State Of Wisconsin **Circuit Court** **Fond Du Lac County**

SAFE WATER ASSOCIATION, INC.,

Plaintiff,

vs.

Case No. 92 CV 579

CITY OF FOND DU LAC,

Defendant.

AFFIDAVIT OF ALBERT W. BURGSTAHLER, Ph.D.
IN SUPPORT OF MOTION FOR SUMMARY JUDGMENT

State of Kansas
Douglas County

Albert W. Burgstahler, Ph.D., being first duly sworn on oath and with personal knowledge of the information contained herein, respectfully states to the Court as follows:

EDUCATION AND EXPERIENCE

1. I am a professor of chemistry on the faculty of the Department of Chemistry, The University of Kansas, Lawrence, Kansas 66045.
2. I was born in Grand Rapids, Michigan, on July 10, 1928, and was graduated magna cum laude from the University of Notre Dame in 1949 with a B.S. degree in Chemistry. I received my M.A. (1950) and Ph.D. (1953) degrees in organic chemistry from Harvard University. I then did postdoctoral research at the University of London (Birkbeck College) and later at the University of Wisconsin (Madison) before becoming Instructor of Chemistry at the University of Kansas in 1956. In 1957 I was appointed Assistant Professor of Chemistry at Kansas. In 1961 I was promoted to the rank of Associate Professor and in 1965 to the rank of Professor.
3. Some of my honors are: Visiting Scientist, National Institutes of Health, Bethesda, Maryland (summers, 1958 and 1961); Alfred P. Sloan Research Fellow, University of Kansas (1961-1964); Notre Dame Centennial of Science Award (1965); President, International Society for Fluoride Research (1971-1974); McGregory Lecture, Colgate University (November 1979).
4. My principal areas of chemical research are in the field of organic synthesis and the chemistry of natural products with current emphasis on stereostructural and optical rotational properties of conjugated chiral dienes and enones. My interest in fluoride research began in the early 1960s with studies on the synthesis and biological properties of fluorinated amino acids. Subsequently I broadened this interest to problems concerning fluoride in the environment and water fluoridation.
5. Besides approximately 100 reports and articles on my chemical research, I have authored or co-authored numerous articles and review on various aspects of fluoride and fluoridation, including (partial listing):
    a. Dental and Medical Aspects of Fluoridated Drinking Water,

Transactions of the Kansas Academy of Science, 1965.

b. In Vivo Studies with Fluoroproline, Nature, 1966.
c. Review of J. H. Simons, Fluorine Chemistry, Volume IV, AMA Archives of Environmental Health, 1967.
d. Fluoridation and the Problem of Dental Caries, National Health Federation Bulletin, 1967.
e. Better Diet vs. Fluoridation, National Fluoridation News, 1967 (reprinted in Prevention, 1967).
f. Scientists and Fluoridation, Vitalstoffe Zivilisations-krankheiten, 1968; later versions in Natural Food and Farming, 1968; National Fluoridation News, 1968; Prevention, 1968; and The Register of Phi Lamda Upsilon, 1970.
g. Review of R. Y. Eagers, The Toxic Properties of Inorganic Fluorine Compounds, FLUORIDE, 1970.
h. Fluoride and Down's Syndrome (Mongolism), FLUORIDE, 1975.
i. Review of D. Rose and J. R. Marier, Environmental Fluoride, 1977, Journal of the American Chemical Society, 1979.
j. Review of E. Johansen et al., Continuing Evaluation of the Use of Fluorides, FLUORIDE, 1980.
k. Effects of Supplemental Vitamin E on Dental Fluorosis in Rats. A Qualitative Preliminary Study, FLUORIDE, 1985.
l. Water Fluoridation: Promise and Reality, National Fluoridation News, 1985.
m. Osteoporotic Hip Fractures and Fluoridation, FLUORIDE, 1986.
n. Should We Fluoridate Our Drinking Water? No, It Isn't Safe. U.S. Water News, 1986.
o. Continuing Controversy over Fluoride Tolerance for Dairy Cattle, FLUORIDE, 1987.
p. Review of W. Varney, Fluoride in Australia - A Case to Answer, FLUORIDE, 1988.
q. Effect of Carbon Treatment on Aqueous Fluoride Determinations, FLUORIDE, 1993 (in press).

6. In addition to the foregoing publications, I am a collaborating co-author, along with Prof. H. Lewis McKinney, of the book, Fluoridation: The Great Dilemma, by the late (1898-1982) George L. Waldbott, M.D. (with a Foreword by the late [1896-1981] Alton Ochsner, M.D., of the Ochsner Clinic in New Orleans), Coronado Press, 1978.
7. Beginning in the 1960s I initiated an extensive search of the biomedical literature pertaining to fluoride and fluoridation. Before that time, based on what I and many others had been led to believe, I had viewed water fluoridation as an effective and safe way to help prevent dental caries (tooth decay). From my study of many of the original research reports, however, I was compelled to reconsider that viewpoint and soon found it untenable. In particular, I was impressed (and disturbed) by the fact that the actual evidence for significant dental benefit was questionable and that there were many clear and unmistakable findings of harmful effects even from fairly low levels of fluoride intake.

HISTORICAL BACKGROUND

8. The element fluorine is the lightest and most reactive of the group of chemical elements known as the halogens--the others being chlorine, bromine, iodine, and the radioactive element astitine. Fluorine is widely distributed as the 13th or 14th most abundant element in the earth's crust and occurs naturally mainly as relatively insoluble inorganic fluorides.

9. In 1931 the highly toxic nature of inorganic fluorides became a matter of heightened general concern with the discovery that relatively small amounts of fluoride ion in the drinking water of children are responsible for the unsightly endemic dental defect known as mottled enamel. Previously, the devastating effects of volcanic and industrial fluoride emissions on livestock and vegetation had been recognized and were also of increasing concern. Moreover, the acute toxicity of fluoride in decigram (0.1 gram) amounts to humans was well documented, but the chronic, cumulative toxicity of milligram (0.001 gram) levels of intake still awaited investigation. Mottled enamel, or dental fluorosis, which results from fluoride interference with enamel-forming cells prior to tooth eruption, is one of the first visible signs of chronic fluoride poisoning.
10. Dental surveys by the United States Public Health Service during the 1930s appeared to indicate less tooth decay (dental caries) among children in certain areas where dental fluorosis was found. At the time it was recognized, however, that such lower caries rates might be due, at least in part, to other components in the drinking water and/or diet besides fluoride. In fact, later work showed this was indeed the case. Nevertheless, the proposal was made to increase the fluoride content of ordinary low-fluoride water supplies to a level of about one part of fluoride ion per million parts of water as an effective way to reduce dental caries by 50 to 70 percent without causing significant dental fluorosis or other toxic effects. Subsequent findings, however, have shown that this goal has not been achieved. Dental fluorosis in fluoridated communities is more extensive and more severe than predicted, and the anti-caries effect of fluoridation has been found to be negligible or at best only marginal.

FLUORIDATION AND DENTAL CARIES

11. Within six years after the inception of trial studies in 1945, fluoridation was reported to have produced a dramatic reduction in the incidence of dental caries in children, and on June 1, 1950, the U. S. Public Health Service gave its approval and recommendation for widespread adoption of the procedure. Other health organizations quickly followed suit, thereby making it extremely difficult and often professionally suicidal for public health officials, physicians, dentists, and waterworks engineers not to support fluoridation, despite evidence that the original studies were seriously flawed and that verified harmful effects were being observed and reported. Having given their unqualified endorsement to fluoridation, leaders of many professional organizations were, and continue to be, reluctant to consider members in good standing who question or challenge fluoridation, no matter how strong their grounds for doing so may be. (Exhibits_____).
12. In the study by the Public Health Service of fluoridation in Grand Rapids, Michigan, the teeth of 19,680 children in 79 schools were examined in 1944-1945. (I was a senior at Union High School in Grand Rapids at the time and recall being examined.) After fluoridation began in January 1945, however, subsequent annual examinations were confined to the children (about 4000 to 5000) in only 25 schools, and the published data (Exhibit____) show that much of the caries reduction after five years appeared to have occurred during the first year of fluoridation. Clearly, this indicated that the initial results from these 25 schools were not fully representative of the entire city and, to a considerable extent, were simply an artifact resulting from the change to a different study sample.
13. In 1951 the water supply of the control city, Muskegon, Michigan, which had been showing a decline in tooth decay without fluoridation, began to be

fluoridated. Decay rates in Grand Rapids were then compared primarily with those in naturally fluoridated Aurora, Illinois, without conceding, however, that a significant portion of the putative decrease in caries rates in Grand Rapids might have been occurring independently of fluoridation.

14. The potential for error from selective sampling can also be seen in the Newburgh-Kingston fluoridation study. Thus, in 1955, after 10 years of fluoridation, 58 percent less tooth decay was reported in the permanent teeth of about one third of the children 6 to 9 years of age residing in the fluoridated city of Newburgh, New York, compared to a similar group in the nearby nonfluoridated control city of Kingston. (Exhibit____). On the other hand, in 1953 a comprehensive health examination of nearly all (97-98%) of the children in these two communities disclosed that 3139 out of 4969 children (63.2%) in fluoridated Newburgh had "dental defects" (including tooth decay), whereas there were only 2209 such children out of 5308 (41.6%) in nonfluoridated Kingston (Exhibit____). Clearly, after eight years of fluoridation, children in Newburgh were worse off dentally than those in nonfluoridated Kingston.
15. During the 1960s and 1970s, tooth decay rates were, in fact, decreasing about as rapidly in nonfluoridated communities as in fluoridated ones. (Exhibit____). In many cases these declining caries rates were occurring in places and countries before widespread use of fluoride supplements and fluoride dental products. Further declines in tooth decay among children in communities after 15 or more years of fluoridation are therefore more likely to be due to significant improvements in the nutritional quality of the diets of infants and children and improved dental hygiene rather than to fluoridation.
16. During the 1980s, large-scale dental surveys in the United States, Canada, Australia, and New Zealand, as well as data collected by the World Health Organization, failed to reveal significantly lower tooth decay rates among children living in fluoridated as compared to nonfluoridated areas, thereby casting further doubt on the generality of the conclusions reached in earlier studies. (Exhibits_____).
17. To illustrate, consider how the results of an official, large-scale, 1983-1984 dental survey of children in 84 (mainly rural) communities in the State of Missouri (exhibit____) contradict those of an earlier nine-city Missouri survey, published in 1953, that purported to demonstrate lower caries rates with increasing natural fluoride levels in the drinking water (exhibit____). In the 1983-1984 survey, 6819 life-long resident second and sixth grade children in various parts of the state were examined. Among the seven geochemical regions for which comparisons could be made, the higher and lower caries scores were equally distributed between the communities with "optimal" and "suboptimal" levels of fluoride in the drinking water. In the words of the authors (exhibit____): "We found that caries prevalences do vary between the geochemical regions of the state. In the total sample, however, there were no significant differences between those children drinking optimally fluoridated water and those drinking suboptimally fluoridated water."
18. Contrary to the expectation of less tooth decay with 1-ppm fluoride in drinking water, surveys in India have revealed more, rather than less, tooth decay among persons drinking water containing the recommended 0.8-1.2 ppm fluoride than among those using water with 0.4 ppm or less. Similarly, in a large-scale survey of schoolchildren in Japan, more tooth decay was observed with 0.5-2.4 ppm natural fluoride in the drinking water than with only 0.2-0.4 ppm. (Exhibit____). In poverty areas of Puerto Rico, "dental caries were [sic] common" with fluoridation, and "dental fluorosis was

particularly prevalent among school and adolescent boys" (Exhibit____).

19. Even an official survey in the United Kingdom found that, after 11 years of fluoridation, there was only a delay or retardation of cavities by 1.2 years, while the rate of decay remained essentially the same as in the nonfluoridated comparison control areas . (Exhibit____). This same feature has been noted in many of the official U.S. studies.
20. In 1987-1988, a dental survey of all 26,000 elementary school children in Tucson, Arizona, disclosed that, contrary to predictions, the highest percentages of tooth decay were found in the areas of supposedly optimal levels of fluoride (0.7-1.0 ppm) in the water, whereas the lowest percentages of tooth decay were recorded in children living in areas with the lowest suboptimal levels of fluoride (0.2-0.4 ppm) in the water. (Exhibit____). The differences in caries rates did, however, correlate closely with access to good nutrition and dental care, with the highest caries scores being found among economically disadvantaged children residing in the higher fluoride areas. (Id.)
21. Even from the standpoint of dental practice, fluoridation does not appear to make much difference. For example, again contrary to expectation, dental repair requirements of children residing from birth in eight midwestern fluoridated communities during the 1960s were found not to differ significantly from those in eight carefully matched nonfluoridated communities (Exhibit____).

FLUORIDE IN THE BODY

22. Upon ingestion, fluoride is absorbed into the blood from the stomach and upper intestines, where it can sometimes cause gastric irritation and pain (see, for example, exhibit____, Gibson). Within a few hours much of it is excreted, mainly through the kidneys, although some of it is retained in the body, primarily in the bones and teeth. The total concentration of fluoride (both bound and unbound) in the blood stays fairly constant at about 0.15 ppm (except after heavy intake), but the concentration of "free" ionic (unbound) fluoride is only about one-tenth this level, i.e., 0.005-0.02 ppm, and responds more directly to the amount of fluoride ingested.
23. Drinking water containing 1-ppm fluoride thus has a 50- to 200-fold higher concentration than the ionic level normally present in the blood. Intake at a level of 1 ppm therefore places the body under a certain amount of physiological stress, and, in the case of children, causes interference with the enamel-forming cells of the teeth, thereby resulting in dental fluorosis.
24. In young children, only about half the fluoride that is ingested is excreted. The rest gradually accumulates in the skeleton, teeth, and calcified sites in soft tissue organs. In adults the proportion of fluoride that is retained is significantly less than in children except when kidney function is impaired. Persons with nephritis, for example, have been found to excrete only about 60 percent as much fluoride as persons with healthy kidneys.

REVERSIBLE NONDENTAL HARMFUL EFFECTS

25. Since fluoridation is intended to reach and affect every member of the community, proof of its universal health safety is of overriding importance. Unfortunately, the original studies were not designed to detect nondental toxic effects of the type that have been reported since 1955. For example, in the Newburgh-Kingston study in New York State, the examination of urine specimens for evidence of kidney changes contained this admission: "No

specimens were taken if there was any history of clinical illness, no matter how mild, during the previous two weeks." (Exhibit____). Since intermittent episodes of urinary tract irritation often occur in the preskeletal stages of chronic fluoride poisoning, the very persons who might have been found to have ill effects from fluoride were excluded from the study!

26. Although generally ignored or denied by proponents of fluoridation, direct clinical evidence of reversible toxic effects from 1-ppm fluoride in drinking water has been reported not only in the United States but abroad as well. Many of the symptoms are the same as those first recognized as a preskeletal phase of debilitating fluorosis by the distinguished Danish pioneer fluoride medical research, Kaj Roholm, in his studies on ailments in aluminum foundry workers. Because the symptoms are so common, they are easily and often mistaken as being due to other causes. Salient features include: unaccountable fatigue not relieved by extra sleep (thyroid depression), excessive thirst resulting in polydipsia and polyuria; muscular weakness, involuntary muscle spasms, joint and back pains and stiffness, urinary tract irritation, stomach distention and pains, mouth sores, skin rashes and itching, and visual disturbances involving the retina (Waldbott G., Fluoridation, the Great Dilemma, Coronado Press 1978, Chapters 9, 14 and pages 392-3). Such a broad spectrum of neuromuscular and gastro-intestinal symptoms is plausible in view of the marked ability of fluoride to affect and interfere with cell function, enzyme activity, and mineral metabolism.
27. When the illness is caused by fluoride in the drinking water, and is not too far advanced, the symptoms clear up or subside without medication simply by substituting distilled or other low-fluoride water for all drinking and cooking and avoiding foods high in fluoride, such as mechanically deboned meat, skin of chicken, bony ocean fish, tea, and gelatin manufactured with fluoridated water. Moreover, the symptoms and illness promptly return when the use of fluoridated water is resumed, and in many cases the diagnosis has been confirmed by blind or double blind challenge tests with coded bottles of fluoridated and nonfluoridated water. (Exhibit____, Moolenburgh; exhibit____).
28. Because the drinking water is rarely suspected as the source of these disorders, incorrect diagnosis ascribing them to other causes is very common. Yet even the Physicians' Desk Reference (45th Edition, 1991, p. 2173) warns of such toxic reactions to dental prescription supplements of fluoride for infants and children: "In hypersensitive individual fluorides occasionally cause skin eruptions such as atopic dermatitis, eczema or urticaria. Gastric distress, headache, and weakness have also been reported. These hypersensitivity reactions usually disappear promptly after discontinuation of the fluoride."
29. Persons who have or have a tendency toward allergy, asthma, kidney disease, diabetes, gastric ulcer, low thyroid function, and deficient nutrition are especially susceptible to toxic effects of fluoride in drinking water. Moreover, inadequate intake of calcium, magnesium, and ascorbic acid (vitamin C), as well as the presence of fluoride in beverages (especially tea), food, air, medications, tobacco, toothpaste, and mouthrinses can also precipitate or contribute to such intoxication.
30. As already noted, individuals with kidney impairment retain and store more fluoride than normal. They also are at greater risk for developing debilitating skeletal fluorosis.
31. The ability of 1-ppm fluoridated water to affect kidney function has been well demonstrated by in vivo mammal studies in the laboratory. Thus, after nine months on 1-ppm fluoridated drinking water, golden hamsters were found to have undergone a 48 percent reduction in the activity of the enzyme

succinic dehydrogenase in the kidney compared to animals on fluoride free water (Exhibit____). Similarly, in squirrel monkeys, "significant cytochemical changes" were observed after 18 months in the kidney of animals drinking 1 and 5 ppm fluoridated water compared to controls drinking distilled water. (Exhibit____). Moreover, in the final 10 months of the study, water consumption by the monkeys drinking the fluoridated water was significantly higher than by those on distilled water, just as has been found with many human adults in fluoridated communities.

IRREVERSIBLE NONDENTAL HARMFUL EFFECTS

32. In addition to the testable reversible toxic effects already mentioned, 1-ppm fluoride in drinking water has been linked through epidemiological studies to a number of serious life-threatening disorders, including, among others: (1) increased rates of hip fractures among the elderly, especially women; (2) increased rates of certain types of cancer, such as osteosarcoma (bone cancer) in young males; and (3) increased rates of Down's syndrome births, particularly among mothers below the age of 35-40. A wide range of biochemical and biological laboratory data provides strong support for the validity of these associations.

Hip Fractures

33. First, with respect to a connection between fluoridation and increased rates of hip fractures among the elderly, a recent medical report from the State of Utah (exhibit____) found nearly a doubling of the rate of hip fractures among women in the 75-year age group in the fluoridated area compared to women of this age group in the nonfluoridated control areas. Among men a similar increase occurred at age 80 and older. This study cites other recent investigations in the United States and the United Kingdom that agree with these findings. Because they are costly to treat and are often fatal, any increase in hip fractures with water fluoridation is clearly a matter of serious concern. (See also Exhibits_____).

Cancer

34. Second, although there is still considerable debate about the extent to which fluoridated drinking water may affect cancer death rates, recent findings concerning the incidence of osteosarcoma among young males point strongly toward an association with water fluoridation. In November 1992, the New Jersey Department of Health released a report showing a significantly higher incidence of osteosarcoma in males age 0-19 residing in fluoridated areas compared with those living in nonfluoridated areas. (Exhibit____). When the female rates are subtracted from the male rates for this age group, an excellent internal control is obtained, and differences in these rate differences are significantly greater in the fluoridated areas than in the nonfluoridated areas, not only in this study but also in two other recent studies that have claimed to find no association between fluoridation and osteosarcoma.

Birth Defects

35. Third, in regard to fluoride and the birth defect known as Down's syndrome (mongolism, or trisomy 21), epidemiological evidence showing a connection

between the occurrence of Down's syndrome and the fluoride content of drinking water was first reported in 1956 in studies done at the University of Wisconsin. (Rapaport I. Bulletin of Academe Nationale De Medecine, 1956 140:524-531). This investigation of the distribution by urban birthplace of 687 cases of Down's syndrome under institutional care in Wisconsin, North and South Dakota, and Illinois showed that there was a statistically significant, two-fold higher frequency of such births per 100,000 inhabitants in cities with elevated natural fluoride in the water supply compared to cities with 0.2 ppm or less. A distinctly lower mean maternal age for the mothers of Down's syndrome babies was also seen in the higher fluoride communities, but only a relatively small increase in frequency was found after a few years of artificial fluoridation (in Illinois and Wisconsin). (Rapaport I. Extrait de L'ENCEPHALE, 1957 4:468-481).

36. In a second investigation designed to overcome objections to the first, all recorded cases of Down's syndrome born in the years 1950-1956 to mothers residing in cities of 10,000 to 100,000 population in the State of Illinois (and also those in cities of 5,000 to 10,000 population) were noted and classified according to the fluoride content of the mother's water supply. Again, the results revealed a statistically significant higher incidence ($P<0.001$) of Down's syndrome births with increasing fluoride content in the water. As in Wisconsin, the incidence was higher among younger mothers in the high-fluoride cities (and among older mothers in the low-fluoride cities), just as would be expected from different intake levels of a widespread cumulative genotoxic agent. Moreover, in agreement with the known ameliorating effect of calcium toward fluoride intoxication, a lower incidence of Down's syndrome births was found with high levels of calcium in the water supply.
37. Later studies on the incidence of Down's syndrome have claimed no significant increase with fluoridation, but in two of these studies (in Massachusetts and in Atlanta, Georgia), the incidence was about 15 percent higher in the fluoridated areas after a few years of fluoridation, just as would be expected from the earlier work already cited. Moreover, in the Atlanta study, in which maternal age-specific incidence rates were recorded, a distinctly higher rate was found for younger mothers in the fluoridated areas as well as for older mothers in the nonfluoridated areas, just as in the original work already mentioned, although the authors were evidently unaware of this fact.
38. Other research prior to 1978 showing a connection between fluoride and Down's syndrome is reviewed in Waldbott, Chapter 13. The only subsequent report bearing on this topic appeared in 1980. (Exhibit____). In it the rates of Down's syndrome cases identified at birth varied by more than 10-fold, which, considering the large city populations involved, clearly reflected severe under-ascertainment. Even so, when the unrealistic zero rates are excluded, along with the dubious high rate in fluoridated Richmond, Virginia, the 15 fluoridated cities had a 15 percent higher mean rate of Down's syndrome births than the 15 nonfluoridated cities. Furthermore, when paired in decreasing order, the rates were lower for each nonfluoridated city than the corresponding fluoridated city (Exhibit_____). Such a relationship hardly seems fortuitous. Thus previous work showing an association between fluoridation and increased rates of Down's syndrome births actually appears to be supported rather than refuted by this report.

OTHER CONSIDERATIONS

39. An argument often advanced in support of fluoridation is that fluorine (as fluoride ion, F-) is an essential trace nutrient element, and that drinking

water containing less than 0.7 ppm fluoride should be considered "fluoride-deficient." The first contention has never been substantiated, and the second is simply a euphemism. No metabolic requirement for fluoride in mammals has ever been demonstrated, and, in many regions of the world, people whose drinking water contains only 0.1-0.2 ppm fluoride have excellent teeth that are relatively free of dental caries.

40. One of the most impressive studies demonstrating the lack of need for fluoride even found that the laboratory animals (mice and rats) eating an extremely low-fluoride diet (0.1-0.3 ppm) derived from yeast and a green alga were actually healthier, reproduced better, and lived considerably longer than their counterparts raised on standard laboratory chow containing about 20 ppm fluoride. (Exhibit____).
41. From a technical standpoint, there are consequences and costs of fluoridation that were not anticipated. For example, significant increases in corrosion and break-down of piping and hot-water plumbing have been reported, especially from fluoridation of soft water supplies with hydrofluosilicic acid. Instances of accidental overfeed malfunctions responsible for episodes of mass poisonings and even several acknowledged fatalities have occurred in Alaska, Maryland, Michigan, Connecticut, and elsewhere. Clearly, the procedure is not always fail-safe and constantly poses an inherent potential risk, especially because elevated levels of fluoride are so much more difficult to detect by taste than, say, excessive amounts of chlorine.

CONCLUSION

42. In conclusion, it is my best professional judgment that, in the light of what we now know, clear evidence of harm and a lack of provable dental benefit make continuation of fluoridation both unscientific and unjustifiable.
43. Papers and articles cited as support in this affidavit were written by persons recognized as experts in their fields, and are of the type normally relied upon by experts in my field.
44. I offer this affidavit in support of the Plaintiff's Motion for Summary Judgment.
