State of Washington

Fact Sheet

Controlling Metals and Dioxins in Fertilizers

Background

Some of the fertilizers and soil additives used to grow food crops on farms in Washington and nationwide contain heavy metals and dioxins that "tag along" with the intended ingredients. Citizens and some farmers have raised concerns about whether these metals and dioxins are making their way into the food we eat and the environment that surrounds farmland. They also have questioned whether the state is adequately scrutinizing the practice of recycling industrial waste products into a small but agriculturally important group of fertilizers used to produce food and other crops.

Given current standards, the state has no reason to believe that the quality of the Washington's food crops is threatened by the fertilizers used on farmland, either from heavy metals or dioxins. However, state regulators believe fertilizers must be more closely monitored to ensure that level of quality does not change.

The state proposes to tighten laws that regulate all fertilizers, require fertilizer makers to list heavy metals on the labels of their products, adopt the best available standards for the content and application of fertilizers, and fund research on whether heavy metals are taken up by plants. In addition, state agencies will consider broader testing of fertilizers for dioxins and will encourage fertilizer companies to seek out the cleanest sources of raw materials they can find.

Testing of Fertilizers for Metals

The state departments of Agriculture and Ecology tested 55 fertilizers for their metals content. The state screening study concluded that the concentration of metals in several fertilizers will need further study as standards for metals in fertilizers are developed.

The state also considered the rate at which these fertilizers are applied to land and compared the results to federal standards for biosolids (sewage treatment plant sludge)

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applied to land; these standards are based on human-health risk assessments. Wood ash, a by-product of burning wood for electricity or steam generation, was the only waste-derived fertilizer product to violate biosolids standards. Wood ash is not used on food crops.

The screening survey tested for numerous metals. Among those are lead, cadmium and arsenic, which are associated with various human health affects depending on the level of exposure. Listed below are the highest levels of lead, cadmium and arsenic measured in the survey, based on maximum annual application rates:

Fertilizers With the Highest Annual Loading at the Maximum Annual Application Rates

Pounds per Acre*

Product	Arsenic	Cadmium	Lead
*Adjusted Biosolids Standards***	*0.36*	*0.35*	*2.67*
Triple Superphosphate	ND	**0.12**	ND
Ammonium Phosphate Sulfate	<0.01	**0.07**	<0.01
Wood Ash	**1.24*****	ND	**3.20*****
Kiln Dust Lime	**0.10**	<0.01	**0.40**
Granular Zinc #1	ND	<0.01	**0.25**
Bornonat (micronutrient)	**0.03**	ND	ND

ND = not detected **Bold** numbers represent highest values in the state survey

*NOTE: These numbers have been converted to pounds per acre for the purpose of this fact sheet. Data in the full screening survey report are in metric numbers (kilograms per hectare).
**These numbers represent the annual loading of metals expected from application of "exceptional quality (EQ)" biosolids (40CFR 503.13) applied at a rate of 10 metric tons/hectare. Biosolids that meet this standard are not subject to monitoring requirements.
***Although these numbers exceed the standards for exceptional quality biosolids, they do not exceed the annual pollutant loading rate limits for biosolids (arsenic-1.78 lbs., and lead-13.33 lbs.)

Testing of Fertilizers for Dioxins

State scientists conducted dioxin tests on five fertilizers produced in the state using industrial by-products, and detected dioxins in all of them. Waste-derived fertilizers were chosen for testing because they were most likely to contain dioxins.

There are no state or national standards for heavy metals or dioxins in fertilizers, so levels in the tested fertilizers were compared to the most closely related standards available. Also, for comparison purposes, state scientists assumed the fertilizers would be regularly applied to farmland at their recommended maximum annual rates.

At those rates, application of two of the fertilizers would not result in farmland exceeding the EPA estimated average background soil concentration level for North America, which is 8 parts per trillion. Two of the fertilizers would result in minimal increases of .004 and one part per trillion. Soil concentrations for the fifth product are still being researched. It is also important to note that federal studies indicate that plants do not readily absorb dioxins from soil.

ESTIMATED INCREASE IN SOIL CONCENTRATION OF DIOXINS FROM FERTILIZERS COMPARED TO EXISTING SOIL STANDARDS

Product	Annual Application Rate* (lbs. per acre)	TEQ Concentration (parts per trillion)	Annual increase in soil concentration** (parts per trillion)
Liquid Zinc Fertilizer	Not Available	1.31	Not Available***
Granular Zinc from Tire Ash	22.5	5.6	0.00007
Cement Kiln Dust	2660	.95	0.001
Granular Zinc Fertilizer from Steel Mill Flue Dust	22.5	340	0.004
Liming Material – Wood Ash (Hog fuel boiler)	48,886	35	1.0

Most Closely Related Comparison Standards:

Washington State Model Toxics Control Act (MTCA) Method B residential soil standard – **6.67 ppt** – This standard is used for cleanup of hazardous waste sites that have dioxins in the soil. While it can be a final cleanup level for sites that will have residential use, it is possible to have a higher number if the exposure pathways do not exist or have been mitigated.

U.S. Agency for Toxic Substances and Disease Registry (ATSDR) Residential Soil Screening Levels – **50 to 1000 ppt** - These levels are used as screens to trigger a more comprehensive, site-specific evaluation of potential human exposures. These screening levels are based on human exposure for direct ingestion of soils contaminated with dioxins.

* Application rates selected are the top of the reported range of application rates for these products in WA. The Wood Ash is reported to be only applied once per field.

** Formula to calculate soil concentration assumes a soil mixing depth of 15 cm (6 inches) and a soil density of 1.33 grams per cubic centimeters. The annual increase in soil concentration assumes a starting dioxin soil concentration of zero.

*** This product is applied directly to plants as a foliar nutrient and to soil. State officials are researching the range of application rates for this product.

DIOXINS SCREENING RESULTS

Material Sampled	TEQ Concentration (parts per trillion*)
Liming Material - Cement Kiln Dust sample #1	0.67
Liming Material - Cement Kiln Dust sample #2	0.95
Liming Material - Wood Ash (Hog Fuel Boiler)	35.4
Liquid Zinc Fertilizer	0.59
Liquid Zinc Fertilizer (Duplicate)	1.31
Steel Foundry Dust (K061) (Raw Material)	815
Granular Zinc Fertilizer from K061	342
Granular Zinc Fertilizer from K061 (Duplicate)	322
Tire Ash (Raw Material)	1.62
Granular Zinc Fertilizer from Tire Ash	5.60

*** In calculating the TEQ, concentrations of forms (congeners) that were not detected were assumed to equal 0. All are fertilizer products except as noted to be raw material.**

What are dioxin TEFs and TEQs?

There are 17 forms of dioxins considered to be toxic, but not all are equally toxic. The most toxic dioxin is called 2,3,7,8-TCDD, and other similar dioxins have been assigned toxicity values relative to it. These relative toxicity values are called toxicity equivalency factors (TEFs). 2,3,7,8-TCDD is assigned a TEF of 1, and the others are assigned values less than 1. Total concentrations of dioxins in the environment are reached by factoring in the TEF of each form of dioxin before adding them together. The resulting concentration is referred to as TEQ (toxic equivalent).

About Dioxins

Dioxins are unintended by-products formed when materials containing chlorine or chloride are burned, during chlorine bleaching of pulp and paper, or during the manufacture of pesticides and other chemicals. They are widespread in the environment and are commonly found in soils throughout the world at very low concentrations. EPA has classified dioxins as "probable" human carcinogens, which means there is sufficient evidence from animal studies but insufficient evidence from human studies. Other noncancer effects are also suspected.

It is important to note that federal studies show that dioxins are not readily absorbed by plants from the soil around them. The EPA estimates that eating meat, fish and dairy products is the primary pathway of human exposures to dioxins because dioxins accumulate in the fatty tissues of animals. However, EPA also estimates that dioxin-like compounds in meat and dairy products come from atmospheric deposition of dioxins originating from combustion and incineration sources, long-range transport in the environment, and recirculation of dioxins already in the environment. We currently don't know what contribution, if any, fertilizers are making to accumulation in animals and subsequent exposures to people, and what contribution this may make to a person's overall exposure.

For More Information

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