



Hazard Alert

Topic Summary:

Fatal Hazards in Agriculture: Two Boys Die in Silo

Employers: Protect yourself and your workers. Confined spaces including silos present serious and complex safety issues. Silos are particularly dangerous because they may not contain enough oxygen inside to support life and may contain toxic “silo gases.”

In August 2003, two 16-year-old boys working on a Washington State dairy farm died from asphyxiation when they entered an upright-sealed silo three days after filling it with hay. Nationally, between 1987-2002, at least 14 people have died in silos. Below you will find some additional information on the atmospheric hazards associated with silos and confined spaces. **Never enter a silo without appropriate equipment and training.**

Why are silos dangerous?

Oxygen-deficient atmospheres

The silage process produces carbon dioxide that displaces the oxygen in the silo. Carbon dioxide has no odor and is invisible. There is no way to sense a life-threatening oxygen-deficient atmosphere. Many people have died after entering silos and other confined spaces without sufficient oxygen to support life.

Silo gases

The silage process also produces potentially lethal oxides of nitrogen (NO_x) including nitric oxide (NO), nitrogen dioxide (NO₂), and nitrogen tetraoxide (N₂O₄). These gases start forming soon after loading chopped plant material and the start of the silage process. People have reported seeing an orange-brown or yellow gas or haze and smelling a bleach-like odor. Even if you do not see or smell something, NO_x may be present in any recently filled or tightly sealed silos. Exposure to NO_x may result in chemical burns, permanent lung damage, and death.

How do I protect my workers and myself?

- **Never assume the air in your silo is “safe.”**
- Recognize confined spaces including silos present serious and complex safety issues. Use or hire a confined space consultant from the Department or a private firm to assist you with critical planning, hazard identification, and hazard control before entering a silo. The Department of Labor and Industries has consultation services available for your use at no charge. You would find private firms with confined space expertise listed in the phone book under “Safety” and “Industrial Hygiene”.
- Always ventilate the silo prior to and during any entries. Prior to entry into a silo open all vents and hatches and run the blower to force clean air into the silo.
- Test the air for at least oxygen concentration and oxides of nitrogen before entering. Do not enter if test results indicate the presence of a hazardous atmosphere.

- Train all personnel about the hazards and safety procedures you have implemented for working around silos and other confined spaces on your farm. Allow only properly trained employees to enter the silo or other confined spaces.
- If you hire someone to work in your silo, like a contractor or service provider, make sure they have received appropriate safety training, equipment, and entry procedures in place.

For additional information on the regulatory requirements for confined space (silo) entry in agriculture, please see SafetyRules.LNI.wa.gov.

How can I get help from Labor and Industries?

The Department of Labor and Industries (L&I) has assistance available at no charge. Please contact one of the regional offices listed below and ask for the WISHA Consultation Supervisor.

Counties	Telephone Number
Island, San Juan, Skagit, Snohomish, Whatcom	425-290-1431
King	206-515-2837 or 206-835-1146
Clallam, Jefferson, Kitsap, Pierce	253-596-3917
Clark, Cowlitz, Grays Harbor, Klickitat, Lewis, Mason, Pacific, Thurston, Wahkiakum	360-902-5458
Northwest Adams, Benton, Chelan, Columbia, Douglas, Franklin, Grant, Kittitas, Okanogan, Walla Walla, Yakima	509-886 6570
Southeast Adams, Asotin, Ferry, Garfield, Lincoln, Stevens, Pend Oreille, Spokane, Whitman	509-324 2543

Other resources

Teen workers in agriculture

Washington State child labor regulations prohibit minors under the age of 16 from working in hazardous environments such as silos or more than 20 feet above ground level. For more information on prohibited occupations for minors, please call 360-902-5316 or e-mail to teensafety@LNI.wa.gov. You may also call your nearest L&I office and ask for an Industrial Relations Agent.

Online resources

- Teen Worker safety: Teenworkers.LNI.wa.gov
- Labor and Industries, WISHA Services Division: www.LNI.wa.gov/Safety
- WISHA Safety and Health Video Library: Videos.LNI.wa.gov
- National Institute of Occupational Safety and Health (NIOSH) Agriculture Resources: www.cdc.gov/niosh/topics/agriculture
- National Agricultural Safety Database: www.cdc.gov/nasd