DOSH DIRECTIVE

Department of Labor and Industries
Division of Occupational Safety and Health
Keeping Washington Safe and Working

14.00 Surgical Smoke Evacuation Systems

Date: December 19, 2023

I. Purpose

This Directive provides enforcement policy when evaluating workplace exposures to surgical smoke as required in RCW 49.17.500 and WAC 296-62-510 and under general workplace safety rules.

II. Scope and Application

WAC 296-62-510 applies to employers operating hospitals (defined in RCW 70.41.020) and ambulatory surgical facilities (defined in RCW 70.230.010). As required by statute, these facilities must have surgical smoke policies and evacuation equipment. DOSH is required to ensure compliance with these requirements during any on-site inspection.

For other facilities, surgical smoke is a well-recognized hazard. General standards for air contaminants and biological hazards apply to activities in any setting.

III. References

- Chapter 296-800 WAC, Safety and Health Core Rules
  - WAC 296-800-11005, Provide a Workplace Free From Recognized Hazards
  - WAC 296-800-130, Safety Committees
  - WAC 296-800-140, Accident Prevention Program
  - WAC 296-800-280 Basic Electrical Rules
- Chapter 296-841 WAC, Air Contaminants
- Chapter 296-842 WAC, Respirators
- Chapter 296-62 WAC, General Occupational Health Standards
  - WAC 296-62-09005 Non-ionizing Radiation
  - WAC 296-62-510, Surgical Smoke
- RCW 49.17.500 & 49.17.505
- NIOSH Surgical Smoke

IV. Background

During surgical procedures using a laser, electrosurgical unit, or other energy generating surgical tools, the thermal destruction of tissue creates a smoke byproduct. Research studies have confirmed that this smoke plume can contain toxic gases and vapors such as benzene,

hydrogen cyanide, and formaldehyde, bioaerosols, dead and live cellular material (including blood fragments), and viruses. At high concentrations, the smoke causes ocular and upper respiratory tract irritation in health care personnel, and creates visual problems for the surgeon. The smoke has unpleasant odors and has been shown to have mutagenic potential. Further information on surgical smoke properties and assessment can be found at DOSH and NIOSH websites.

V. Enforcement Policy

Enforcement of surgical smoke issues has two components. The first is a legislative requirement for DOSH to evaluate these issues during certain onsite inspections. The second aspect is general application of other rules to the hazards of surgical smoke, including in health care facilities not covered by the surgical smoke rule.

A. Required Inspections.

1. RCW 49.17.500(3) requires the department to ensure compliance with the requirements in RCW 49.17.500 during any onsite inspection. WAC 296-62-510, Surgical Smoke, has been promulgated for enforcement purposes and enacts the enforceable requirements of the RCW.

    a. Onsite inspections that are covered by this mandate include any inspection in a hospital (as defined in RCW 70.41.020) or ambulatory surgical facility (as defined in RCW 70.230.010).

    b. These are facilities licensed by the Department of Health. Site licensing can be verified through the Department of Health website at:
    Facility Search (wa.gov) (https://fortress.wa.gov/doh/facilitysearch/)

    c. The requirements are delayed until 2025 for small rural hospitals. Hospitals that meet the criteria for this delay will typically be listed as Critical Access Hospitals, Rural Health Systems | Washington State Department of Health. Other hospitals that have fewer than 25 beds may also qualify for delayed enforcement. See WAC 296-62-51060(2).

    d. At a minimum, the CSHO will inquire about and review the facility surgical smoke policies, unless a thorough review has been conducted during a previous inspection within the past year. Conduct employee interviews to verify that the policies are effective in practice.

    e. Policies must have at minimum the following elements:

        i. Comprehensive listing of energy generating surgical equipment that may be used at the facility.

        ii. Identify surgical smoke evacuation equipment to be used during procedures with the energy generating surgical equipment.

        iii. Identify personnel responsible for operation and maintenance of energy generating surgical equipment and surgical smoke evacuation equipment. Specify special training or designations, such as laser safety officers.

        iv. Process for periodic review of the policies by facility safety committees.

2. If the CSHO identifies deficiencies in the facility policies, is given information from employees indicating that the policies are not effective, or if there are complaint allegations about surgical smoke exposures, the CSHO will assess the surgical smoke exposures in the facility and compliance with WAC 296-62-510.

    a. The CSHO should identify surgical procedures and locations where surgical smoke exposures are occurring. These exposures may be prioritized based on type of procedure and employee concerns. Surgical smoke hazards are most associated with laser or electrosurgical procedures conducted in operating rooms, but may also be generated during smaller procedures conducted in exam rooms.

    b. The CSHO will assess whether the employer is providing equipment and instituting policies that effectively prevent visible plumes of surgical smoke from reaching employee eyes or respiratory tracts.

    c. The CSHO may conduct monitoring of respirable particulate or other substances of concern to further evaluate the effectiveness of surgical smoke controls and potential hazardous exposures to employees during surgical procedures.

    d. Additional investigation may be conducted following the guidance in section B. General Enforcement.

B. General Enforcement.

1. Surgical smoke hazards may be addressed during inspections in any health care workplace when energy generating surgical equipment is in use. This may be triggered by:

    a. Complaint or referral allegations of unsafe exposures to surgical smoke.

    b. Observation by the CSHO of surgical smoke exposures.

    c. Information gathered during employee interviews.

    d. Comprehensive inspection of the facility during a scheduled inspection or when an inspection is expanded due to initial findings.

2. When surgery using energy generating devices is being conducted the CSHO will do further investigation of hazards in the following conditions:

    a. Visible surgical smoke plumes reaching employee eyes or respiratory tract are observed or reported by employees.
    b. Surgical procedures with energy generating devices are conducted on tissue with potential HPV infection.
    c. If the CSHO determines there is a potential for exposure to a components of the smoke that may exceed a permissible exposure limit (PEL) or short term exposure limit (STEL). (See Chapter 296-841 WAC, Airborne contaminants.)

        i. Surgical smoke is a complex mixture of particulates, vapors, and gasses. The mixture calculation can be used to determine a combined exposure limit.
        ii. Based on past studies by NIOSH, respirable particulate greater than 1 mg/m^3 for a 15 minute period may indicate a potentially harmful exposure to the overall mixture of materials commonly present in the smoke. This is

one tenth of the short-term exposure limit (STEL) for respirable particulate not otherwise regulated (PNOR).

d. If the CSHO determines there is a potential for exposure to biological hazards. Transmission of human papillomavirus (HPV) is of particular concern as transmission in surgical smoke has been documented. Other

3. The CSHO will evaluate compliance with the following rules:

a. Surgical smoke policies are only explicitly required for hospitals and ambulatory surgical facilities. For these facilities issues with their policies and programs can be addressed under WAC 296-62-510. Other health care employers with common use of energy generating surgical equipment may need to address use of that equipment in their accident prevention program, WAC 296-800-140.

b. Exposures to a serious biological hazard or potentially exceeding an air contaminant limit (permissible exposure limit, short-term exposure limit, or ceiling limit) is reviewed for compliance with WAC 296-841-20010, Exposure Controls, and Chapter 296-842 WAC, respiratory protection.

i. Initial testing for respiratory particulate is recommended as a screening tool. If exposures are below 1 mg/m³ for a 15 minute TWA, it is likely that overall exposures are below the limits of the airborne contaminates rule.

ii. Combined exposures to multiple pathogens and/or substances in the surgical smoke plume may be assessed for potential additive or synergistic hazards. CSHOs may apply the mixture formula (WAC 296-841-20005(5)) when addressing additive effects.

iii. If there are concerns with combinations of biological hazards or potential synergistic effects smoke components, Compliance Operations or Technical Services should be consulted.

c. When radiofrequency electrical energy or lasers are in use, evaluate compliance with the requirements of WAC 296-62-09005 and WAC 296-800-280. Programs should be in place to make sure:

i. Well trained and certified personnel are in charge of the equipment,

ii. There is regular inspection and maintenance of the equipment.,

iii. Appropriate training and administrative controls are used during surgery,

iv. Operation of the equipment is consistent with the manufacturer's manuals and guidelines, and

v. Appropriate personal protective equipment is used.

VI. Point of Contact

DOSH staff should contact Compliance Operations if there are questions about applicability of WISHA rules to an infectious disease in the workplace. Technical Services may be contacted with technical questions about workplace practices.

VII. Review and Expiration

DOSH will review this Directive for applicability on an "as needed" basis, and it will remain effective until superseded or canceled.

Approved: 

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Division of Occupational Safety and Health