# RACEHORSE BREAKDOWNS AND ARTIFICIALLY FLUORIDATED WATER IN LOS ANGELES

**SUMMARY: The incidence of racehorse fatalities at two Southern California racetracks, before and after being provided fluorosilicic acid treated water supplies, correlated with fluoridated water consumption. Possible contributing factors involved are discussed. Known toxicologic effects of fluoride that could contribute to breakdowns are presented. A working hypothesis is that fluoride ingestion under certain conditions can lead to increased breakdown incidence.**

Key Words: Bone fluoride; Fluoridated water; Fluoride in bone; Hydrofluoric acid; Racehorse breakdowns; Silicic acid; Stomach ulcers.

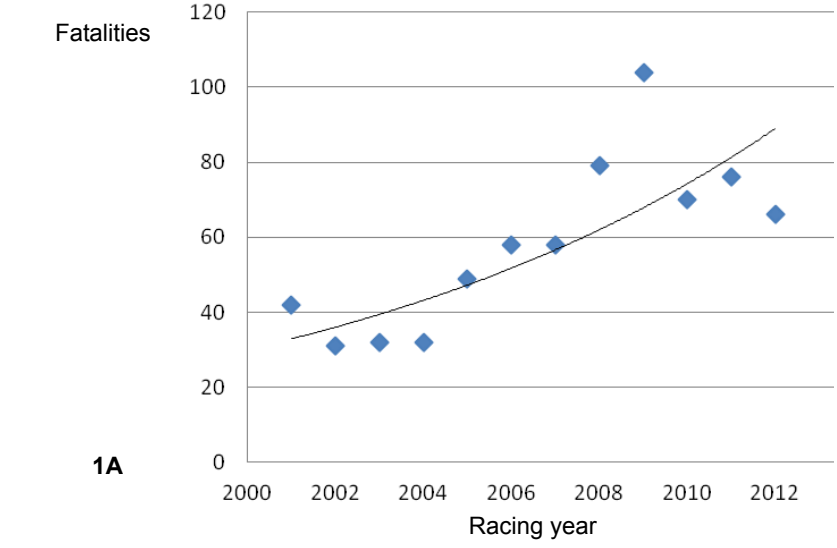
Although 99% of racing starts at horse racetracks are successful, fatalities have been steadily rising in the USA. Five thousand horses were killed from 2003–2008, most being euthanized after bone breaks.[1-4] This prompted Congress to hold hearings, to find causes, and to recommend alterations in racing practices.[2-4] Because fluoride from synthetic sources, including sodium fluoride (NaF) and fluorosilicic acid ($H_2SiF_6$), is a known calcium chelator,[5,6] and horses turn over whole body water in a few days, it is prudent to examine whether materials used to artificially fluoridate water supplies could be involved.

Fluoride is not a normal component of the horse bloodstream in either man or animals and of course has no physiologic role in man or horse.[7,8] Ingested fluoride could possibly impair racehorse performance by decreasing calcium assimilation or by direct toxicity. Studies on research animals and man indicate that long-term consumption of fluoride from water with sufficient elevation of blood fluoride can cause anemia,[9] bone weakening following incorporation into bone,[6,10] and alterations in lung,[11] thyroid,[10] and brain.[10] Under certain conditions, consumption of soft calcium-deficient water treated with fluorosilicic acid over many years caused pathology and lethality in horses that did not occur in horses under the same conditions given non-fluoridated water.[12-14]

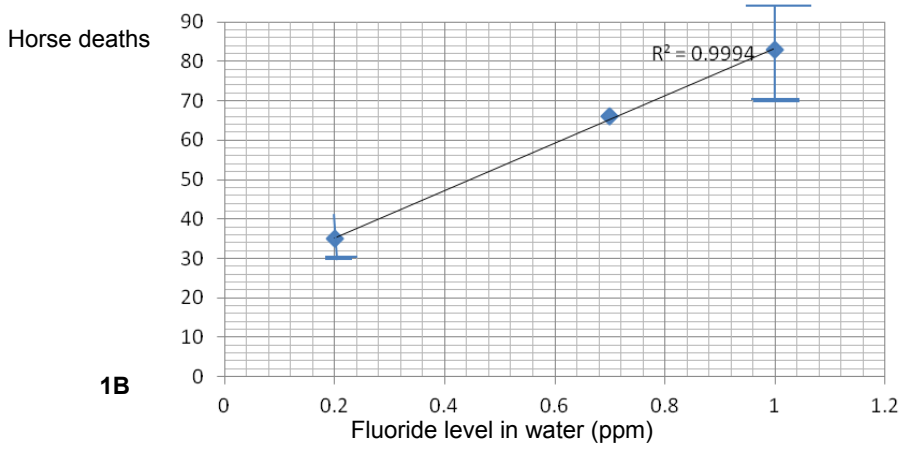
## RESULTS

Results of an observational study of quarter horses at the Los Alamitos racetrack as a function of time are shown in Figure 1. This is the only track in the state that retained a dirt surface throughout the entire study period. The observations, on age-matched (2–6-year-old) horses on well-regulated diets, are prospective. The results are compared for the seven years before the commencement of the fluorosilicic acid treatment of water supplies in November 2007 and for the following five years. All horses at the track consumed municipal water throughout both periods. Measurements of fluoride ion concentrations with a LaMotte Instruments fluoride specific electrode confirmed that water fluoride levels were increased in Metropolitan Water District water five-fold from 0.2 ppm natural to 1.0 ppm total, including artificial fluoride from fluorosilicic acid. Breakdown incidence increased precipitously thereafter. The last data value in 2011 represents 7 fatalities per 1,000 racing starts. The peak breakdown incidence was the highest in the country at 10.8 fatalities per 1,000 starts. In a two-year period, 186 horses

perished at Los Alamitos. After the fluoride level was reduced in February 2011, following a recommendation of the US Health and Human Services, there was a downward trend in the fatalities. In 12 years, for 170,000 racing starts, there were 708 fatalities.




1A




1B

**Figure 1.** Los Alamitos quarterhorse fatalities per season (A) and as a function of Metropolitan Water District (MWD) water fluoride level (B). Data are from the California Horse Racing Board[1] for all 181 day racing seasons since 2000–2001. Water was infused with $H_2SiF_6$ at 1.0 ppm fluoride from November 2007 and then at 0.7 ppm from February 2011. Data from (A) were averaged for 2000–2004 before fluoridation (approximately 0.2–0.3 ppm natural fluoride), and from 2008–2011 (artificial fluoride 1.0 ppm, 0.8 ppm silicic acid, 93 ppm sodium) and the center value is from 2012 (0.7 ppm fluoride, 0.6 ppm silicic acid, 85 ppm sodium). The concentrations are for fluoride levels in MWD water delivered to the distributors for the racetracks. Actual water concentrations consumed can differ from that indicated due to seasonal blending with well water in Los Alamitos and in Inglewood before consumption. All water contained 55–68 ppm calcium. Error bars are standard deviations.

Similar findings occurred at Hollywood Park in Inglewood, CA (Figure 2). Again, an upward trend after 2007 was followed by a slight drop in 2011. The

same year fluoridation began, the dirt track was replaced with a synthetic surface known to reduce fatalities when dry. Nevertheless, with typically 5,300 racing starts per season, the fatality incidence increased from 0.5 to 1%, comparable to Los Alamitos. All values represent fatalities per season but not exactly per racing start because some breakdowns occurred during training. In 8 years, for 40,000 racing starts, there were 328 fatalities. For all horses examined to 2005, for both tracks, the breakdown incidence was 0.2%. After 2007, it was 0.7%.

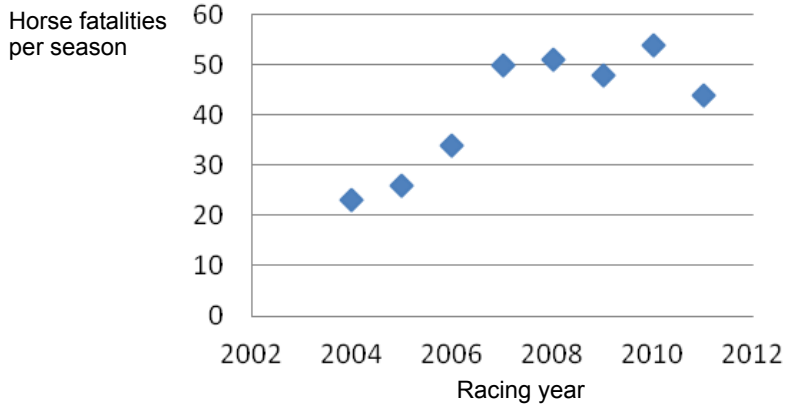



**Figure 2.** Hollywood Park thoroughbred fatalities per season. Entries for each year represent the season spanning into the next year (from mid-November to December 2006, April to July 2007, and early- to mid-November 2007). Hollywood Park and Los Alamitos seasonal racing days do not coincide.

## DISCUSSION

Fluoride assimilation from drinking water is substantial in horses but depends on water hardness. Blood fluoride in thoroughbred horses throughout India ranged from 0.096 ppm to 0.3 ppm.[15] One thousand pound horses consume from 1 ppm treated water daily 0.26 mg per kilogram body weight (120 mg/455 kg). Intake much less than this causes acute gastrointestinal (GI) symptoms in some humans at 0.028 mg/kg bw.[16]

Racehorses consume 25–30 gallons of water daily with more in hot weather. Horse temperatures range from 99–102ºF and water loss through sweat is significant during racing. Most horses were stabled for long periods without access to pasture grazing, which would restrict fluoride assimilation from the GI tract. This may have led to higher blood fluoride levels. Ninety-five percent of retained fluoride resides in bone and this magnitude of uptake is not without adverse biochemical effect. Fluoride is a calcium chelator that progressively and permanently accumulates into bone. The lower the calcium content of bone, the lower is its tensile and compression strength.[17]

The close agreement in the horse fatality trends for the two racetracks indicates a correlation between artificially fluoridated water and horse breakdowns. This does not prove causation which would require control horses that consumed only

hauled non-fluoridated water for comparison. However, the biphasic trend at both tracks that correlated with the biphasic fluoride levels would be unlikely to be due to causes other than the water supply. A plot of average fluoride concentration as a function of year provided by the local water district also mirrored this biphasic breakdown incidence (Figure 3).

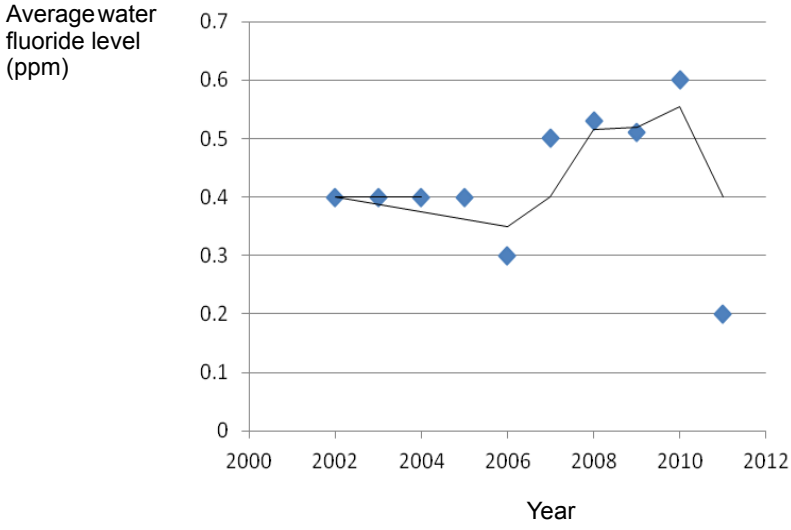



**Figure 3.** Average fluoride levels (ppm) as a function of year in Los Alamitos published by Golden State Water in water quality reports. Levels can differ from the verified values in Metropolitan Water District water because of variable blending with local well water, more MWD water usually in summer than in winter. (Water levels could not at any time be outside extreme limits, for 2002–2006 in the range 0.25–0.45, for 2007–early 2011 in the range 0.45–1.2, and after 2007 from 0.45–0.8 ppm). MWD water for blending was nearly completely discontinued there at the end of 2011 according to GSW reports. The last value for that year is a spurious estimate among a widely fluctuating range of values reported. Orange County ground water for wells averages 0.45 ppm fluoride naturally. MWD water has remained constant at 0.7 ppm since April, 2011. Fluoride levels in blended water prior to 2005 (0.4 ppm) are higher than levels in MWD water before fluoridation (0.2–0.3 ppm), as expected. The biphasic trend is considered reliable, being consistent with the years that MWD fluoridated. Blending MWD water with well water is also conducted at Hollywood Park, but fluoride levels reported in Inglewood water quality reports are in closer agreement with MWD levels, at 0.89 ppm in 2010 and 0.68 ppm from 2011–2013 until the Park closed permanently on December 21, 2013.

The correlations from the age-matched, 2–6- year-old, horses under strict dietary management and in prime health are consistent for both thoroughbreds and quarter horses.

Water district officials were unaware of treating the horses. The horses were unaware of the treatment, and the owners were not informed. The author/observer had no role in either the treatment or handling of the horses. The most logical objective explanation of these data is that the breakdown incidence parallels the level of fluoride in the fluoridated water supply. It is useful to consider possible mechanisms.

Fluoride is converted to hydrofluoric acid, HF, in the acidic stomach. Most fluoride in the horse stomach pyloric region, where the pH is 2.6,[17] is protonated

to HF[6], the fully assimilated form.[18] Stomach ulcers have been diagnosed by video endoscopy in 80–90% of racehorses.[17] Poor racing performance is the chief resulting complaint but veterinarians often certify racing soundness, believing the condition to be mild in most cases.[19] Ulcers are absent during natural pasture foraging but are enhanced by stress.[20] Sodium fluoride at 1 ppm in plain drinking water causes GI discomfort from HF in 7% of humans[21-23] in the absence of ulcers. At low concentrations, HF can aggravate ulcerated tissue and in horses could conceivably cause heartburn during racing and possible mis-steps.

A suggested possibility is that silicosis-induced bone deformations may be involved in racehorse breakdowns in the state.[24] Silicic acid, $H_4SiO_4$, levels in the treated water exhibited a biphasic trend in conjunction with the added fluoride. Horses that consume treated water rather than well water ingest daily 8 mg of silicic acid and 9.3 g of sodium (93 ppm = 93 mg/L × 100 L/day). Silicate has been reported to strengthen bone in chickens. Some argue it may be a mineral nutrient. It is not regulated by the EPA. Pure sodium silicate ingested in acute doses is tolerated and has no published $LD_{50}$[25] but liver silicosis has occurred in alligators from residing in fluorosilicic acid treated water.[12] Silicic acid and fluoride might act synergistically. Sodium levels in water before (85 ppm) and after (93 ppm) the infusions do not explain the 2–3 fold increases in breakdowns. Other contaminants in the fluorosilicic acid materials may be contributing.

The FDA ruled fluoride does not strengthen bone, based on studies commissioned in 1989.[26] Bone fluoride at 3,000 mg/kg from consumption of 1 ppm fluoride water for decades weakens human bone making it more subject to fracture.[6] Fluoride is an EPA regulated water contaminant with a secondary maximum contaminant level (SMCL) of 2 ppm assessed for natural calcium fluoride ($CaF_2$ $LD_{50}$ 3,000–5,000 mg/kg).[25] There is no maximum contaminant level (MCL) for the more toxic fluoride compounds made by industrial reaction used to treat water that lack calcium ($LD_{50}$~ 60 mg/kg).[25] It would be unethical to administer sodium fluoride versus fluorosilicic acid treated waters to horses to clarify which substances may be involved since these compounds are calcium chelators. Such controlled human studies have also not been done for industrial fluoride ingestion, even though this is a requirement for FDA approval for any foreign substance being used as a drug.

Systemic fluoride abnormally alters bone hydroxyapatite[6] by ion exchange. Normal bone is a repository for blood calcium during dietary insufficiency[17] but parathyroid hormone is not designed to mobilize fluoride which has a 20 year half-life in bone.[6,27,28] Horse blood ionized calcium ranges from 2.6–3.5 mM (10–14 mg/dL)[20] and is crucial for normal heart function. Systemic low level fluoride can cause hormonal mobilization of normal bone regions to prevent hypocalcemia, but this can eventually cause bone mineral depletion affecting performance.

Thoracic leg cannon bone fluoride levels in horses consuming soft water infused with 0.35–1.3 ppm fluoride from diluted $H_2SiF_6$ over a 19 year period were 587–936 mg/kg. This is 4–6 times higher than that in control horses without fluoridated water. Quarter horses exhibited effects on bone-resorbing and bone-forming cells

with osteomegaly and osteopenia. Bone bulged deep into the internal marrow and the bones exhibited extra, low-density growths along their shafts. Noticeable structural abnormalities occurred with fluoride levels as low as 500 mg/kg.[10] Since fluoride during continuous ingestion typically accumulates in bone,[6] the more years a horse consumes soluble fluoride the more bone must be synthesized to maintain blood calcium homeostasis. Chemically altered bone will break with smaller forces. Bone breaks in California were accompanied with a pathologic bone structure of unknown cause which was observed on X-rays before the breaks occurred.[24] Fatal injuries usually started as mild ones that went undetected.[29] A lateral manœuver during a race can place most of the force on one of two lateral positioned bones. At full gallop, all four hooves are airborne (Figure 4).


Photograph courtesy of Jeff Kubina

**Figure 4.** A thoroughbred horse racing at full gallop at Churchill Downs, Louisville, KY, USA, with all four hooves airborne.

Stopping abruptly from distraction or pain can be disastrous if bone is fluoride-enriched as $Ca_{10}[PO_4]_6F_2$. It is possible that silicate plus fluoride act synergistically.

Consumption of 1 ppm artificially fluoridated water in man for one year disrupts iron-assimilating intestinal cells causing anemia and reduced hemoglobin levels that return to normal after the withdrawal of fluoridated water.[9] Any possible anemia in racehorses could be dangerous during bouts of exercise with full cardiac output. Heart rates increase 10-fold, from 24 to 240 beats per minute (bpm) during racing.

Many race officials and jockeys fault drug combinations, such as painkilling steroids and nonsteroidal fluorine-containing flunixin [2-methyl-3-(trifluoromethyl)phenyl]amino]pyridine-3-carboxylic acid] for causing increased

breakdown rates.[30,31] In 2005, flunixin was approved by the FDA as a generic horse drug.[32] The incidence of breakdowns could be complicated by any use of such drugs. Ulcers are common side-effects of flunixin[33] which was banned by the International Federation for Equestrian Sports in Switzerland.[34] The California Horse Racing Board (CHRB) raised its allowable blood level to 50 ppb in 2007 but then lowered it again in 2010.[1]

Two of the Southern California racehorses that recently perished had trace levels of an unidentified rodent poison.[35] Any warfarin-based anticoagulant could act at lower levels in fluoridated blood. Several deaths were from hemorrhage.

California leads the states in racehorse fatalities at 3 per 1,000 racing starts compared to a USA average of 1 per 1,000. Fatalities in Washington State, where the water is soft, increased recently to 2.64 per 1,000 starts. Twelve deaths in CA (2010–2011) were from sudden heart failure from aortic rupture or myocarditis.[29] Nineteen such deaths occurred in 2011–2012 and 17 in 2012–2013 with three months remaining in the fiscal season, 11 of these being heart failure and most were stabled at Hollywood Park. The CAHRB and the Animal Health and Food Safety Laboratory System have not found the cause after necropsy and toxicologic and histologic study.[35] Systemic fluoride accumulates in aorta in man and animals[36] and in atherosclerotic plaque in human coronary arteries.[37]

Many of the recent horses having heart failure were being treated with thyroxine. It has long been known that fluoridated water is a thyroid suppressant,[6,10] and fluctuations in fluoride content during thyroid therapy is an improper practice. Returning to lower water fluoride concentrations lowers blood and soft tissue fluoride levels, but fluoride accumulation into bone and aorta are not known to be reversible.

Blood fluoride levels typically from treated water consumption abnormally cause simultaneous elevation of two bone-regulating hormones in man.[6] These hormones have opposite effects, so normally only one is elevated when the other is not. Elevated calcitonin (>20 pg/mL in horses) supports new bone growth to replace bone that is converted to fluoroapatite. But elevated parathyroid hormone (>1.7 ng/mL) resorbs calcium from normal hydroxyapatite areas to counter the calcium chelator fluoride ion. Together the result is abnormally structured bone. Approximately 25 g of water fluoride was ingested by horses over the duration of the study. At half incorporation, bone fluoride levels would reach ~300 mg/kg, or higher because of fluoride in feed. The minimum fluoride level required to cause bone pain during racing in horses is not known.

At Churchill Downs, Louisville, KY, municipal fluoridated water is used but only temporarily by horses during racing visits. No horses are housed there during the winter season. This is significant since the severity of the effects on ulcerated tissue caused by HF would depend on length of exposure. Fluoride toxicity is dependent on conditions[38] such as water hardness and food availability during drinking.

Generally toxicologic tests for ingested substances exhibit wide biologic variability even within one animal strain. Administration of $LD_{50}$ acute oral doses cause 50% of animals to die but the remaining 50% are either sickened and recover or are often seemingly unaffected. Variation in genetic factors, hormonal and other traits also apply to low level chronic exposure and explain why artificially fluoridated water could contribute to breakdowns in a small fraction of the population while most horses performed normally. The lifetime accumulation of fluoride and silicate would affect all horses to a varying degree but the effects would be difficult to assess since speed and stamina decline naturally with age.

The toxic effects of low level chronic exposure to chemicals in racehorses can be minimized with superior care such as providing sufficient dietary calcium, offering feed with drinking water, and pasturing horses frequently. Quality reverse osmosis defluoridated water equipment could be employed on site by owners at racing venues. However, halting chemical infusions into water supplies is the best practice.

Controlled trials in horses do not exist for long-term safety of ingested diluted fluorosilicic acid under various conditions of quartering. Racehorse health and performance affect attendance at tracks. The 75-year-old Hollywood Park is now closing due to insufficient attendance influenced in part by increased fatalities. Also since MWD water is being avoided as of 2012 at Los Alamitos, it may be considered that this particular fluoridation experiment has now concluded.

Water districts infuse public supplies with materials to treat human caries, not horses. Topical fluoride is not used on horse teeth. The soft cementum layer covering teeth is synthesized by cells under the gumline forming a smooth shape during circular chewing.[7,17]

Halting fluoride infusions would not eliminate racehorse fatalities but could prevent many. Even in the absence of observed symptoms, all horses given fluoridated water have elevated blood fluoride contaminant levels and accumulate fluoride. Controlled studies in man indicate fluoride at dilute levels in water causes detectable adverse effects in only a small percentage of a population at first. The longer the exposure, and the more calcium-deficient the diet, the greater the effect and incidence.[39] Although horses and man are biologically widely different, both are sensitive to industrial fluoride.[6,12-14] Horses accumulate fluoride in bone less readily than humans do during long-term consumption for unexplained reasons. But horses cannot recover from bone breaks as humans can.

In the interest of health and welfare, it is prudent to follow Federal water laws designed to protect the natural chemistry of U.S. waterways. The FDA ruled that fluoride added into water is an uncontrolled use of an unapproved drug and that it is not a mineral nutrient. Whole body fluoridation is an improper procedure to treat caries. Ingested fluoride does not decrease caries after assimilation into the blood.[10,40] The FDA in 1966 banned the sale of fluoride intended to be ingested by pregnant women because of lack of positive effect on dental health in

offspring.[38] Therefore fluoridated water is unnecessary and affects horses without a purpose.

Fluoride is an EPA regulated pollutant. As such, any facility requires a permit to discharge the material into public water supplies, as stipulated in the US Clean Water Act. An MWD attorney wrote the opinion that no permit is necessary since the industrial fluoride is not discharged into US water. However, fluoridated water is supplied not only to homes for private use but also to all public and agricultural water, which re-enters the local water table. Other districts label fluoride as a supplement, food, or drug without obtaining FDA approval. We must all honor the statutes in the CWA, the Food Drug and Cosmetic Act, and the US Safe Drinking Water Act.

## DISCLOSURE

Analysis of data was conducted on the author's personal time and does not necessarily reflect any institutional view

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## DEDICATION

This work is dedicated to the late Professor Emeritus Albert Burgstahler, Editor-in-Chief of *Fluoride*, who asked that an editorial on fluoride exposure in racehorses be written. He is sorely missed. His rigorous work on the toxicity of fluoridated water remains superior, and his assistance with the present article for the past year is greatly appreciated.

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## REFERENCES

1 California Horse Racing Board annual reports to the Governor; 2001-2012. Available from: www.chrb.ca.gov.
2 NBC News. Study shows 5,000 racehorse deaths since 2003. Associated Press;2008. Available from: http://nbcsports.msnbc.com/id/25163444/
3 NY Times; 2013. Available from: http://www.nytimes.com/2013/04/11/sports/california- examines-puzzling-trend-of-horses-sudden-deaths.html?_r=0
4 NY Times; 2012. Available at: http://www.nytimes.com/2012/07/13/sports/at-senate-hearing-calls-for-strict-discipline-on-doping-in-horses.html
5 Goodman LS, Gilman A. The pharmacological basis of therapeutics. 5th ed. NY: MacMillan Publishing Co;1975. pp. 804-5.
6 Doull J, Boekelheide K, Farishian BG, Isaacson RL, Klotz JB, Kumar JV, et al. Committee on Fluoride in Drinking Water, Board of Environmental Studies and Toxicology, Division of Earth and Life Studies, National Research Council of the National Academies. Fluoride in drinking water: a scientific review of EPA's standards. Washington, DC: The National Academies Press; 2006.
7 Aiello SE, editor. The Merck Veterinary Manual. Whitehouse Station, NJ: Merck and Co; 2012.
8 Porter RS, editor. The Merck Manual. Whitehouse Station, NJ: Merck and Co; 2012.
9 Susheela A, Mondal N, Rashmi, G, Kamla G, Brahmankar S, Bhasin S, Gupta G. Effective interventional approach to control anemia in pregnant women. Curr Science 2010;98(10):1320-30.

10 Connett P, Beck J, Micklem HS. The case against fluoride: how hazardous waste ended up in our drinking water and the bad science and powerful politics that keep it there. White River Junction, VT: Chelsea Green Publishing; 2010.
11 El-Agamy DS, El-Labban NH, El-Kashef HA. Effect of fluoride on the respiratory system of rats. Journal of Basic and Applied Sciences 2006:2(1). 8 pages. [Published in collaboration with Lifescience Global]. Available from: http://www.jbaas.com/HTML/Previous%20Issues/Volume%20No.%202%20No.%201/Headings/H-5.html
12 Spittle B. Fluoride fatigue. Revised 3rd printing. Dunedin, New Zealand: Paua Press; 2008. Available from: http://www.pauapress.com/fluoride/files/1418.pdf.
13 Justus C, Krook LP. Allergy in horses from artificially fluoridated water. Fluoride 2006; 39(2) 89-94.
14 Macicek P, Krook LP. Fluorosis in horses drinking artificially fluoridated water. Fluoride 2008; 41(3) 177-83.
15 Dwivedi S, Dey S. Fluoride concentrations in thoroughbred horses in India. Vet Hum Toxicol 2002;44(5):292-293. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12361116. See also: http://en.wikipedia.org/wiki/Fluoridation_by_country#India
16 Acute F toxicity. Available from: http://www.fluoridealert.org/issues/health/poisoning/
17 Merck Manual for Pet Health;2013. Available from: http://www.merckmanuals.com/pethealth/horse_disorders_and_diseases/bone_joint_and_muscle_disorders_in_horses/muscle_disorders_in_horses.html
18 Whitford GM, Sampaio FC, Pinto CS, Maria AG, Cardoso V, Buzalaf M. Pharmacokinetics of ingested fluoride: lack of effect of chemical compound. Arch Oral Biol 1988;53: 1037–41.
19 Southern Pines Equine Associates, N.C. and Wind in the Woods Farm, Auburn, OH. Available from: http://www.wiwfarm.com/spec2.htm
20 Hy Gain Feeds 2012. Available from: http://www.hygain.com.au/Nutrition_Center/The-horses-digestive-system.php
21 Waldbott GL. Incipient chronic fluoride intoxication from drinking water. II. Distinction between allergic reactions and drug intolerance. Int Arch Allergy Appl Immun 1966; 9(5):241-9.
22 Petraborg HT. Hydrofluorosis in the fluoridated Milwaukee area. Fluoride 1977;10(4):165-9.
23 Grimbergen GW. A double blind test for determination of intolerance to fluoridated water (preliminary report). Fluoride 1974; 7(3):146-52.
24 Murray M, Stover, S. Silicosis associated osteoporosis. Available from: http://www.vetmed.ucdavis.edu/vorl/research_programs/musculoskeletal_disease_injuries/index.cfm.
25 The Merck Index. 12th ed. Rahway, NJ: Merck & Co., Inc.;1997.
26 Pollner F. Med World News 1989;30(17):14.
27 Prystupa J. Fluorine: a current literature review. An NRC and ATSDR based review of safety standards for exposure to fluorine and fluorides. Toxicology Mechanisms and Methods 2011; 21(2): 103–70
28 Baud CA, Lagier R, Bouvin G, Biolla MA Value of the bone biopsy in the diagnosis of industrial fluorosis. Virchows Archiv A Pathol Anat Histol 1978;380:283-97.
29 UC Davis School of Veterinary Medicine, Postmortem Examination Program 2012. Available from: http://www.chrb.ca.gov/annual_reports/2010-11_post_mortem_annual_report.pdf
30 New York Times. 2012 Mar 25. Available from: http://www.nytimes.com/2012/03/25/us/death-and-disarray-at-americas-racetracks.html?_r=0
31 Los Alamitos Patch 2012. Available from: http://losalamitos.patch.com/articles/los-alamitos-track-among-nation-s-worst-for-deadly-injuries
32 US Food and Drug Administration. Available from: http://www.fda.gov/downloads/AnimalVeterinary/Products/ApprovedAnimalDrugProducts/FOIADrugSummaries/ucm061738.pdf
33 Forney B. Wedgewood Pharmacy, Swedesboro, NJ. Available from: http://www.wedgewoodpetrx.com/learning- center/professional-monographs/flunixin-meglumine-for-veterinary- use.html
34 Wikipedia. Available from: http://en.wikipedia.org/wiki/Flunixin_meglumine
35 Zieralski E. Spotlight will be on dark side of California racing, again. Union Tribune San Diego. 2013 Apr 12;Sect. D:3 and 2013 Apr 13;Sect. D:9.
36 US Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Toxicological profile for fluorides, hydrogen fluoride, and fluorine. Atlanta, GA: US Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry; 2003. Available from: http://www.atsdr.cdc.gov/toxprofiles/tp11.pdf
37 Li Y, Berenji GR, Shaba WF, Tafti B, Yevdayev E, Dadparvar S. Association of vascular fluoride uptake with vascular calcification and coronary artery disease. Nuc Med Comm January 2012;33(1): 14–20. Available from: http://journals.lww.com/nuclearmedicinecomm/Fulltext/2012/01000/Association_of_vascular_fluoride_uptake_with.3.aspx
38 Sauerheber R. Physiologic conditions affect the toxicity of ingested industrial fluoride. J Env Pub Health 2013. Article ID 439490, 13 pages. Available from: http://dx.doi.org/10.1155/2013/439490.
39 Evidence based medical science used to end policy of fluoridation of drinking water in the Netherlands. Waugh D. Fluoride Free Water 2013 Jan 18. Available from: http://ffwireland.blogspot.ie/2013/01/evidence-based-medical-science-used-to.html
40 Fluoride Recommendations Work Group. Recommendations for using fluoride to prevent and control dental caries in the United States. MMWR Morb Mortal Wkly Rep (Recommendations and Reports) 2001 Aug 17;50 (RR14):1-42. Available from: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5014a1.htm