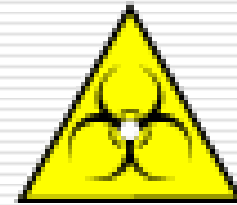
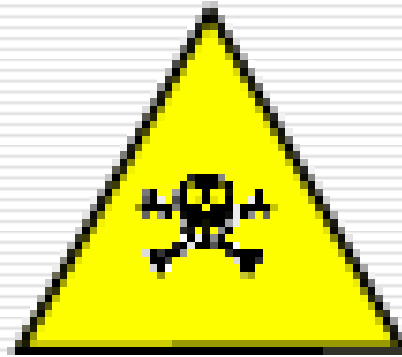
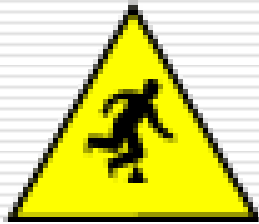




# HAZARDS IN OPERATING ROOM



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# Definition

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Hazard:

- ❑ an unavoidable danger or risk, even though often foreseeable
- ❑ the absence or lack of predictability; chance
- ❑ *Synonyms: Danger Accident, fortuity,*

# Hazards of Operating Room

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The risk / dangers of

❑ impaired function,

❑ disease,

❑ disability,

❑ injury and

❑ discomfort resulting

from exposure to operating room environment.

# Objective of this lecture

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- is to identify hazards present in operating rooms and to list actions that can be taken to minimize these hazards.

# What I am going to speak

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- Historical Perspectives
- Classification
- Expected Approach
- Accidental, Physical, Chemical & Biological hazards
- Ergonomic, psychosocial and organizational factors
- Risk to Female anaesthesiologists,

# What I am going to speak

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- ❑ OT Pollution, Noise Pollution,
- ❑ NIOSH Guidelines
- ❑ Blood/Body Fluid Exposures
- ❑ Particulate Releases
- ❑ LASER
- ❑ Head injury
- ❑ The OR Fire Problem
- ❑ Airway Fire, Drape Fire



# Historical Perspectives

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- Kelling (1918) developed one of the first equipment for control of Operation Theatre pollution. Perthes (1925) developed a more sophisticated variant. Weiloach (1925) and Holscher (1928) gave their variants too. Werthmann's (1948) "Artificial Climate" was a more efficient and practical concept.

# Historical Perspectives

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- Vaismann's (1967) report caused an awakening. It explained adverse working conditions and associated health hazards. So this became an obvious world wide interest and concern, which we were quite oblivious to, till sometime ago.

# The persons at risk

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- Patient
- Anaesthesiologist
- Surgeon
- Other OR staff: nurse, technicians  
wardboys etc.

# Classification

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- ❑ Accident hazards
- ❑ Physical hazards
- ❑ Chemical hazards
- ❑ Biological hazards
- ❑ Ergonomic, psychosocial and organizational factors

# Expected Approach

## ~~Hazard~~

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- Anticipation
- Recognition
- Evaluation
- Control / intervention

# Accidental hazards



- ❑ Injuries to legs and toes
- ❑ Slips, trips, and falls on wet floors,
- ❑ Stabs and cuts from sharp objects, needle-pricks and cuts by blades, ampoules.
- ❑ Fire and explosions
- ❑ Cautery Burns and scalds
- ❑ Electrical shock

# Physical hazards

- Ionising & non-ionising radiation
- Exposure to radiation from x-ray and radioisotope sources
- Exposure to Lasers
- Excessive noise
- Awkward posture and back pain
- Temperature

# Chemical hazards

- Exposure to various anesthetic drugs/gases
- Skin defatting, irritation, and dermatoses
- Irritation of the eyes, nose, and throat - airborne aerosols / washing and cleaning liquids.
- Chronic poisoning -long-term exposure to medications, sterilizing fluids (e.g., glutaraldehyde), anesthetic gases, etc.
- Latex allergy



# Biological hazards

- Infections due to the exposure to blood, body fluids
- Risk of contracting a nosocomial disease
- Possibility of contracting palm and finger herpes
- Increased hazard of spontaneous miscarriages congenital anomalies

# Ergonomic, psychosocial and organizational factors

- ❑ Fatigue and lower back pain
- ❑ Psychological stress -heavy responsibility towards patients.
- ❑ Stress, strained family relations, and burnout due to shift and night work, overtime work.
- ❑ Problems of interpersonal relations with surgeons and other members of the operating team.
- ❑ Post-traumatic stress syndrome: Exposure to severely traumatized patients, multiple victims of a disaster or catastrophic event or severely violent patients

# Female anaesthesiologists,

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- ❑ Increased rates of abortion, infertility, congenital abnormality in unborn foetus.
- ❑ General health could be at stake. It can manifest as headache, irritability, lack of concentration, nausea, pruritus, fatigue, depression.
- ❑ Even liver and renal disorders, neurological abnormalities and cervical cancer
- ❑ Might affect the skills; significant decrements in various perceptual and cognitive skills.
- ❑ Ultraviolet and Ionising radiation, propellants, defatting agents, volatile by-products of surgical cement also contribute to such pollution.

# NIOSH Guidelines

(National Institute For Operational Safety and Health)

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- ❑ Correlation between blood tests, urinalysis and atmospheric levels have been tried to prove the hazardous effects of these gases, especially during a prolonged exposure.
- ❑ To combat these hazards, NIOSH in 1977 recommended standard criteria for the limit of gas levels in theatre's atmosphere.
  - Halogenated agent alone – 2ppm.
  - Nitrous Oxide – 25ppm.
  - Halogenated agent and Nitrous Oxide together  
Agent (0.5ppm), N<sub>2</sub>O (25ppm).

# OT Pollution

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- ❑ So many surveys and studies on OT pollution have shown it could be an alarming health hazard.
- ❑ Safest option is to remove these waste gases before they are released into OT atmosphere.
- ❑ Obviously, Scavenging Systems are the best  
Scavenging is appropriately defined as "*The collection and subsequent removal of vented gases from the OT.*" It minimizes the pollution to the maximum.

# OT Pollution

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- ❑ Other measures in the form of reducing the spillage of gases into the theatre atmosphere can be achieved by control of leaks from anaesthesia system, performing an ideal induction and suction techniques.
- ❑ Furthermore, room air ventilating systems play an important role in which a non recirculating air conditioning system through which the spilled gases are recovered and vented out is ideal, but very expensive.

# OT Pollution

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- ❑ Lesser the concentration of inhalational agents used, lesser the pollution such as in Low Flow Systems.
- ❑ For both ecological and economical reasons, the use of newer inhalational anaesthetics, with low tissue solubility and low anaesthetic potency. Usage of Sevoflurane / Desflurane and air for Halothane and Nitrous Oxide in the latest machines reduce pollution to a certain extent.

# OT Pollution

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- ❑ A reasonably new concept, where a ventilator attached to a circle system with a Zeolite reflector decreases documented Isoflurane consumption.
- ❑ Performing surgeries under RA/LA
- ❑ TIVA offers a definite advantage. Traps and Filters are used to capture waste gases and absorb the pollutants and efficient air filters are capable of filtering out anaesthetic drugs.
- ❑ Also, at the present times, surveys can be best carried out using adsorption tubes of diffusion dosimeter and a portable infrared spectrometer for background N<sub>2</sub>O concentrations.



# Noise Pollution.

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- It is well documented that noise is stressful, eliciting changes in ANS, impairing the mental faculties leading to decreased work performance and increased anxiety respectively. Noisiest time is during the preparation period.
- A decibel level of 10 – 40 represents relative quiet, 40 – 80 is moderately loud and 100 – 130 is uncomfortable. At 160, the tympanic membrane gives way.
- The sources are the health personnel, machines and that incessant conversation, moving equipment here and there, suction machines, monitor and their sensitive alarms. Intercoms and ventilators add to the chaos.
- Even air-conditioning systems, opening packages, dropping the surgical instruments into the bowl play their part in this orchestra.

# Noise Pollution.

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- Effects could be seen on endocrine system in the form of activation of pituitary adrenal axis, cardiovascular system in the form of increasing blood pressure, auditory apparatus, sleep and finally, mental function.
- A better acoustic designing and maintenance of equipment together with an increased awareness of staff towards this vital factor of work environment may decrease noise pollution.
- A department of sound has been suggested in limiting this hazard where they take care of monitoring and controlling the noise and provides centre of music therapy.

# Blood/Body Fluid Exposures



**□ 50% of our sharps injuries occur during use. Procedures with the most sharps injuries:**

- Opening of ampoules
- Blood sampling
- Intradermal injections (lidocaine)
- Inserting peripheral I.V. line

# Blood/Body Fluid Exposures (contd)

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- Withdrawing needle from patient
- During clean up and disassembly
- During disposal
  - □ Overfilled sharps container, protruding needles
- Stuck by needle left in trash, laundry, beds, & on floor

# Blood/Body Fluid Exposures

- What can you do to prevent these exposures and injuries?
  - □ Utilize safe zone during each surgical procedure
  - □ Account for all sharps used
  - □ Dispose of sharp in sharps container immediately after use
  - □ When emptying suction canisters, always pour carefully and wear eye/face protection



# Blood/Body Fluid Exposures

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- Other actions include: Using personal protective equipment (PPE)
  - □ Although PPE (gloves, mask) is used, consider wearing combination visor-mask to help prevent eye exposures



# Blood/Body Fluid Exposures

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- Should an exposure occur:
  - For eye/face exposures: Use an eyewash station and rinse for about 15 minutes
  - For a needlestick: Express blood from stick, wash with soap/water or use betadine
  - Report exposures immediately to management

# Particulate Releases

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- ❑ Some procedures in the OR generate particulates into the air (i.e., from cauterizing blood vessels, using lasers)
- ❑ These particulates can have viable organisms present that can cause infections
- ❑ Preventive actions:
  - Use suction close to point of generation
  - Wear N95 respirator (medical clearance and fit testing is required)
  - Wear tight fitting safety goggles



# Cleaning Agents

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- A number of cleaning agents are used for equipment and the room
- Those using the cleaning agents have the greatest potential of exposure.  
Before use:
  - Read the product label and  
Observe the necessary precautions for use



# Slips/Trips/Falls

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- ❑ The walking surface of OR locations can be slippery, causing an injury
- ❑ Take the appropriate precautions
  - Wear slip resistant foot wear
  - Report water/fluids on floor for clean up
  - Have personnel place a “CAUTION –WET FLOOR” sign on floor until cleaned

# Lasers

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- Recommendations for OR locations which utilize lasers
- The Laser Nurse/Technician must prepare the OR for use
  - Place any needed eye protection at the entries (needed except for certain ophthalmic procedures)
  - Some applications may require covering windows and other reflective surfaces
  - When personnel enter the room, verify they have laser eye protection on
  - Maintain a log of laser use

# Head Injuries

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- ❑ OR lights are adjustable. Sometimes they may be in a position that can cause a head injury
- ❑ Use these simple rules:
  - Keep light up, out of the way until needed
  - Once done using, move the light up, out of the way



# Electrical Shocks

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- Shocks are usually the result of faulty equipment
- Take the following actions:
  - Unplug power cords by holding the plug, never pull the cord
  - Never operate equipment if the ground plug is missing. Take the unit out of service for repairs
  - Should the plug or the cord's insulation be damaged, take the equipment out of service and for repair



# OR Fire Safety

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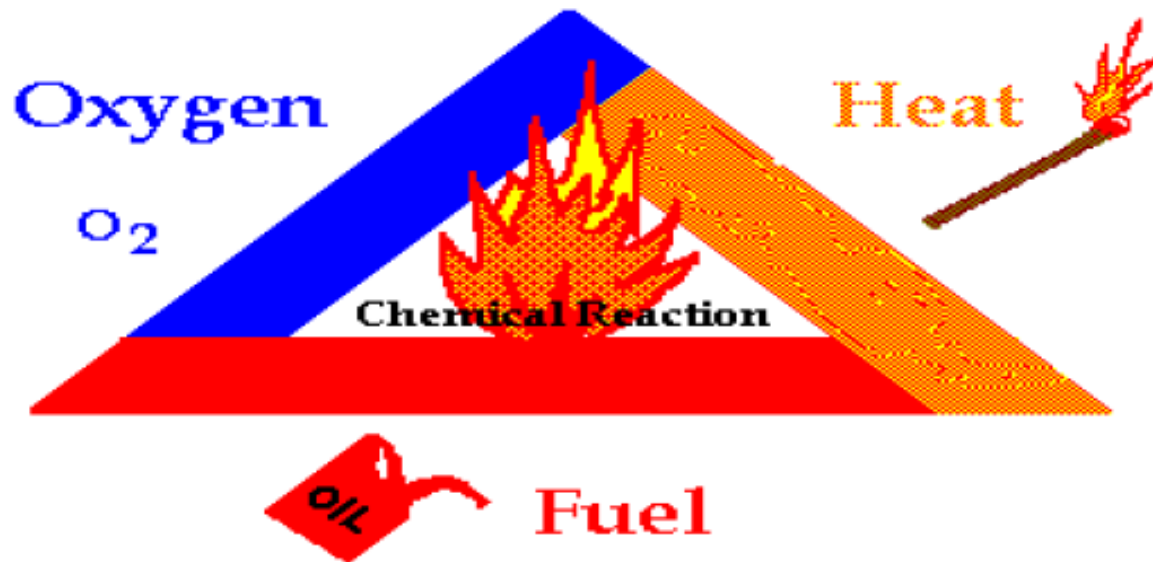
- JCAHO's Sentinel Event Alert on fires in the OR requires personnel:
  - Be trained on the use of fire equipment
  - Know methods for rescue & escape
  - Know location of med gases shut-offs and electrical controls
  - Know location and activation of fire alarm system

# The OR Fire Problem

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- Ignition sources
  - Electro surgical units account for 68% of fires
  - Lasers account for 13% of fires
- Most common location is in patient's airway (34% head or 28% face)
- O<sub>2</sub>enriched atmospheres was a contributing factor in 74% of the cases

# Fire Triangle





# Common surgical fire **HEAT**sources & prevention

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- Electro surgical units and lasers
  - □ Place ESU in holsters
  - □ Place lasers in stand-by mode
- Fiber-optic headlights or endoscopes
  - Never lay these sources lying on surgical drapes

# Common surgical fire **FUEL**sources & prevention

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- Prepping/ointments solutions
  - Allow sufficient evaporation time
- Dressings –gauze, sponges
  - Keep away from heat sources
- Linens and surgical drapes
  - Drape to facilitate dissipation of gases
  - Scavenge with separate suction
- Anything with an electrical plug
  - Inspect cords and equipment
- Patient –hair
  - Large clean shaven area
  - Use soluble lubricating jelly

## Common surgical fire **OXYGEN** sources & prevention

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### Oxygen

- Maintain adequate ventilation especially under drapes of patients having face or neck surgery
- Know O<sub>2</sub> shut off locations
- Use medical air when possible because it has < 30% oxygen

# Example of OR Shut Off Valve

**OXYGEN**  
**CAUTION: Medical Gas Systems Control Valve**  
Close only in Emergency.

**Oxygen**  
Caution: Close only  
in an emergency  
Controls rooms:  
**OR #11**  
(B1880)



# OR Fire Procedures

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## R.A.C.E.

- **Rescue The Patient**
  - General OR Fire Safety
  - Airway Fires
  - Drape Fires
  - Equipment Fires

# OR Fire Procedures R.A.C.E.

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- **Activate Building Fire Alarm System**
  - Fire Detection Devices
  - Phone Calls

# OR Fire Procedures R.A.C.E

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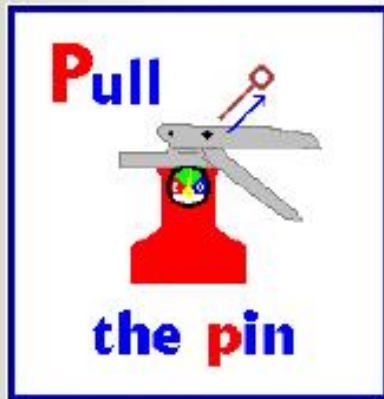
## Confine

- Compartmentalization by closing doors
- Gas Shut Off

- **Extinguish**
  - Saline Solution
  - Fire Extinguishers
    - P.A.S.S.
- **Evacuate**
  - Staff Responsibilities



## REMEMBER P.A.S.S.



### Pull the pin

This will allow you to discharge the extinguisher

### Aim at the base of the fire

If you aim at the flame (which is frequently the temptation), the extinguishing agent will fly right through and do no good. You want to hit the fuel.



Squeeze the top handle or lever.

This depresses a button that releases the pressurized extinguishing agent in the extinguisher.



Sweep from side to side

Until the fire is completely out. Start using the extinguisher from a safe distance away, then move forward. Once the fire is out, keep an eye on the area in case it re-ignites.

# General OR Fire Safety

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- At the first sign of smoke or flames
  - Stop the flow of breathing gases to the patient
  - Remove the burning material from in or around the patient
  - Care for the patient medically

# Special Considerations -Airway Fire

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- Prevention –Use air instead of O<sub>2</sub>when possible
  - Use laser resistant endotracheal tube
  - Soak gauze/sponges used with uncuffed tracheal tubes to minimizeleakage
- Recognize that a fire exists (Black smoke from patients mouth)
- Use saline solution to put out fire
- Remove endotracheal tube from patient (save for investigation)
- Examine the airway to be sure the fire is out and nothing is still burning
- Re-establish an airway, perform bronchoscopy (to remove particulatematter)
- Treat as medically indicated

# Special Considerations –Drape Fire

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- Extinguish the fire with saline solution or smother
- Saline and water may be ineffective due to the repellent surfaces
- Remove the drape from the patient

# Special Considerations

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- Extinguish only if small and if you know you have the proper fire extinguisher
- Even if the fire is out, an evacuation may be required due to smoke

# Evacuation Considerations

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- Narrow corridors and doorways
- Items blocking the evacuation routes
- Bringing the table to “wheels” if power is lost
- Forgetting to unplug ALL equipment before evacuation
- Knowing your receiving site
- Limited plugs and outlets at receiving site

# Fires: Know The 7 Absolutes

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- 1.Ensure proper application of and drying of prep solutions
- 2.Clear the prep area of any pooled prep solutions
- 3.Inflate the endotracheal tube with methylene blue-tinted water or saline solution
- 4.Ensure drapes are vented and remain vented. Use evacuation suction if area can't be kept vented
- 5.Ensure basin of sterile water or saline solution is readily available
- 6.Smother flames
- 7.Apply the dispersing electrode to a clean, dry, hair free surface



*Thank You!*