, growth retardation at very low rates (0.5 mg/kg of maternal body weight), and death of the fetus at higher rates (100 mg/kg).**

2,4-D causes point mutations; it does not seem to cause breakage or non-disjunction of chromosomes. It stimulates cell division in some animal cells.

**Several human epidemiological studies have shown increased cancer rates after 2,4-D exposure.** However, these studies included persons exposed to other herbicides as well, making it impossible to be sure which herbicide produced the cancers.

Some other serious, but non-lethal known effects to 2,4-D exposure include:

- **Progressive neuropathy resulting in long term partial paralysis,**
- **Myotonia (uncontrolled muscle spasms).**

The evidence concerning 2,4-D is far from complete, unfortunately. What is known is sufficiently indicting that if it were submitted to the U.S.A. Environmental Protection Agency or Health Canada today it would almost certainly fail, or at least be severely restricted. After decades of legal use, it seems to be just too cheap, useful, and familiar to receive adequate respect or regulation. Therefore, citizens, schools, and municipalities unfortunately need to educate and protect themselves in the absence of adequate Federal regulation.

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