Fluoride: The Hidden Poison in the National Organic Standards

Asking organic farmers to adopt fluoride-free farming

by Ellen and Paul Connett, Ph.D.

[Editor's Note: This article raises serious health questions about the continued use of fluoride in food production, specifically organic farming systems, and in public water supplies. It leads to a larger discussion of allowable inert or secret product ingredients and permitted synthetic materials in organic agriculture under the national organic standards, adopted in December 2000. However, it should be noted that chemical-intensive practices in conventional agricultural systems incorporate polluting practices that also result in fluoride contamination and other pollution problems of a magnitude that far exceeds organic practices. Nevertheless, as consumers and farmers seek to improve and purify organic practices, we must face the challenges raised by Ellen and Paul Connett's article and others.]

Introduction

The U.S. Department of Agriculture's (USDA) revised rule on National Organic Standards (NOS), proposed in March 2000, was finalized in December 2000. For the most part, the standards have been written with care and integrity. For the rest, they attracted over 40,000 comments from the public. The standards were first proposed in 1997 and included proposals to use sewage sludge, irradiation, antibiotics in livestock, and genetically modified organisms. USDA withdrew the proposal after receiving over 275,000 comments from the public— the most comments received on any U.S. agency proposal in history.

In the main the public's efforts on this issue paid off well. In the final NOS the four practices listed above were out, but unfortunately, despite over 100 comments, those concerned about fluoride were ignored. Incredibly, the new standards allow the use of the toxic substance sodium fluoride in organic agriculture.

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Fluoride is a persistent and non-degradable poison that accumulates in soil, plants, wildlife, and humans. Many organic farmers may be unaware that this highly toxic substance has been allowed for use in the NOS, because its presence is hidden. However, it is there:

- As Sodium Fluoride tucked away in the U.S. EPA List 4B Inerts ("Inerts which have sufficient data to substantiate they can be used safely in pesticide products, according to EPA."), which are allowed for use in the NOS.

- In Bone Meal (which can contain 1000 ppm - or more- fluoride), also included in U.S. EPA List 4A Inerts ("Inerts generally regarded as safe, i.e., corn cobs and cookie crumbs," according to EPA).

To call sodium fluoride an "inert" is Orwellian and defies one of the NOS's stated principles: producers shall not use "natural poisons such as arsenic or lead salts that have long-term effects and persist in the environment." Fluoride is clearly in this category. Sadly, the use of fluoride in organic farming could undermine the public's confidence and safety in organic food- both here and abroad. This will become more obvious as the movement against fluoridation of public water picks up momentum worldwide. As it does, more and more people will be asking questions about fluoride levels in their food. Unlike the List of Inerts, fluoride levels in organic food cannot be hidden.

The purpose of this article is to argue the case against any use of fluoride in organic agriculture in the hope that despite these new standards it will encourage organic farmers to go "fluoride free." Before we proceed we wish to note the following:

- The Agency for Toxic Substances and Disease Registry (ATSDR) stated in 1993: "Existing data indicate that subsets of the population may be unusually susceptible to the toxic effects of fluoride and its compounds. These populations include the elderly, people with deficiencies of calcium, magnesium, and/or vitamin C, and people with cardiovascular and kidney problems... Because fluoride is ubiquitous in food and water, the potential for human exposure is substantial (ATSDR, p 112, 153)."

- The studies on which the U.S. EPA relied in establishing its maximum contaminant level (MCL) for fluoride in drinking water -4 parts per million (ppm)- and on which it has relied to perform risk assessments for fluoride pesticide residue levels were seriously flawed. Not only has the union representing professionals at EPA's Washington, DC headquarters called for an independent review of these studies, their concern led

TABLE 1

7 ppm Established Tolerances: For combined residues of the insecticidal fluorine compounds cryolite and synthetic cryolite (sodium aluminum fluoride) in or on the following:

Apricots; Beets, roots; Blackberries; Blueberries (huckleberries); Boysenberries; Broccoli; Brussels sprouts; Cabbage; Cauliflower; Citrus fruits; Collards; Cranberries; Cucumbers; Dewberries; Eggplant; Grapes; Kale; Kohlrabi; Lettuce; Loganberries; Melons; Nectarines; Peaches; Peppers; Plums (fresh prunes); Pumpkins; Radish, roots; Raspberries; Rutabaga, roots; Squash (winter); Squash (summer); Strawberries; Tomatoes; Turnip, roots; Youngberries.

them to two *unprecedented* actions. In 1986 they filed an Amicus Curiae brief in a lawsuit brought by the Natural Resources Defense Council against EPA for its MCL of 4 ppm for fluoride in drinking water. The union charged that the MCL was based on shoddy science and was not protective of public health. In 1997 the union announced its support of a citizens group fighting mandatory fluoridation in California.

- Elsewhere, we have gone into the dangers posed by water fluoridation (see "50 Reasons for Opposing Fluoridation," <http://www.fluoridealert.org>). A great deal of animal and human research, much of it published since 1990, points to fluoride's potential to damage the bones of the elderly, and interfere with the functioning of the brain, thyroid gland, pineal gland, kidney, and reproductive system.

- In 1998, a fluoride study published in *Brain Research* reported damage to rat kidneys and brain at very low doses. Rats were given 1 ppm fluoride in doubly distilled and deionized water for 52 weeks. In other words they were given the same levels as we get in fluoridated water, albeit without the other ions present in tap water. One group of rats was given aluminum-fluoride (AlF_3) and another, sodium fluoride (NaF). In both cases amyloid deposits were found in the rat brains. Amyloid deposits are tangles in the brain and are associated with Alzheimer's Disease and other forms of dementia. Scientists do not know why they form. The rats in the control did not have them. The authors of the study speculate that fluoride enables aluminum to cross the blood brain barrier (Varner et al). This paper has caused quite a stir in regulatory circles and has prompted both the NIEHS and the EPA to nominate aluminum fluoride for comprehensive study by the National Toxicology Program.

- In 1994, a FDA researcher published results from a study that found an association between residence in counties with high fluoride concentrations in drinking water (3 ppm) with decreased birth rates. The author raised the question "whether public health concerns and toxicologic research should not shift their focus from the isolated intake from fluoridated water to the potential toxicity of the total fluoride intake (Freni)." This suggestion is important, because surprisingly, a great deal of the promotion of fluoridation in the U.S. has centered on the concentration of fluoride in drinking water and has been very cavalier about the total dose of fluoride we get from ALL sources.

A Little History

Fluorine is one of 92 naturally occurring elements. It is a member of the halogen family, which includes chlorine, bromine and iodine. It is a pale yellow gas which is extremely reactive. As a result it is never found free in nature but only combined with other elements. These compounds are called fluorides. Fluorine readily forms compounds with all elements except two: helium and neon. Despite being the thirteenth most abundant element in the earth's crust, it is not an essential nutrient for any living thing.

The level in human milk is 100 times lower than infant formula reconstituted with fluoridated drinking water, e.g. 0.01 ppm vs 1.0 ppm. Apart from its reaction with the calcium hydroxy apatite found in dental enamel, bone, and the pineal gland, fluorine has never been incorporated into the building blocks of living things.

The most common mineral containing fluorine is fluorspar (CaF_2). It has been used for centuries as a flux in the smelting of ores and gave fluorine its name (from the Latin word fluere meaning "to flow"). Other important mineral sources of fluorine are cryolite (Na_3AlF_6), flurapatite ($Ca_5(PO_4)_3.F$) and other phosphate rocks.

Before World War II, fluorine could only be generated in very small quantities for experimental purposes "and could not be purchased at any price." The breakthrough to large scale production came from the work of the Manhattan Project's efforts to build the Atomic Bomb (Kirk et al). Massive quantities of fluorine were necessary to separate and concentrate the uranium isotopes

After World War II, huge quantities of fluorine have been used to produce organofluorine compounds (compounds where fluorine is attached to carbon). These include chlorinated fluorocarbons (CFCs); Teflon® (polytetrafluoroethylene), an extremely stable plastic resistent to the vast majority of chemicals including fluorine gas; and many pharmaceuticals and pesticides.

The Sources of Fluoride Getting into the Food Supply

1. Background levels of fluoride in food.

According to Waldbott et al, "Virtually every food contains at least some fluoride. Plants take it up from the soil and from the air. From the soil, fluoride is transmitted through fine hair rootlets into the stems, and some reaches the leaves. Plants absorb more fluoride from sandy than from clay soil and more from wet and acid soils than from dry and alkaline ones... (Waldbott et al, p 37)."

According to the Department of Health and Human Services (DHHS), "Fresh or unprocessed foods available in the U.S. have fluoride concentrations that generally range from 0.02 to 2.00 ppm. Marine fish that are consumed with bones and bone meal supplements have been shown to be a rich source of fluoride in human food. The bones of some land-based animals also contain high levels of fluoride (DHHS, p 10)."

2. Cooking with fluoridated water.

According to ATSDR, "Cooking food in fluoridated water results in increased dietary fluoride levels (p 151)." Approximately 60% of U.S. public drinking water supplies are fluoridated. Unlike chlorine, fluoride does not enter the steam when water is boiled. Thus during cooking the fluoride increases in concentration.

3. Processed food and beverages.

One of the unexpected results of water fluoridation was the multiplier effect caused by the processing of foods and beverages using fluoridated water. According to DHSS, "The natural food content of most foods is so small that its contribution is insignificant compared with the amount of fluoride produced through cooking and processing food in fluoridated water (p 10)." However, that comment may not have included the contribution made by pesticide residues containing fluoride.

4. Pesticides.

We have identified approximately 150 fluoridated pesticides. The three most widely used are herbicides: Trifluralin, Fluometuron and Benefin (Befluralin) (EPA, Aug 97). The category "Fluorine Insecticides" include Cryolite, Barium hexafluorosilicate, Sodium hexafluorosilicate, Sodium fluoride, and Sulfluramid.

TABLE 2

1997: Proposed tolerances for combined residues of the insecticidal fluorine compounds cryolite and synthetic cryolite (sodium aluminum fluoride) in or on the following. EPA has yet to make a decision on these proposed new tolerances.

Commodity	Current	Proposed
cabbage	7 ppm	45 ppm
citrus fruits	7 ppm	95 ppm
collards	7 ppm	35 ppm
eggplant	7 ppm	30 ppm
lettuce	7 ppm	
head		180 ppm
leaf		40 ppm
peaches	7 ppm	10 ppm
raisins	none	55 ppm
tomatoes	7 ppm	30 ppm
tomato paste	none	45 ppm

(Federal Register: August 7, 1997)

5. The use of cryolite in agriculture.

Cryolite is a naturally occurring inorganic substance; however, most present day supplies of cryolite are synthetically produced. It is used on many fruits, vegetables and ornamental crops to protect against leaf eating pests. Cryolite is formulated as dusts, wettable powders and water dispersible granulars and can be applied by ground or aerial spray. The predominant use of cryolite is on California grapes followed by potatoes and citrus.

Cryolite was first registered as a pesticide in the U.S. in 1957. Its insecticidal mode of action is predominantly as a stomach poison. Fluoride has been identified as the residue of toxicological concern (Federal Register, March 1997).

The fact that cryolite contains an aluminofluoride ion which loses fluoride ions in solution is of considerable concern. It is well established that the complex ion AlF4- is able to switch on G-proteins which are of fundamental importance in the transmission of messages from some water soluble hormones and neurotransmitters across cell membranes (Strunecka and Patocka).

California grape growers use cryolite to control two insects that can devastate vineyards. Researchers from California State University in Fresno conducted a 5 year study (1990-1994) on vineyards throughout the San Joaquin Valley. They found that "[m]ultiple applications of Cryolite during the growing season significantly increase fluoride in wines." Notably they found fluoride levels between 3 - 6 ppm in Zinfandel, Chardonnay, Cabernet Sauvignon, Chenin Blanc, Thompson Seedless, Barbera, Muscat Candi, Ruby Cabernet; and levels between 6 - <9 ppm in French Colombard and Zinfandel. They noted "that fluoride levels in wine produced from grapes not treated with Cryolite can range from 0.1 to 1.6 ppm, depending upon location and variety (Ostrom)." At 6 ppm one glass of wine (175 ml) would have delivered as much fluoride as about a liter of optimally fluoridated water!

In the 1990's a 3 ppm fluoride limit was in effect for U.S. wines exported to European Communities (EC). However, the EC recently lowered the allowable levels of fluoride in wine to 1 ppm. (Note: the vast majority of EC countries do not fluoridate their water). Responding to the potential loss of a $250 million export market, California received a time-limited residue tolerance for Tebufenozide on grapes as an alternative to cryolite. As stated in EPA's approval: "... for the 2000 crop year, nearly all major California wineries with export markets have advised their growers that they will not accept grapes which have been treated with cryolite or any other product which would affect the level of fluorides in wines. There is a direct correlation between even limited use of cryolite on wine grapes which can result in fluoride levels in wine above 3 ppm (Federal Register, July 2000)."

The current tolerance levels for cryolite on allowed crops is 7 ppm (see Table 1). In 1997 EPA proposed much higher tolerances (see Table 2). In 1997 EPA re-extended a time-limited tolerance use (up to November 21, 2001) of 22 ppm for potato waste, a processed animal feed commodity and a

2 ppm fluoride residue in or on raw potatoes (Federal Register, Dec 1997).

In our view, the current tolerance level of 7 ppm is high. The tolerances proposed in 1997 (Table 2) are exceedingly high and EPA has not made a final decision on them. What is extremely disturbing is that the proposed increases were not based on any new toxicological or health considerations but simply on the calculations by the cryolite pesticide producers of what residues were left after typical spraying operations! Instead of proposing different spraying strategies the EPA came back and proposed increasing the tolerance level. In other words the EPA is adjusting its toxicological analysis to fit industry's needs, not to protect the public health or the environment. Moroever, out of the 95 references cited in EPA's 155 page report for these tolerances, only 2 were published in the open literature. Of the two published reports, one was a 1975 paper on toxicity of chemicals to honey bees, and the second was the intensely controversial 1990 National Toxicology Program (NTP) report on fluoride's carcinogencity. The majority of the unpublished papers were submitted by the producers of cryolite pesticides (U.S. EPA, 1996).

[Sodium flouride] is obtained as a waste product from the superphosphate fertilizer industry containing other toxic contaminants . . . like arsenic, lead, and even traces of radioactive isotopes.

6. Sodium fluoride (NaF).

Sodium fluoride is used as a rodenticide and insecticide (mainly for roaches and ants), as a disinfectant for fermentation apparatus in breweries and distilleries, in wood preservation, and in rimmed steel manufacture (ATSDR, p 138). NaF is far more toxic than cryolite because it is far more soluble in water and thus more readily taken up by plants and absorbed by animals.

ATSDR states that the main use of NaF is as a drinking water additive for prevention of dental caries, but fails to point out that this is obtained as a waste product from the superphosphate fertilizer industry containing other toxic contaminants (see below).

We had requested information from USDA on the uses of NaF in organic agriculture. They have not replied. It is possible that the NaF which is allowed, like the agent used for fluoridating public drinking water, is an industrial waste product. In which case in addition to the toxicity of fluoride must be added concern about contaminants like arsenic, lead, and even traces of radioactive isotopes. This is an incredible state of affairs for something described as an "inert" in EPA's list 4 inerts included in the NOS!

7. Superphosphate fertilizer.

Phosphate rock minerals are the only significant global resources of phosphorus. Approximately 90% of phosphate rock production is used for fertilizers and animal feed supplements, which are defluorinated, and the balance for industrial chemicals (U.S. Geologic Survey, 1999).

In the U.S., phosphate rock is produced by 11 companies at 18 mines. 12 mines in Florida and 1 in North Carolina accounted for 86% of domestic production. The U.S. accounted for more than 50% of global trade of converted phosphate products.

Because phosphate rock contains considerable quantities of fluoride (up to 5%) the superphosphate industry has been a key player in fluoride pollution and exposure of people to fluoride for over a century.

Firstly, the superphosphate itself contains residual fluoride and according to a 1971 study cited by the ATSDR: "fertilization with superphosphates added to the soil 8-20 kg fluoride/hectare (ATSDR, p 146)." Phosphate fertilizers contain between one and three percent fluoride, and "fertilized tuber plants such as potatoes, beets, radishes, etc., assimilate more fluoride from the soil than from the atmosphere (Waldbott et al, p 37)."

Secondly, to prepare superphosphate, phosphate rock is heated with sulfuric acid. This results in the release of gaseous hydrogen fluoride and silicon tetrafluoride. Prior to World War II this led to considerable damage to local farmland and grazing cattle. Today, most of the hydrogen fluoride and silicon tetrafluoride are captured in wet scrubbing systems producing a solution of hexafluorosilicic acid, together with other toxic contaminants such as arsenic, lead and trace amounts of radioactive isotopes.

Thirdly, the hexafluorosilicic acid captured by the superphosphate fertilizer industry is then sold for fluoridating our public drinking water. Over 90% of the fluoridated waters systems in the U.S. use either hexafluorosilicic acid or the sodium salt made from it.

So one way or another the fluoride from the superphosphate industry enters our bodies via our food, our air or our water!

8. Powdered or raw phosphate rock.

Organic farmers and gardeners are advised to use powdered phosphate rock as a "natural" fertilizer. Unfortunately in this context, the word "natural" does not mean benign. In addition to containing 2-5% fluoride, the raw phosphate rock also contains a number of other toxic substances. The following advice is listed in our 1978 edition of *The Encyclopedia of Organic Gardening*: the use of Phosphate rock is as an "excellent source of phosphorus for fertilizer use... it contains 65 percent calcium phosphate or bone phosphate of lime as well as ... calcium, carbonate, calcium fluoride, iron oxide, iron sulfide, alumina, silica, manganese dioxide, titanium oxide, sodium, copper, chromium, magnesium, strontium, barium, lead, zinc, vanadium, boron, silver, and iodine... Phosphate rock today has been ground finer than talcum powder, so that a significant part of it is gradually available to the plant... (Rodale, p 863)."

What you can do:

Request a "Specific Prohibition" for Sodium Fluoride and Bone Meal (on EPA's List 4 Inerts) from the "National List." This is the list of approved and prohibited substances in the National Organic Standards. Petitions should be submitted to: Program Manager, USDA/AMS/TMP/NOP, Room 2945, South Building, P.O. Box 96456, Washington, DC 20090-6456.

We would add that unfortunately this means that the fluoride is also slowly available for uptake into the plants and thence into our "wholesome organic" diet.

9. Bone meal.

Another concern with organic gardening and farming is the use of bone meal, which is allowed for use in the National Organic Standards under EPA's List 4 Inerts. This meal is prepared mainly from the bones of farm animals. Fluoride concentrates in the bones of all mammals and we can expect concentrations to be in the 1000 ppm plus range. There is also the concern about transmission of Mad Cow disease through contact with bone meal.

10. Industrial air pollution.

In addition to the Superphosphate industry, discussed above, many other industries put fluoride compounds into the air, some of which ends up in our food. These include: aluminum smelters, zinc smelters, brickworks, ceramic works, steel mills, uranium enrichment facilities, coal fired power plants, and oil refineries.

"An estimated 74% of the reported fluorspar (CaF2) consumption in the United States in 1995 went into the production of hydrogen fluoride (HF) in Louisiana, Texas, and Kentucky. HF is the primary ingredient from which virtually all organic and inorganic fluorine-bearing chemicals are produced (U.S. Geologic Survey, 1997)."

In 1998, the Toxic Release Inventory (TRI) ranked Hydrofluoric Acid number 6 for Toxic Air Releases in the U.S.

Conclusion

A recent analysis of the Canadian food basket indicates that a typical North American diet delivers about 1.8 mg of fluoride per day (Dabeka, 1995). This is nearly twice the amount of fluoride one would receive from drinking one liter of fluoridated water. Some of this fluoride we can do little about, but the one source we should not have to contend with is that introduced by organic farmers. When we pay extra money to avoid pesticides, we don't expect to get doses of an extremely toxic pesticide! Thus, even though these new National Organic Standards permit organic farmers to use bone meal and sodium fluoride, we urge them not to do so. We also urge them to avoid the use of powdered phosphate rock. We urge readers to make their voices heard on this issue. In the future, we will be looking for labels that say "organic" and "fluoride free".

The National Organic Standards are available at:
www.ams.usda.gov/nop

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