Paper 3. Our Response as Individuals

So what can we do as individuals to protect the environment and ourselves? What is our responsibility to protect others? I clearly don't have all the answers, but I think there certainly are some practical things we can do, particularly to protect ourselves.

First of all I would suggest some general rules of precaution. "Never put all your eggs in one basket" A good example is brown rice. We know that brown rice is much healthier than white rice which is processed. Unfortunately, a toxin accumulates in the outer covering of rice (the brown part) This toxin is arsenic. Not acute poisoning arsenic, but chronic arsenic exposure is also a carcinogen, in that it predisposes to cancer. Low doses of exposure are probably fine. But too much chronic exposure is not fine. In many areas of the world the ground water has higher levels of arsenic and is a significant cause of cancer. Not only does brown rice contain more arsenic due to its outer coat, but much of the brown rice grown in the US is grown on old cotton fields. Guess what they used to control cotton weevils? Yup, arsenicals. So particularly US brown rice has more arsenic. Remember I said that dose is everything in toxicology. So I am not saying never eat brown rice. On the other hand, the old Greek admonition "moderation in all things" applies: don't eat it every day. And parents of infants who want to feed their children the healthiest foods need to keep in mind that infants tend to be more sensitive to most toxins. So daily brown rice (unless certified to be low arsenic) should not be on the menu. In other words, don't eat the same things every day. Remember, in toxicology dosage is king. So it is better to eat a variety of foods and get smaller doses of different toxins, rather than larger doses of fewer toxins.

How about eating organic produce? Because children are more sensitive to herbicides and pesticides I think it is much more important for them to have organic selections. Most pesticides or herbicides are located on the outer peel of fruits and vegetables. This means that fruit like bananas or oranges that we peel could be safely bought non-organic". However, what about the fruits and veggies with skin that we eat? Consumer Reports tested washing these products and found that simple washing removed very little of the contamination. (I think there is a solution that is more effective for washing produce, but I don't know how well it has been tested). This means to me, that if you are financially able, organic grapes, apples, strawberries, celery etc. would be the way to go, particularly for children or especially infants. If you are particularly interested in which fruits are the most contaminated, I would suggest you Google EWG and look at their "dirty dozen". (Note that EWG tends to be fairly opinionated about environmental issues) Honestly, there is no way to know if eating organic will translate into more health in a normal adult, and we can only speculate.

There are more concrete ways to avoid toxins. Firstly, anybody drinking the water at Forest Lake can appreciate that it tastes wonderful. Unfortunately, Forest is a static body of water. There is a slow constant flow of water to and from the lake underground, but toxins from fuel additives, lead hooks, herbicides used on lawns, and pesticides used on flowers do get in the lake, and some of them (not apparently 2,4 D) accumulate in the biomass despite the slow circulation of water. At a minimum I believe it would be prudent to use an activated charcoal filter for the water in your kitchen to absorb organic chemicals, and change it regularly. In general a charcoal filter is best for organic compounds like pesticides and herbicides. Reverse

osmosis systems seem to be the best, however, at removing heavy metals according to my reading. I would note that an activated charcoal filter is very effective at removing 2,4 D. How safe is it to eat the fish? I don't know, but it is probably reasonably safe, noting that some mercury is not retained in the body long term. However, toxins like PCB's and heavy metals get concentrated as they go up the food chain, so a large bass or walleye would definitely be less healthy than a small panfish. In addition, pregnant women and young children would be well advised to avoid not to eat fish too often.

Avoid smoking, as chronic smoking will decrease your average life span by about 10 years. Alcohol should be used in moderation (yes, alcohol is also a cancer causing chemical, particularly estrogen sensitive cancers such as colon and breast). Processed red meats are labeled in Europe as carcinogenic, and bacon (sorry Mark G) is probably the worst of the bunch. Keep your weight down (people who are overweight get more cancer). Exercise regularly as this seems to increase excretion of some toxins, and helps prevent cancers and heart disease and it seems to delay the onset of Alzheimer's. (Exercise does not have to be a painful ordeal. Humans are built to walk and going for walks is an excellent form of exercise) Be careful about what you apply to your skin. For example, when the FDA began regulating sunscreen, they grandfathered in all the chemicals that were in current use. We now know that some of them get absorbed into the human body, and persist for quite a while. At least one of these chemicals is likely to act as a "false estrogen" and be harmful to sperm counts and menstrual health. At this time in my opinion the only sunscreen known to be safe (not absorbed into the body) is either micronized zinc, or titanium, or even better a combination of the 2. (It goes on white but if you rub it, it rapidly becomes colorless).

In addition to avoiding potentially toxic compounds, it is also important to not add toxic substances into the lake or our groundwater. Some of the pesticides or herbicides in lawn care products persist in the environment and do make it into the ground water. A good steward of the lake would tolerate weeds in the lawn rather than using herbicides or pesticides. Similarly, we can tolerate some milfoil in our lake but we couldn't tolerate milfoil choking our bays and preventing our access to the water. In addition, if there is not a natural buffer between the lawn and lake, runoff can significantly increase the contamination of the lake water. Plant a vegetation buffer between your grass and the lake if you have to have grass. If you need a new engine for use on the water, consider a 4 stroke, as the hydrocarbons spilling into the lake are reduced significantly. Whenever possible drink from glass or stainless steel. Many plastic glasses contain BPA or other materials. These can leach into your food and drink. When using the microwave, try to put things in glass or ceramic containers rather than heating them in their plastic container.

FINALLY, we can look at 2,4 D. I am sure by now you can appreciate that there is no absolute certainty about any of the thousands of chemicals we are exposed to. However, definitely some are safer than others. I would feel much more comfortable being exposed to a herbicide if it has a long track record of no known toxicity, exposure is minimal and transient, does not accumulate in the body, does not accumulate in the food we eat, does not persist in the environment, and can be removed from our drinking water very easily.

To repeat, 2,4 D has been used as an agricultural herbicide since the 40"s (about 80 years) so it has an extremely long track record. It tends to be a very nontoxic chemical. It has been studied VERY intensively because it was an ingredient in Agent Orange. Because of this and the multiple Agent Orange lawsuits, it has been scrutinized to the extreme. Ultimately it was determined that the dioxin in AO was the source of human toxicity. Because of Agent Orange, 2,4 D is one of the most tested substances in the world. The dioxin was a contaminant, and is felt to be responsible for a number of health problems in exposed vets, including some cancers. 2,4 D is also one of the most used herbicides in the world. It has no known toxicity to humans unless ingested directly in large amounts, and has little toxicity in animal studies

unless large doses are used. It is listed by the EPA as toxic, because if the chemical is sprayed accidentally directly into the eyes, there is a significant inflammatory reaction. (Recently a paper noted 10% of walleye larvae were affected, which was a little surprising given normal exposure levels had no previous discernible effect on most fish, invertebrates etc.) 2,4D is not absorbed through human skin, but when ingested it is absorbed. It is rapidly excreted from the human body in the urine in an unchanged form. The time for the 2,4 D levels to decrease by 50% in humans is felt to be about 10 hours which is very rapid. It does not seem to persist in lake water for long periods. 2,4 D is broken down by the microbes in the lake. 2,4 D does not reach well water in lakes treated for milfoil.

The levels of 2,4 D when applied to Forest will be monitored closely in the lake. 2,4 D has not been found in the drinking water of lakes that are treated for milfoil. It does not accumulate in the lake biomass.

In summary, of the thousands of chemicals we are constantly exposed to in our environment, 2,4 D does not have any of the characteristics which would raise special concern. It has been studied very extensively particularly since Agent Orange in multiple different ways, and no red flags have been raised. It does not persist for long periods in the lake, and does not accumulate in the fish we eat. When humans ingest 2,4 D the chemical does not accumulate and is rapidly excreted in the urine unchanged. While I cannot say definitively that there is not some still unstudied effect of 2,4 D on something like estrogen receptors, the short human half-life and the transient nature of any minimal exposure would be insignificant, particularly given the multiple endocrine disrupters we are constantly exposed to and accumulate in our bodies over long periods of time (such as sunscreen, BPA, PCB's and even lilac scent in skin creams). The 2,4 D we apply to the lake will not pass through our food chain, and it is unlikely to reach our well water.

In 1990 the EPA released the results of the National Pesticide Survey. 1300 community and rural domestic well systems were analyzed. No 2,4 D was found in any of the water samples, despite its common use as a herbicide. A Connecticut lake was tested for Eurasian Milfoil with 2,4 D, and 3 shallow wells (5-15feet deep) were monitored for 73 days. No 2,4 D was detected in any samples. If there is any concern about possible exposure to our FL residents, a simple charcoal filter on your water faucet you drink and cook with, could completely eliminate this. (Instapure sells one, very inexpensive, and easy to attach to your faucet. I believe they carry them at Costco, or Amazon).

In short, 2,4 D has virtually no animal toxicity in the concentrations that we will experience temporarily in the lake. It has been studied very extensively for about 80 years. It is only absorbed by humans by ingestion. It does not accumulate in the food chain of Forest, and it is rapidly excreted by humans. A charcoal filter on your drinking water is possibly overkill, but I would advise one for the other toxins likely in our lake in any case. (I have had one for the last 15 years). I would like to remind you this is only 1 person's opinion, but I would add that I have been looking at the issue of environmental toxins for a very long time and I have no concern about 2,4 D for myself or family.

DESPITE all of the above factors, I still have no absolute certainty about 2,4 D. I would suggest all the precautions in this letter and previous letters. In addition, I would expect that the use of herbicide on Forest will be extremely infrequent and only if other measures are ineffective. In addition, because "dosage is king" I would suggest that if we need another herbicide application in the far future, we consider a different herbicide as an added safety measure. I do think as a general precaution, because Forest is a static body of water, it would be prudent that we also look at the quality of the ground water we drink from Forest Lake looking for toxins. I would like to propose that the Lake Association arrange to randomly test about 4 taps from various locations around the lake for heavy metal and pesticide levels. I would suggest mid

summer, and again at the end of the summer. This should be relatively inexpensive, but I think it could be very useful, if only for peace of mind.

I am sure that some of our residents will disagree with some of the things I have written. Some won't read these papers. My charge from the Foundation was to educate our members on environmental toxins, including herbicides. I believe my opinions are based on the best information we have available. On the historical aspects of environmental exposures, I will however say that facts are facts. Ultimately most of what I personally do is for my children and their children. Some might view my paper as overly alarmist. When I am writing this paper I am always trying to proactively protect our children and grandchildren. Given the history of toxic pollution mankind has often dealt with, and the rapid pace of industrialization here and in the rest of the world, it will require a continuous effort to identify toxins in our environment. In summary, environmental safety will always be a "moving target" and we have to continuously strive to study and identify any unknown or known toxins to preserve our amazing lake as a safe and natural place for all of our children and grandchildren.

Mark Dreyer

2,4-D Chemical Fact Sheet

Formulations

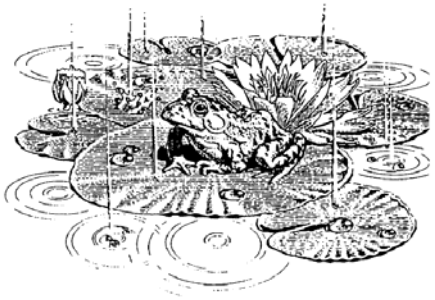
2,4-D is an herbicide that is widely used as a household weed-killer, agricultural herbicide, and aquatic herbicide. It has been in use since 1946, and was registered with the EPA in 1986 and re-reviewed in 2005. The active ingredient is 2,4-dichloro-phenoxyacetic acid. There are two types of 2,4-D used as aquatic herbicides: dimethyl amine salt and butoxyethyl ester. Both liquid and slow-release granular formulations are available. 2,4-D is sold under the trade names Aqua-Kleen, Weedar 64 and Navigate (product names are provided solely for your reference and should not be considered endorsements nor exhaustive).

Aquatic Use and Considerations

2,4-D is a widely-used herbicide that affects plant cell growth and division. It affects primarily broad-leaf plants. When the treatment occurs, the 2,4-D is absorbed into the plant and moved to the roots, stems, and leaves. Plants begin to die in a few days to a week following treatment, but can take several weeks to decompose. Treatments should be made when plants are growing.

For many years, 2,4-D has been used primarily in small-scale spot treatments. Recently, some studies have found that 2,4-D moves quickly through the water and mixes throughout the waterbody, regardless of where it is applied. Accordingly, 2,4-D has been used in Wisconsin experimentally for whole-lake treatments.

2,4-D is effective at treating the invasive Eurasian watermilfoil (*Myriophyllum spicatum*). Desirable native species that may be affected include native milfoils, coontail (*Ceratophyllum demersum*), naiads (*Najas* spp.), elodea (*Elodea canadensis*) and duckweeds (*Lemna* spp.). Lilies (*Nymphaea* spp. and *Nuphar* spp.) and bladderworts (Utricularia spp.) also can be affected.



Post-Treatment Water Use Restrictions

There are no restrictions on eating fish from treated water bodies, human drinking water or pet/livestock drinking water. Following the last registration review in 2005, the ester products require a 24-hour waiting period for swimming. Depending on the type of waterbody treated and the type of plant being watered, irrigation restrictions may apply for up to 30 days. Certain plants, such as tomatoes and peppers and newly seeded lawn, should not be watered with treated water until the concentration is less than 5 parts per billion (ppb).

Herbicide Degradation, Persistence and Trace Contaminants

The half-life of 2,4-D (the time it takes for half of the active ingredient to degrade) ranges from 12.9 to 40 days depending on water conditions. In anaerobic lab conditions, the half-life has been measured up to 333 days. After treatment, the 2,4-D concentration in the water is reduced primarily through microbial activity, off-site movement by water, or adsorption to small particles in silty water. It is slower to degrade in cold or acidic water, and appears to be slower to degrade in lakes that have not been treated with 2,4-D previously.

There are several degradation products from 2,4-D: 1,2,4-benzenetriol, 2,4-dichlorophenol, 2,4-dichloroanisole, chlorohydroquinone (CHQ), 4-chlorophenol and volatile organics.

Impacts on Fish and Other Aquatic Organisms

Toxicity of aquatic 2,4-D products vary depending on whether the formulation is an amine or an ester 2,4-D. The ester formulations are toxic to fish and some important invertebrates such as water fleas (*Daphnia*) and midges at application rates; the amine formulations are not toxic to fish or invertebrates at application rates. Loss of habitat following treatment may cause reductions in populations of invertebrates with either formulation, as with any herbicide treatment. These organisms only recolonize the treated areas as vegetation becomes re-established.

Available data indicate 2,4-D does not accumulate at significant levels in the bodies of fish that have been tested. Although fish that are exposed to 2,4-D will take up some of the chemical, the small amounts that accumulate are eliminated after exposure to 2,4-D ceases.

On an acute basis, 2,4-D is considered moderately to practically nontoxic to birds. 2,4-D is not toxic to amphibians at application rates; effects on reptiles are unknown. Studies have shown some endocrine disruption in amphibians at rates used in lake applications, and DNR is currently funding a study to investigate endocrine disruption in fish at application rates.

As with all chemical herbicide applications it is very important to read and follow all label instructions to prevent adverse environmental impacts.

Human Health

Adverse health effects can be produced by acute and chronic exposure to 2,4-D. Those who mix or apply 2,4-D need to protect their skin and eyes from contact with 2,4-D products to minimize irritation, and avoid inhaling the spray. In its consideration of exposure risks, the EPA believes no significant risks will occur to recreational users of water treated with 2,4-D.

Concerns have been raised about exposure to 2,4-D and elevated cancer risk. Some (but not all) epidemiological studies have found 2,4-D associated with a slight increase in risk of non-Hodgkin's lymphoma in high exposure populations (farmers and herbicide applicators). The studies show only a possible association that may be caused by other factors, and do not show that 2,4-D causes cancer. The EPA determined in 2005 that there is not sufficient evidence to classify 2,4-D as a human carcinogen.

The other chronic health concern with 2,4-D is the potential for endocrine disruption. There is some evidence that 2,4-D may have estrogenic activities, and that two of the break-down products of 2,4-D (4-chlorophenol and 2,4-dichloroanisole) may affect male reproductive development. The extent and implications of this are not clear and it is an area of ongoing research.

For Additional Information

Environmental Protection Agency
Office of Pesticide Programs
www.epa.gov/pesticides

Wisconsin Department of Agriculture, Trade, and Consumer Protection
http://datcp.wi.gov/Plants/Pesticides/

Wisconsin Department of Natural Resources
608-266-2621
http://dnr.wi.gov/lakes/plants/

Wisconsin Department of Health Services
http://www.dhs.wisconsin.gov/

National Pesticide Information Center
1-800-858-7378
http://npic.orst.edu/

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