Common ~~Misteaks~~ Mistakes in OR Design

Bruce C. Steffes, MD, FACS

Charlene Gilbert RN, CNOR, CRNFA

Modified from lecture given at the CMDE conference in Thailand, 2019

We have no conflict of interest.

Objectives

- PARTICIPANTS WILL BE ABLE TO:
  - List several common errors of OR design.
  - Take the knowledge of common errors and evaluate their own home OR suite.
  - Discuss the use of work-flow diagrams to design both the OR complex and each room therein.
  - Give reasons why the hospital personnel should be integrally involved in the design of the next OR and not just leave it up to the architect.

We are not going to talk about mistakes per se – but rather about how it <u>should</u> be. And you can compare your experience and your OR to the ideal – and find your

If the design principle “form follows function” is true, which of the following persons is the least expert on the function of the OR?

A. Surgeon
B. OR Nurse
C. Anesthesiologist
D. Central sterile technicians
E. Architect.

If the design principle “form follows function” is true, which of the following persons is the least expert on the function of the OR?

A. Surgeon
B. OR Nurse
C. Anesthesiologist
D. Central sterile technicians
E. Architect.

- “The most important factor in OR design for a particular institution is the careful delineation of the existing problems, preferences, and potential use of the room <u>before</u> construction. Special attention should be paid to solutions that maximize efficiencies of time, motion, space and money.”

Steffes et al., p. 46, Surgical Services Management, Vol 3 No 10, October 97,p. 46

Conflicting Desires and Expectations

- “Measure twice, cut once” In OR suite design it should be “Plan multiple times, execute once.”
- There are multiple shareholders, each with some different desires and expectations of the new operating room.
  - Patient
  - Hospital Administrator
  - Nurses
  - Surgeons
  - Other related departments

OR Suite Design – General Considerations

- Design the next generation of operating rooms before building the first generation.
- Do not scrimp on space!
  - You always need more office space, toilets and storage than you think!
  - Have adequate hallway size – all 8 foot wide
  - Have adequate ceiling height
- Work flow should reflect the concept of Critical, Semi-Critical and Non-Critical areas.
  - Work and traffic flow should be consistent with the idea of progressive sterility.
  - Work flow diagrams – general and room specific – are recommended.

OR Suite Design – General Considerations

- Adequate AC – air-flow pattern considerations
- Adequate electricity supply with adequate surge and brownout protection
  - 110 v (60 Hz) for N. American equipment
  - 220 v (50 Hz) for the rest of the world
- Pure water (free of minerals) – distiller or reverse osmosis
- Double-doors (electric if possible, or door-stops) except into those going from OR into sterile core

OR Suite Design – General Considerations

- Inpatient ORs cater to critical procedures.
- Outpatient ORs to cater to critical and semi-critical procedures.
- An ER OR may cater to non-critical and semi-critical cases
  - Trauma
  - Minor surgery and procedures – cast changes, I and D, etc.
  - Cast removal - Taking cast off elsewhere (not in the critical OR) is best (minimize dust with vacuum, draping, etc.)

OR Suite Design – General Considerations

- Always need more storage than you think.
- Storage needs to be considered in the OR as well as in most rooms.
- Best Practice: Storage must be like stored by like
  - Don’t mix sterile with non-sterile supplies.
  - True everywhere sterile items are stored.

OR Suite Design – General Considerations

- Work flow should reflect the concept of Critical, Semi-Critical and Non-Critical areas.
  - Work and traffic flow should be consistent with the idea of progressive sterility.
  - Work flow diagrams – general and room specific – are recommended.
- Lack of separation of traffic flow for all groups if possible
  - Patients, outpatient and inpatient
  - Nurses and technicians
  - Central sterile and supplies (case cart)
  - Dirty instruments (case cart)
  - Doctors

ANESTHESIOLOGY
The Journal of the American Society of Anesthesiologists, Inc.

From: Realizing Improved Patient Care through Human-centered Operating Room Design:A Human Factors Methodology for Observing Flow Disruptions in the Cardiothoracic Operating Room

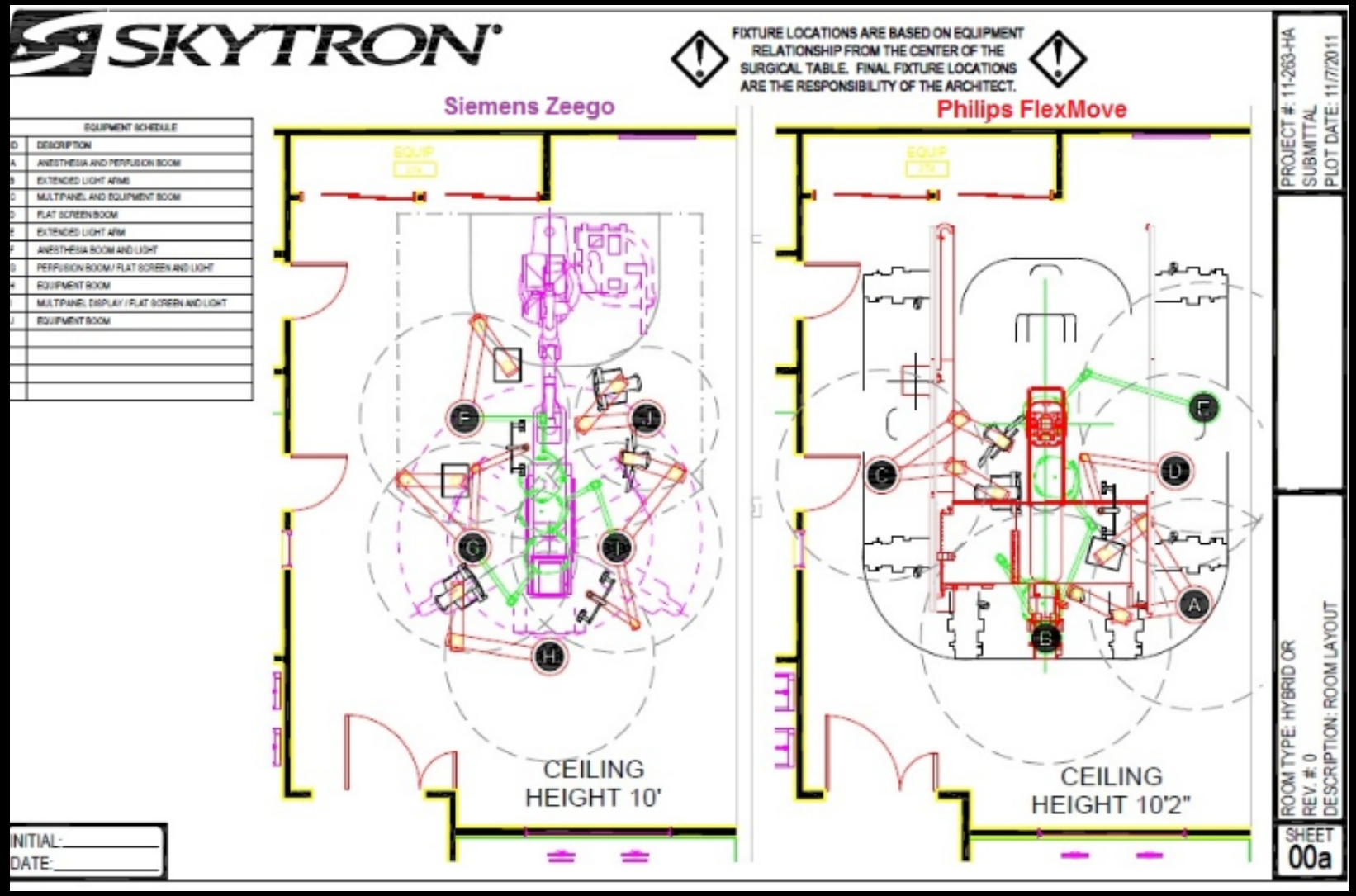
Anesthes. 2013;119(5):1066-1077. doi:10.1097/ALN.0b013e31829f68cf

Figure Legend:

Architectural flow diagram. Architectural plan indicating composite staff movement during the operative phase of observed procedures. The personnel are identified by a specific color (anesthesiologists are denoted in blue, surgeons in purple, nurses in tan, and perfusionists in green). Each representation of a person indicates locations they have traveled, not the total number of people involved in the surgery. The density of the line color indicates the magnitude of movement within the time period studied. Red zones indicate areas with a high density of flow disruptions.

Date of download: 9/2/2018 Copyright © 2018 American Society of Anesthesiologists. All rights reserved.

Use of Equipment Work-Flow Diagrams



Design of “Critical” Areas (Mask, Scrubs and Cap)

- Should be entered from semi-critical areas or critical areas only
- Operating rooms (discussed later)
- Scrub sink area
- Central sterile core
  - Contents might include:
    - “Sterile” and “nonsterile” storage of linen, instrument packs, equipment and disposable supplies
    - Blanket warmer. Fluid warmer
    - Refrigerator,
    - Sink for washing hands
    - Sterile endoscopes
    - Crash cart.
    - Flash autoclave

Design of “Semi-Critical” Areas (Cap & Scrubs)

- Access to and from critical and non-critical areas

- “Sterile” and “nonsterile” storage of linen, instrument packs, equipment and disposable supplies
- Case scheduling desk and case schedule whiteboard
- External hallways
- X-ray darkroom and developer

Design of “Semi-Critical” Areas (Cap & Scrubs)

- Access to housekeeper’s closet
- Access to flush hopper (to empty fluids from the OR)
- Endoscope cleaning and storage
- Anesthesia lounge and workrooms
  - Consider room for blocks, etc. often connected with recovery room.

Design of “Non-Critical” Areas

(Street Clothes or White Coat)

- Access to and from rest of hospital and semi-critical areas

- Head nurses office – unsterile hall.
- Male locker room with adequate sized lockers; showers; toilets
- Female locker room with adequate sized lockers; Showers; toilets
- Staff Lounge/Tea break room
- Housekeeping
- Storage of office supplies, etc.

Design of “Non-Critical” Areas

(Street Clothes or White Coat)

- Pre-op (holding) prep area
  - Nurses’ desk
  - Storage
  - Toilets
  - Room for family to wait at bedside
- Pathology area for frozen section
- PACU (post-anesthesia recovery care unit)
  - Storage
  - Desk space for physicians and nurses
  - Toilets

Decontamination and Sterilization - Dirty

- Folks in semi-critical areas should have access to – but not enter.
- It should be physically separated from the “clean” instrument areas
- All within are wearing PPE when doing any work
- Space for
  - Flush hopper
  - Trash (including biohazard) and dirty linen storage
  - Sinks with high pressure sprayer, pressured air and air exchange
  - Ultrasonic cleaner after spraying
  - Desirable: washer/sterilizer than empties on clean side
  - Storage for PPE and cleaning supplies

Decontamination and Sterilization - Dirty

- Dirty
  - Reception of contaminated supplies and instruments and cleaning
- Clean
  - Pack-wrapping & Sterilization
- Clean (with access to semi-critical areas)
  - Sterile supply storage

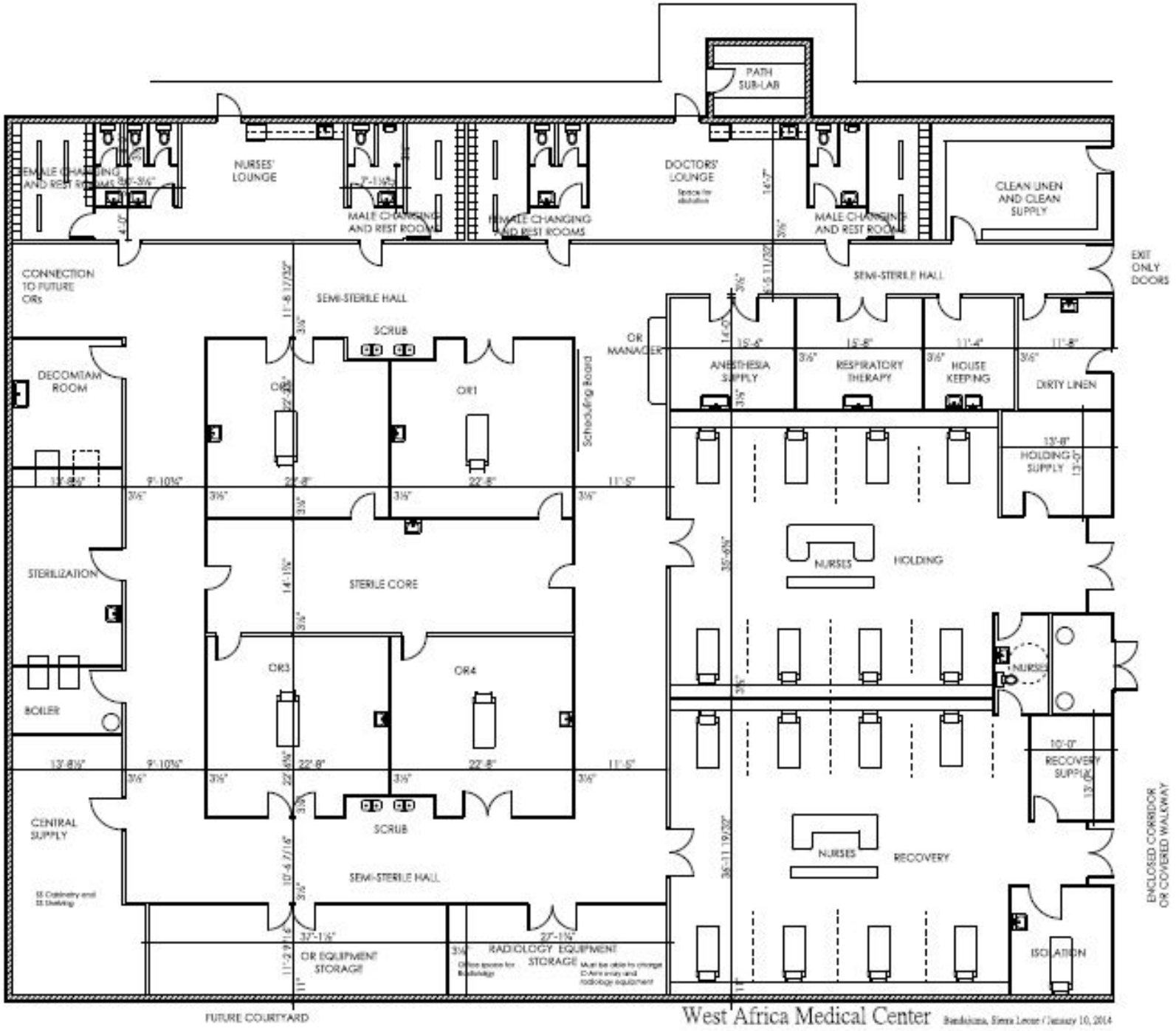
Design of Outpatient Surgery Areas

- For non-critical outpatient surgery areas
  - Reception for OP
  - Pre-op prep area with Nurses' desk
  - Changing area for outpatients
  - Toilets in both family waiting area and patient recovery area
  - Waiting area for family
  - Anesthesia and nursing consulting areas
  - "Nonsterile" storage of linen, instrument packs, equipment and disposable supplies
  - Post-PACU recovery area

OR Design

There is no ONE design or perfect OR –

But this one demonstrates many of the principles discussed



OR Design – Planning

- Before building, consider the most common operations done there.
  - Each OR should have a work-flow worked out for those common operations.
    - Figure out the best configuration for all pieces of attached equipment (including where the cords and cables will run.
    - Maximize flexibility of room use. Avoid designs that mandate a table in a fixed position in the middle of the room.
    - Allow for a maximum number of possible bed and anesthesia machine positions (Use of support arms can do this and also prevent equipment damage by collision with walls and other carts).
    - Each OR should have two doors – a double-door to the external hallway and a single door to the critical core.

OR Design – Planning

- Before building, consider the most common operations done there.
  - Design should facilitate minimally-invasive surgery and allow for a rapid conversion to an open case
    - This implies the proper ergonomic placement and care of videos and all the equipment and tubing related to the equipment normally found on a support tower.
  - Structural considerations
    - 10 ft. ceilings
    - Avoid designs which require placement of columns and weight-bearing beams that interfere with use of ceiling and proper use of lights.
  - It always takes more space than you think.
    - Making the room too small is a fool's economy and may be the most expensive savings you have.

OR Design – “Cleanability”

- Cleanability
  - Finishes (floors, walls, cabinets) should be easily cleanable.
    - Finishes should be durable and chemical-resistant.
    - No cracks, crevices and avoid right angles if possible
  - Avoid in-room storage of too many pieces of technology
  - Do not use suspended ceilings
- This has an effect on infection rates and turnover times

OR Design – Windows in the OR

- Preferably “No” – light and ventilation should have another solution
- If you don’t listen
  - Avoid windows that open.
  - Do not use curtains that can’t be cleaned regularly and easily. Windows with built-in shutter/blind systems would be ideal but often expensive.
  - Have good air-conditioning

OR Design – Other Considerations

- Extra empty conduits should be placed in concrete walls to allow easy running of any new cords or cables for new technology.
- Put in lots of plugs (both 230v and 110v)!
- Suction and gas piping ideally come from the ceiling. – suction (x2), nitrous, O_2.
  - Consider nitrogen (for gas-powered equipment, etc.)
- Consider a vacuum for hair clipping.

OR Design – Other Considerations

- Sterile and nonsterile storage within room. In addition to vital supplies, store in the OR room itself:
  - Clean linens including blankets
  - Table accessories including armboards, stirrups, etc.
  - Positioning aids
- X-ray reading area – If you have film, there should be a light box. If you use digital x-ray, each room needs a screen.

Decontamination & Sterilization

Handling of Contamination Items

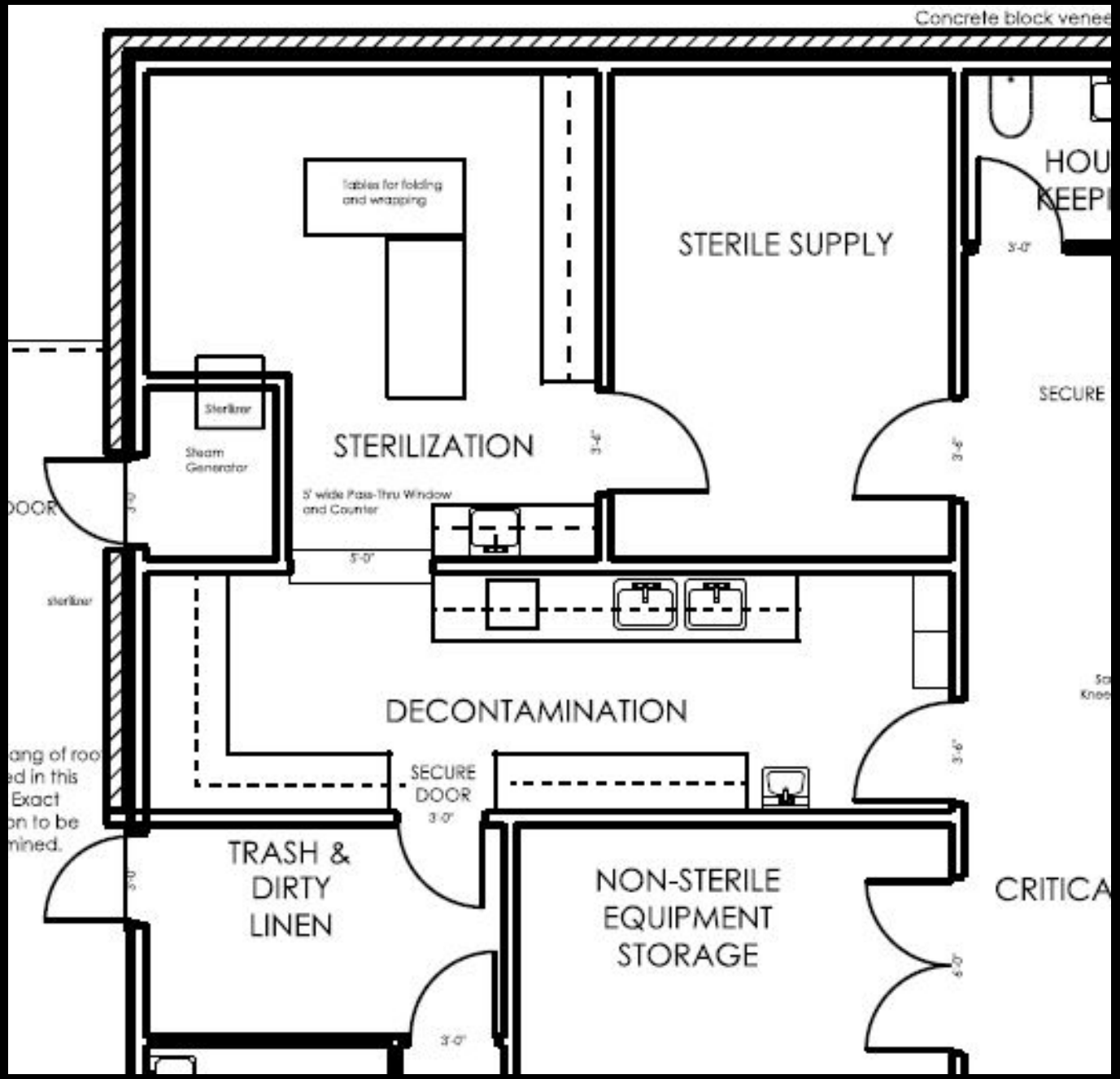
- In the OR itself
  - Linen hopper
  - Ring-stand with basin containing water (not saline)
- At end of case
  - ALL instruments go to decontamination; There are no instruments that you can just resterilize because you didn’t use them or touch them.
  - Place all basins (with fluid), suction containers, tubing etc. on the cart.
- Cover with sheet and roll through external hallway to decontamination
- The OR tech may empty fluids into the hopper in the semicritical area

Handling in Decontamination

- All people in that room should be arrayed in PPE
- All fluids from the basins should be emptied into a hopper.
- Dirty linen should be placed in the dirty linen area (with its own outside access)
- Biohazard should be properly stored in a storage area (with its own outside access)

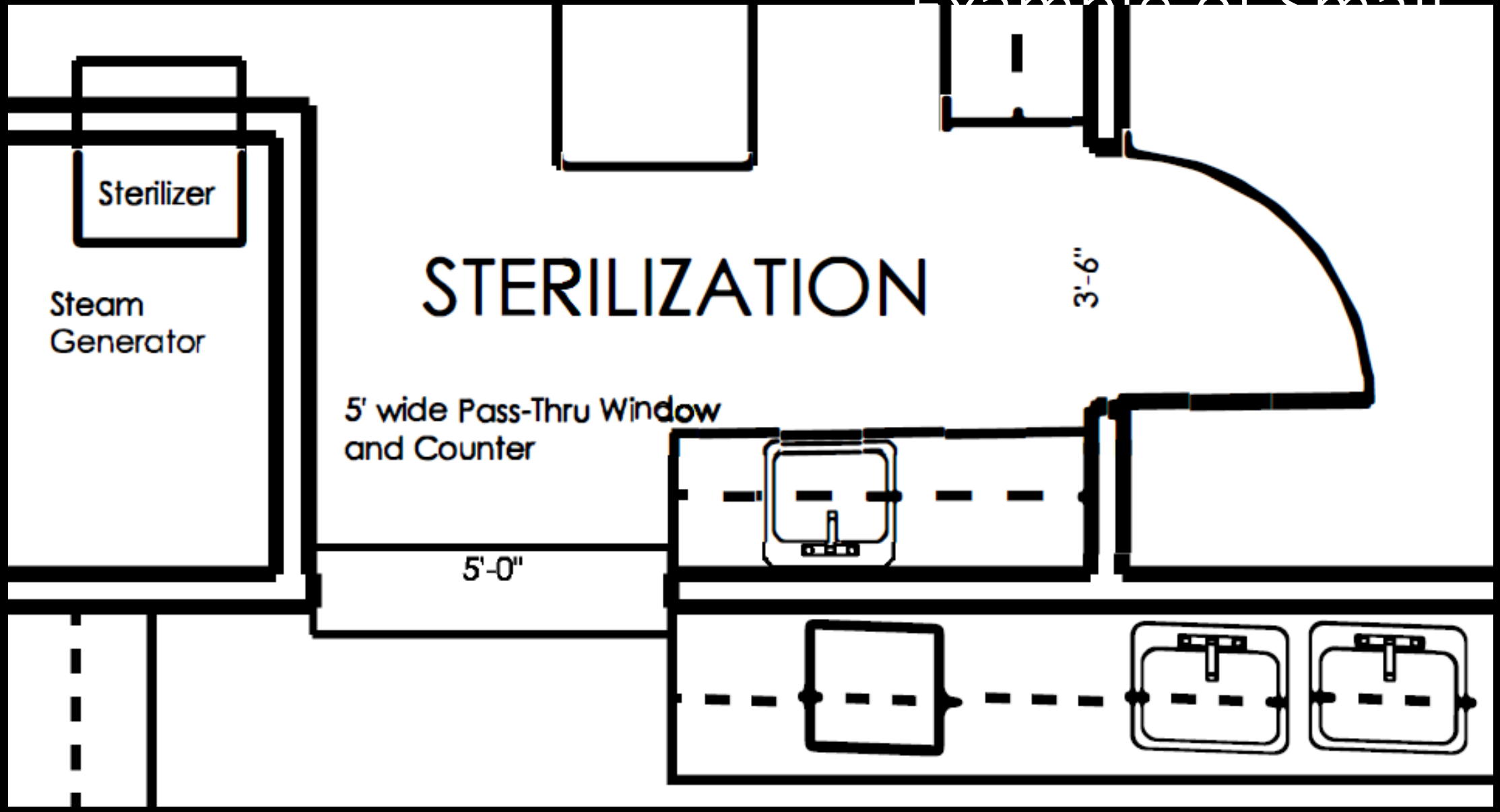
Cleaning in Decontamination

- Sinks with high-pressure sprayer and compressed air to clean instruments
  - Suction devices, tubing, etc. are cleaned here too.
- Ideally, all instruments would go into an ultrasonic cleaner after spraying.
- Those instruments would ideally be loaded into a washer/sterilizer.
  - It goes through the wall to the clean area. Dirty things loaded in decontamination and clean instruments removed on the clean side



Example of Small Hospital

Example of Small

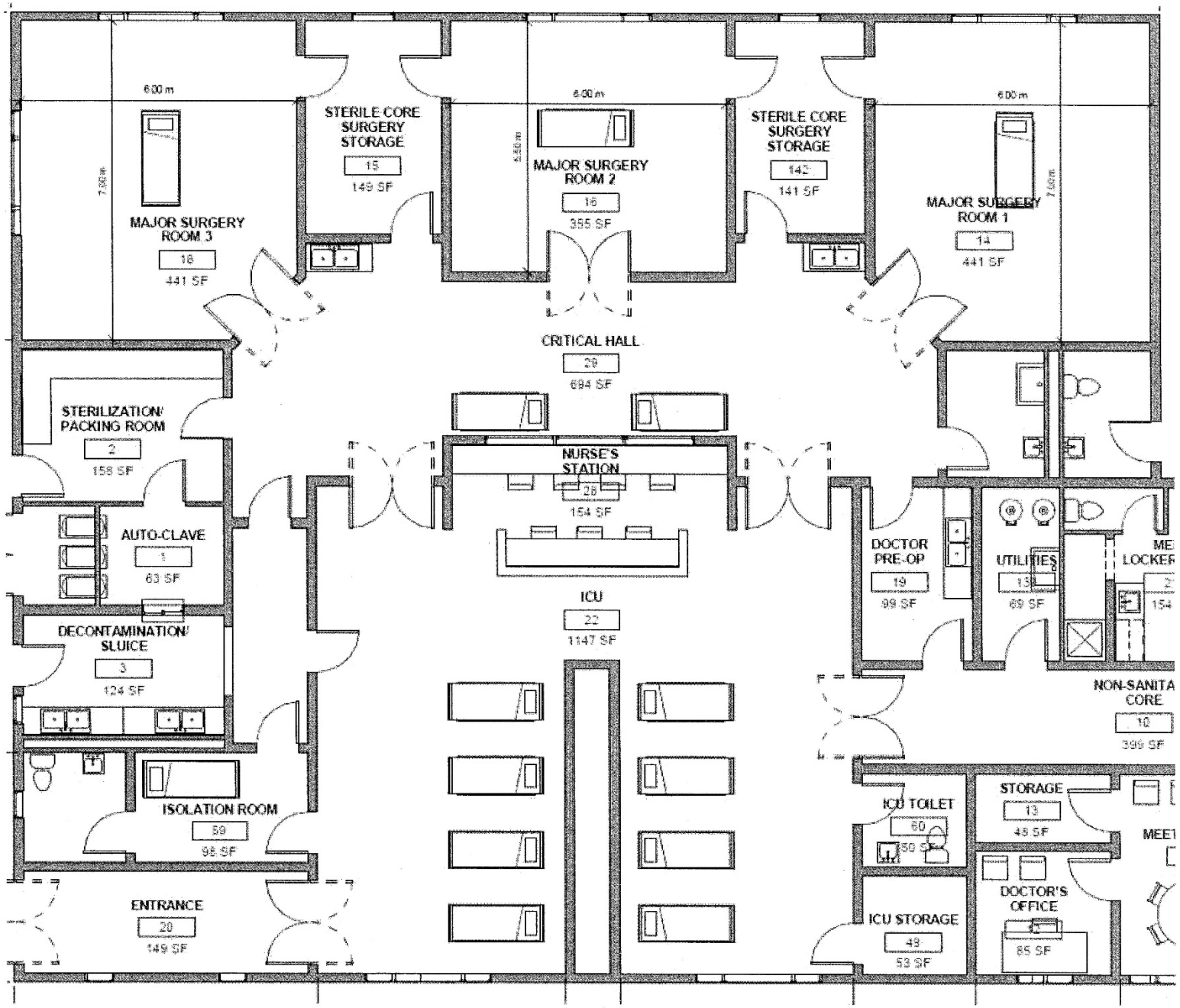


Packing & Sterilization

- Clean instruments and packing trays
  - This area is physically separated from the decontamination area
  - Access from non-critical areas
  - Adequate table area and surfaces for sorting and wrapping packs.
  - Storage of linens, disposables

Packing & Sterilization

- Sterilization
  - Large Autoclaves are located here. Preferably more than one so that you can still sterilize in a second unit while packs are cooling in the first one.
  - Wire racks for sterile packs to dry before being moved to the sterile supply room.
- Sterile Supply room
  - Access for non-critical (sterilization) and semi-critical (OR hall)



Exercise

Hint:
Separation Issues
Work Flow Issues
Other

Thank you!