

Notes from the Field

Acute Sulfuryl Fluoride Poisoning in a Family — Florida, August 2015

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On August 19, 2015, the Florida Department of Health (FDOH) was notified by the Florida Poison Information Center Network and a local hospital of possible sulfuryl fluoride poisonings affecting a family in Martin County, in southeastern Florida. Sulfuryl fluoride is a highly toxic (toxicity category I) gas fumigant used for termite control of homes and buildings.* FDOH personnel in Martin County commenced an investigation and identified a family of five (a grandmother, mother, father, son, and daughter) exposed to sulfuryl fluoride after their house was fumigated. The Florida Department of Agriculture and Consumer Services (FDACS), and the U.S. Environmental Protection Agency (EPA) Criminal Investigation Division also conducted an investigation after being notified by FDOH. Medical records were reviewed, and the father was interviewed by FDOH.

On August 14, 2015, the house was fumigated with sulfuryl fluoride[†] to eradicate a dry-wood termite infestation. At 4:00 p.m. on August 16, approximately 48 hours after the fumigation began, the family was permitted to reenter the house. That evening, the mother and son developed nausea and vomiting. By 6:00 a.m. the next morning, all family members had similar symptoms, prompting all family members except the father to visit a hospital emergency department. The grandmother, mother, and daughter were released the same day with diagnoses of chemical inhalation. The son, a previously healthy boy aged 9 years, was found to have altered mental status, dysarthria, dystonia, rigidity, and hyperreflexia, but was alert and answering questions. He was treated with calcium gluconate to correct hypocalcemia; other laboratory tests were normal, and

a urinary toxicology profile was negative. He was admitted to the pediatric intensive care unit and was intubated for the first 2 days of hospitalization for airway protection from aspiration. Computerized tomography scan of the brain showed no cerebral edema or evidence of bleeding. On August 18, he developed choreoathetosis that progressed to involve both arms, legs, and both sides of his face; a brain magnetic resonance imaging study was consistent with basal ganglia injury. He underwent two rounds of hemodialysis to assist with fluoride ion removal, although documentation of his serum fluoride concentration was not found in the medical record. After excluding carbon monoxide and heavy metal poisoning, anoxic brain injury, and metabolic disorders, the treating physicians attributed his neurologic findings to sulfuryl fluoride poisoning, manifested by basal ganglia necrosis. Because there is no specific antidote for sulfuryl fluoride poisoning, his management was supportive; symptoms improved slightly during hospitalization, although dysarthria and choreoathetosis continued. On September 4, he was transferred to a rehabilitation facility where he experienced some additional improvement, but continued to have expressive aphasia and choreoathetoid movements of the face, trunk, and extremities. He was released on September 25, 2015.

On August 20, 2015, FDACS initiated an investigation and identified multiple violations related to the fumigation of the family's home, including failure to have functioning devices to measure sulfuryl fluoride concentrations and failure of the pest control operator to participate in the sulfuryl fluoride manufacturer's training and stewardship plan. Pest control operators are required to measure the level of sulfuryl fluoride remaining in each room of the fumigated space until all measurements are below the EPA approved concentration of 1 part per million or less before buildings are cleared for reentry. On September 29, FDACS revoked both the business license of the pest control company and certification of the pest control operator who conducted the fumigation. On March 10, 2016, the pest control company and two of its pest control operators pled guilty in federal court to the above-mentioned violations and others (1).

Based on the surveillance case definition (2), FDOH determined that sulfuryl fluoride exposure was the most likely cause of illness among these five family members. Four persons (the grandmother, mother, daughter, and son) were classified as confirmed cases of pesticide-related illness, and

*The toxicity of a pesticide is determined by the U.S. Environmental Protection Agency under guidance available from the Code of Federal Regulations 40 CFR 156.208(c)(1). Pesticides in category I are the most acutely toxic and pesticides in category IV are the least. The EPA has classified sulfuryl fluoride as a restricted use pesticide that can only be used by certified pest control operators.

[†]Zythor (Ensysytem II, Inc., Fayetteville, NC; EPA toxicity category I; EPA registration number 81824-1; active ingredient = 99.3% sulfuryl fluoride, pesticide label, <http://iaspub.epa.gov/apex/pesticides/f?p=PPLS:1>). The structure to be fumigated is usually covered with a tarp or tent and sealed completely before releasing the gas. Chloropicrin, a colorless liquid lacrimating agent with a strong odor, is added to the gas fumigant as a warning agent to deter persons from entering or remaining in an area that has been fumigated. Applicators post warning signs around the building. After fumigating for 2–72 hours, the tarp is removed and the structure is aerated using fans.

the father as a probable case. The severity of illness of the son was high and of the others was low.[§]

Although sulfuryl fluoride is highly toxic and can cause severe injury if recommended safety measures are not followed, severe poisoning and death caused by sulfuryl fluoride are uncommon (3); since 2010, only one other such case has been reported in Florida. Signs and symptoms of sulfuryl fluoride poisoning include irritation of the nose, eyes, and respiratory tract, dyspnea, numbness, weakness, nausea, vomiting, abdominal pain, slowed speech or motor movements, cough, restlessness, muscle twitching, seizures, and pulmonary edema (3).

The findings in this report are subject to at least two limitations. First, concentrations of sulfuryl fluoride were not measured at the house at the time of the incident and no laboratory tests were available to confirm exposure to sulfuryl fluoride. Second, it is not known why only the son developed high severity illness. It is possible he spent more time in less ventilated parts of the house with higher sulfuryl fluoride concentrations or had higher susceptibility.

Although sulfuryl fluoride has been observed to cause basal ganglia injury in animals (4), this is the first report of basal ganglia injury in humans resulting from systemic sulfuryl fluoride poisoning. This exposure underscores the importance of strict compliance with pesticide label requirements. The EPA recently proposed revised rules for enhanced training and certification of pesticide applicators (5).

[§] Standardized coding was used to determine severity of illness (<http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf>). Low severity cases usually resolve without treatment and cause minimal time lost from work (<3 days). High severity cases are considered life threatening and typically require treatment, hospitalization for >3 days or result in ≥6 days lost from work or from normal activities.

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