AMERICAN UNIVERSITY
WASHINGTON, DC

Robert Perciasepe
Administrator (Acting)
U.S. Environmental Protection Agency

DEPARTMENT OF CHEMISTRY

April 22, 2013

Dear Administrator Perciasepe:

On behalf of my co-petitioners, I am submitting on this 43rd anniversary of Earth Day a petition (enclosed) pursuant to 15 United States Code, Chapter 53, Section 2620, also known as section 21 of the Toxic Substances Control Act (TSCA), requesting that you take an action that will save the United States between $1 billion and $6 billion annually. The action will simultaneously prevent hundreds of cases of lung and bladder cancer through the reduction in the amount of arsenic now being delivered to our citizens who drink water that is fluoridated with hydrofluorosilicic acid (HFSA).

Our petition asks that you exercise authority under section 6 of the TSCA , (15 United States Code, Chapter 53, Section 2605), to prohibit the use of HFSA as a water fluoridation agent. A commercially available substitute, pharmaceutical grade sodium fluoride, delivers at least 100-fold lower levels of arsenic than does HFSA when water authorities choose to adjust their water supply to contain about 0.7 milligrams per liter of fluoride.

By prohibiting the use of HFSA the Agency will not be taking any action that would interfere with local decisions about whether or not to artificially fluoridate water supplies. Rather, the Agency would mandate that citizens of the Unites States not be subjected to unnecessarily increased cancer risks – based on the Agency's own analysis of arsenic's carcinogenicity, that as a society we reduce the cost of medical care by a substantial amount, and that the public water systems of the United States no longer be used as extremely profitable hazardous waste disposal sites for the phosphate fertilizer manufacturing industry.

As a former EPA senior scientist during your tenure as Assistant Administrator for the Office of Water, I look forward to working with you once again to help protect the health of our citizenry.

Sincerely,

J. William Hirzy

J. William Hirzy, Ph.D.
Chemist In Residence
202-885-1780

COLLEGE OF ARTS AND SCIENCES
4400 MASSACHUSETTS AVENUE, NW WASHINGTON, DC 20016-8014 202-885-1750 FAX: 202-885-1752

April 22, 2013

Citizens Petition in re: Use of Hydrofluosilicic Acid in Drinking Water Systems of the United States

1. Introduction: This petition seeks a determination by the United States Environmental Protection Agency under authority of 15 United States Code, Chapter 53, Section 2605, that, where implemented, artificial fluoridation of public water supplies, which is not here challenged as a public policy measure, be accomplished exclusively by the use of pharmaceutical or food grade materials, and that, for this purpose, hazardous waste by-products of domestic and foreign industries, most particularly hydrofluosilicic acid (HFSA including its derivative sodium salt) be prohibited in the interests of public health and economy.

HFSA meets the criteria for classification as a hazardous waste (toxicity, reactivity and corrosivity) under 42 United States Code, Section 6901 et seq.

Artificial fluoridation of public drinking water supplies in the United States began on an experimental basis in 1945 using sodium fluoride, largely derived from by-products of the aluminum smelting industry. By 1951 drinking water fluoridation had become a national policy goal of the U.S. Public Health Service, and shortly thereafter sodium fluoride began to be replaced by hydrofluorosilicic acid (HFSA), a waste by-product of the phosphate fertilizer manufacturing industry. Presently, about 90 percent of drinking water systems that add fluoride use HFSA including its derivative sodium salt (known together as "silicofluorides") as the fluoridating agent., and well over 150,000,000 people in the United States consume silicofluorides in their drinking water. They are not pharmaceutical grade substances. Collectively, the public water supply systems of the United States are now a hazardous waste disposal system for these products.[1]

With the advent of fluoridated tooth pastes and other such pharmaceutical products in the 1950s and 1960s, pharmaceutical grade sodium fluoride and other fluoride containing compounds came on the market.

Silicofluoride agents used for artificial fluoridation of public water supplies contain arsenic. For example, HFSA is typically reported by suppliers to contain about 30 parts per million (ppm), or 30 milligrams of arsenic per kilogram of HFSA. This amount of arsenic in HFSA delivers about 0.078 micrograms of arsenic per liter of drinking water, based on calculations shown in Reference 1. The United States Environmental Protection Agency (USEPA) has set a health-based standard for arsenic in drinking water, known as the Maximum Contaminant Level Goal, of zero, based on arsenic's ability to cause cancer in humans. Pharmaceutical grade of sodium

[1] This petition seeks a reversal of the policy expressed in a letter from Deputy Administrator for Water, Rebecca Hanmer, to Leslie A. Russell dated March 30, 1980, insofar as it states: "In regard to the use of fluosilicic acid (sic), this Agency regards such use as an ideal environmental solution to a long-standing problem. By recovering by-product fluosilicic acid from fertilizer manufacturing, water and air pollution are minimized, and water utilities have a low-cost source of fluoride available to them."

fluoride is available containing typical levels of arsenic of less than 1 milligram per kilogram of sodium fluoride, which delivers 0.00084 micrograms of arsenic per liter of drinking water, a 99% reduction from the amount delivered by HFSA.

Of the HFSA which is disposed of in the nation's drinking water supplies, over 99 percent is used for flushing toilets, washing clothes, bathing, showering, watering lawns, and the like, and is simply widely redistributed back into the environment, illustrating the use of the nation's drinking water systems as simply a convenient way to deal with this hazardous waste and giving truth to an aphorism unworthy of the United States Environmental Protection Agency, "dilution is the solution to pollution."

Petitioners contend that, for USEPA to allow foreign and domestic fertilizer producers to dispose of their hazardous waste in the drinking water of the United States and to deny this petition on the basis of comparative prices of HFSA and USP grade sodium fluoride, it must abrogate its duty to protect public health and its stated policy on carcinogens, in this case arsenic, by mandating that a higher level of a carcinogen be present in drinking water.[2] Furthermore, as shown in Reference 1, the net cost to the citizens of the United States of using HFSA is, conservatively, at least $1 billion -$6 billion more per year than using the pharmaceutical grade of sodium fluoride. These savings are based on risk and cost of treating cancers data published by USEPA at *Federal Register* 66 (14) 6975 – 7066, January 22, 2001, in its Final Rule establishing its current Maximum Contaminant Level for arsenic.

2. Petitioner Information: Petitioners are citizens of the United States, some residing in the District of Columbia, and at the time of filing are students, alumni and faculty at American University. Other petitioners also are residents of the United States concerned about the adverse health effects attributable to the addition of silicofluorides to their drinking water. Written inquiries to or concerning the petitioners may be addressed to Dr. William Hirzy, 506 E Street, N.E., Washington, D.C. 20002.

3. Description of the Problem: The problem is two-fold: (A) direct contamination of drinking water with heavy metals, particularly arsenic, contained in hydrofluosilicic acid; and (B) subsequent contamination of drinking water flowing through piping systems with lead-brass or other lead fixtures by silicofluorides in conjunction with chloramine.

(A) Many public water authorities in the United States use hydrofluosilicic acid, CASN 16961-83-4, to adjust the fluoride level in finished drinking water to about 0.7 milligrams per liter (mg/L). The HFSA used in this way is a by-product of the manufacture of phosphate fertilizers, and is formed when phosphate containing ores, which also contain fluoride and silicon compounds among other substances, are heated with sulfuric acid. The chemical reaction between sulfuric acid and the ore mixture produces, among other substances, silicon tetrafluoride and hydrogen fluoride, which are gases that must be prevented from escaping into the environment where they would cause significant harm. See footnote 1.

---

[2] **Chemical Contaminants -- Carcinogens:** If there is evidence that a chemical may cause cancer, and there is no dose below which the chemical is considered safe, the MCLG is set at zero. The **MCLG** for **arsenic** is zero.

(B) These gases, and other substances, are removed from the off-gas stream from the reactor vessel by passing them through a water spray system called a scrubber. The silicon tetrafluoride and hydrogen fluoride combine in the water to form a solution of HFSA. The concentration of HFSA in water is about 25 percent by weight when the solution is transferred to storage or transportation vessels.

Among the other substances present in the HFSA as ultimately sold to water authorities are so-called heavy metals, which include arsenic and lead. In addition, phosphate ores are known to contain radionuclides, and in fact have been a source of uranium for defense and electric power generation uses. See Reference 2. Under provisions of the Safe Drinking Water Act (SDWA), these heavy metals and radionuclides all have the same Maximum Contaminant level Goal (MCLG) of zero, meaning that the Environmental Protection Agency (EPA) does not recognize any level of these substances to be safe when in drinking water[3].

HFSA as supplied by distributors, as to which see Reference 1, contains arsenic at about 30 mg/kg of HFSA[4]. In addition it has been reported that "90 percent of the arsenic that would be contributed by treatment chemicals is attributable to fluoride addition." See Reference 3.

Some phosphate producers convert HFSA to its sodium salt by reacting the acid with sodium carbonate or sodium hydroxide, and the resulting solid, sodium hexafluorosilicate, is used rather than HFSA by some water authorities for fluoridation[5]. Petitioners assert that conversion of the acid to the sodium salt does little or nothing to reduce the levels of lead, arsenic and radionuclides in the final fluoridation product solution used for fluoridation.

Whether HFSA or its sodium salt is used by a particular water authority, work by Richard Maas et al.(Reference 4), Myron Coplan et al., (Reference 5) and Marc Edwards et al. (Reference 6) shows that chloramine, when used as a disinfectant in water systems, results in leaching of lead from lead-containing water piping systems into water (Edwards), and that when chloramine is used in conjunction with silicofluorides greatly enhanced leaching of lead into water occurs (Maas). Maas et al. have shown that when sodium fluoride is used as the fluoridating agent, rather than a silicofluoride, leaching of lead is greatly reduced or eliminated altogether. The publications by Coplan et al. and Edwards et al. offer an explanation of the elevated blood lead levels observed in children residing in Washington, D.C. in 2001-2004.

While not attributing their findings directly to increased leaching of lead from water delivery systems, Masters and Coplan (Reference 7) and Masters et al. (Reference 8) have shown that

---

[3] EPA has delegated authority to set standards for contaminants introduced into drinking water through "water treatment" chemicals to NSF, Inc.. That organization has established Standard 60, which limits the amount of any contaminant having a Maximum Contaminant Level (MCL) Primary Drinking Water Standard under the SDWA that may be introduced through use of a "water treatment" chemical to less than ten percent of the MCL.

[4] While EPA delegated authority to NSF, Inc. to, in effect, assure the public through its Standard 60 that no more than ten percent of any contaminant for which a Primary Drinking Water Standard exists, evidence submitted with this petition (Reference 1) shows that water authorities (or some suppliers) feel under no obligation to provide analytical evidence to consumers that batches of HFSA they use comply with Standard 60.

[5] The solid sodium hexafluorosilicate is dissolved in water in a "day tank" to produce a solution of the hexafluorsilicate ion that is then metered into the finished water.

children drinking water fluoridated with silicofluorides are at increased risk of having elevated blood lead levels.

4. Nature and Severity of Harm Caused by Contaminants in HFSA: EPA's Drinking Water Contaminants website cites increased risk of cancer as a common concern for all radionuclides and arsenic, justifying the SDWA MCLG of zero for these substances. That same website cites delays in physical or mental development and deficits in learning abilities as concerns for exposure to lead. EPA's Integrated Risk Information System provides further justification for the SDWA MCLG of zero for lead with the following quote: "....changes...in aspects of children's neurobehavioral development may occur at blood lead levels so low as to be essentially without a threshold." The well established toxic effects of lead are dealt with by Marcus (Reference 9).

The social costs attributable to increased blood-lead levels and their sequelae associated with use of SiFs as fluoridating agents, have been addressed by Masters et al (References 10a and 10b) and are not directly a part of this analysis. These latter costs to society may well exceed those associated with cancer treatments.

For example, a recent study by Shapiro and Hassett (Reference 11) of the social cost of violent crime shows that direct (e.g., medical treatment, lost salary) and indirect (e.g. pain and suffering) costs in just four cities – Chicago, Boston, Philadelphia and Seattle – which use HFSA to fluoridate total about $10.3 billion/year. If as little as ten percent of those costs, which do not include lower housing values and reduced tax revenue, were avoided, then the social benefit of substituting USP NaF for silicofluorides would increase by about $ 1 billion/year for those four cities alone.

With respect to the excess cancer cases caused by arsenic in HFSA a recent publication by Hirzy et al., (Reference 1), shows that for typical levels of arsenic in HFSA and pharmaceutical grade NaF, the latter produces about 100 fold fewer lung and bladder cancer cases than the former. That study also shows that using typical pharmaceutical grade NaF rather than HFSA delivering an average level of arsenic reported as determined by NSF tests, as to which see the supplemental material in Reference 1, results in over 500 fold fewer lung and bladder cancer cases. On a national scale, these differences result in increased social cost to the United States from using HFSA of about $1 billion to nearly $6 billion annually as shown in Reference 1. Use of HFSA that complies with the NSF/ANSI Standard 60 for arsenic would result in 1200 fold more lung and bladder cancer cases than pharmaceutical grade NaF, resulting in increased social costs for the country of over $14 billion annually, which calls that standard into serious question. See Reference 1

The financial costs above do not account for the additional pain and suffering of those afflicted with these extra cancer cases, nor the anguish of their friends and families.

5. Petitioners' Remedy and Requested Relief: An alternative source of fluoride for water fluoridation exists that would not contribute to drinking water levels of arsenic, lead or radionuclides comparable to those in HFSA. USP Pharmaceutical grade sodium fluoride (NaF) of the quality used in some tooth pastes must contain no more than 0.003% "heavy metals."

Commercially available (Reference 1) USP Grade NaF can be purchased containing no more than 0.00002% arsenic "as As_2O_3" (equivalent to 0.000015% or 1.5 mg As/kg NaF) and no more than 0.003% "heavy metals, as lead."

With respect to lead leaching, NaF does not contribute to leaching of lead from brass water fittings or other lead-containing water delivery hardware (Reference 4). By requiring the replacement of HFSA with commercially available USP Grade NaF in those locations that choose to adjust the fluoride level of their water supply, EPA will take concrete steps to reduce levels of a contaminant (lead) for which the MCLG is zero.

In terms of convenience to water authorities with respect to reduction of leached lead levels in drinking water, those authorities, such as that serving the metropolitan Washington D.C. community, which add orthophosphate for that purpose can cease adding one salt solution (orthophosphate) and begin adding another (NaF) using essentially the same engineering. At the same time those authorities can eliminate the costly maintenance and safety aspects of dealing with highly corrosive HFSA.

Petitioners note that EPA is prohibited from *requiring* (emphasis added) the addition of "any substance" to drinking water for preventive health care purposes, and are using the example of USP grade sodium fluoride as a substitute for HFSA only to illustrate that if local or state water authorities elect to add fluoride to their water supplies, they may do so without the elevated risks of cancer or neurotoxicity to their citizens that come with HFSA.

In summary, by granting petitioners' requested relief, USEPA will reduce the levels of two drinking water contaminants for which its health based standards are zero. It will thereby reduce risks of lung and bladder cancer and of brain damage to children, as to which see References 5 through 10, and will save the nation at least $1 billion in annual health care costs through lower lung and bladder cancer rates. Even greater savings may be realized through lowering blood lead levels in the population. Petitioners reiterate that the risk levels and costs for treating lung and bladder cancer cases used above are derived from the Agency's "National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring; Final Rule," published in 2001 (See Reference 1).

REFERENCES

1. Hirzy, J.W., Carton, R.J., Bonanni, C.D., Montanero, C.M., Nagle, M.F. Comparison of hydrofluorosilicic acid and pharmaceutical sodium fluoride as fluoridating agents – a cost-benefit analysis *J. Environmental Science and Policy* (In Press) DOI 10.1016/j.envsci.2013.01.007

2. a) DeMarthe, J., Solar, S. Process for the recovery of uranium contained in phosphated compounds. *U.S. Patent T970007*. Jan. 19, 1982. b) Stein, M., Starinsky, A. and Kolodny, Y. Behaviour of uranium during phosphate ore calcining. *J. Chem. Technol. and Biotechnol.*. 32 834-847 (1982).