

## **IFPN Guideline on Risks, Hazards, and Management of Surgical Plume**

### **Introduction**

Healthcare workers are exposed to surgical plume when energy based devices such as: diathermy, plasma, ultrasonic equipment, and lasers, are used during surgical interventions. The plume that is released into the atmosphere contains many harmful substances such as carbonised tissue, blood borne pathogens, viral particulates, bacteria, toxic and/or carcinogenic chemicals and noxious gases such as carbon monoxide, benzene, and formaldehyde.

Surgical plume becomes a patient safety hazard when it accumulates in the intra-abdominal cavity during laparoscopic procedures that include vapourisation of tissue with an energy based device. Gases, toxins, and chemicals from plume can absorb into the patient's bloodstream and cause decreased oxygenation of tissues with resulting symptoms, leading to prolonged recovery times and potential complications.

Plume may interfere with visibility of the surgical site, resulting in unsafe operating conditions, or it may be invisible, but noticeable due to the presence of an unpleasant odour. When plume is inhaled, it can cause ocular, respiratory and skin irritation, asthma and allergic reactions, headaches, sinus congestion, and other aero-digestive symptoms.

It is important that Employers and Employees are aware of the risks and hazards associated with exposure to surgical plume and ensure that there are policies in place to reduce that exposure. Surgical policies must comply with Workplace and/or Occupational health and safety laws, International Electro-technical Commission (IEC) and ISO (International Standards Organisation) standards, professional best practices, and other local rules and guidance pertinent to the particular healthcare setting.

### **Definitions**

#### **Surgical Plume**

This is a vaporous product that is generated when electro-cautery, electro-diathermy, laser equipment, or other energy based devices are utilised in perioperative interventions. It is created by the rapid heating action of this equipment that causes tissue membranes to rupture thus releasing a plume in the form of a bio aerosol that contains noxious and toxic materials.

### **Guidelines to reduce the risks of surgical plume**

#### **Face Masks**

Plume evacuation systems should always be selected as the first line of defence against exposure to the occupational health hazards of surgical plume. Face masks, including N-95 respirators, and 0.1micron high filtration masks (often referred to as laser masks, point 1 masks, or high efficiency masks) should never be used as the first line of protection in the operating theatre, or anywhere energy based devices are used to treat or vapourise tissue. (IEC 60825-TR8)

If face masks are used as a secondary form of personal protection against plume, it is important to adhere to good practices in wearing and handling them.

- Masks must be properly fitted and worn, leaving no loose or gaping edges, which allow for peripheral leakage.
- As far as possible such masks should be single use and disposable to ensure that they are free from contamination
- Masks should be disposed of according to appropriate infection control guidelines for contaminated items

### **Surgical Plume Evacuation systems**

In order to minimise the risks of surgical plume hazards to all individuals in the perioperative environment, the use of specific plume evacuation systems is advocated.

- Surgical plume evacuation systems require ULPA filters (ultra low penetrating air filters) that filter out particulates to 0.12 microns in size, at 99.999% efficiency. This provides filtration of viral particulates. HEPA (high efficiency particulate air filters) provide 0.3 micron filtration, and provide only bacterial filtration, which does not capture viral particles, and should not be used for surgical plume. Filters and other accessories should be changed/maintained and used, in accordance with the manufacturer's instructions. Consumable items require regular replacement in order to ensure that the plume evacuation unit operates at maximum efficiency.
- Filters, tubing, and all consumable accessories used with a surgical plume evacuator should be disposed of according to infection control procedures for blood borne pathogen contamination.
- The plume capture device attached to the evacuation system, should be positioned as close as possible to where the plume is generated without interfering in the operative site. This will ensure maximum reduction of surgical plume hazards and provide optimal visibility of the operative field.
- Existing suction units, including HVAC systems, in use in the perioperative environment should not be used for plume evacuation, as they are not designed for this purpose. If wall suction is the only option, a 0.1micron in-line filter must be placed between the wall outlet and the floor canister. These filters are consumable devices, and must be changed according to manufacturer's instructions, and disposed of as biohazard.
- Plume evacuation devices designed for use during laparoscopy can be either active or passive, and must be used to remove plume with limited reduction of the pneumoperitoneum, or without allowing unfiltered venting into the room air.

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