Safety by Design: How to Integrate EH&S into Design and Construction

Erica Stewart, CIH, HEM
Presentation Outline

- Part 1 – Overview of Planning Timeline
- Part 2 – FGI Guidelines’ Safety Risk Assessments
- Part 3 – Persistent Challenges
- Part 4 – KP Design Program and EH&S Involvement
Part 1 - Planning and Design Phases

Master Plan
  • Site Selection, Massing & Blocking

Schematic Design (SD)
  • Line Drawings, Systems Sketch Only

Design Development (DD)
  • Furniture & Equipment, Systems Illustrated

Construction Documentation (CD)
  • Detailed Drawings and Systems Specifications

Construction Administration
  • On Site Status Meetings
Project Decision Framework

The MacLeamy Curve

Source: buildingSMART, HOK
Master Plan

Site Selection
- Existing Campus
- Replacement / Expansion
- New Campus

Building Massing
- Building Location on Site
- Size and Shape of Building

Department Adjacencies
Schematic Design

Programming Assumptions
- per Bed (for hospitals)
- per Procedure (for Clinics)

Room Line Drawings
- Traffic Flow: Public vs. Worker vs. Controlled Access
- Department Process Flow: Walls, Doors, Windows, not Equipment
Design Development

Furniture & Equipment Lists

Line Drawings
- Detailed Casework, Equipment
- Elevations, Reflected Ceiling
- Typical Architectural Details
- Sketch Utility, Engineering Systems (not Detailed)

Room Finish Schedule

Outline Specifications
Construction Documentation

30% CD
- Final Details
- Structural, Architectural, Mechanical, Electrical, Plumbing, Furniture & Equipment Detailed
- Full Specifications

60% CD
- Last Chance to Provide Design Input
- Submitted to OSHPD for Building Permit
## Part 2 – Safety Risk Assessments

<table>
<thead>
<tr>
<th>Infection Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Handling &amp; Movement (Immobility)</td>
</tr>
<tr>
<td>Patient Fall</td>
</tr>
<tr>
<td>Medication Safety</td>
</tr>
<tr>
<td>Behavioral and Mental Health &amp; Security</td>
</tr>
</tbody>
</table>
Safety Risk Assessments

Infection Control Risk Assessment (ICRA)

- Airborne Infection Isolation (AII) and Protective Environment (PE) rooms
- Special HVAC needs
  - OR
  - AII/PE
  - Pharmacy
  - Laboratory
  - Local Exhaust
- Water / Plumbing Systems
  - Hand-washing stations
  - Emergency first aid equipment
  - Waterborne pathogen mitigation
ICRA Construction Elements

- Disruption of essential services
- Inventory of hazards and mitigations
- Patient vulnerability
- Trash & traffic flow
- Spill clean up
- Testing, certification
- External & internal construction
ICRA Mitigation Recommendations

- Patient placement & relocation
- Barriers
- Temporary HVAC & plumbing
- Demolition protection
- Training
- Utility outtages
- Evacuation
<table>
<thead>
<tr>
<th>Pt Risk Group</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>I</td>
<td>II</td>
<td>II</td>
<td>III/IV</td>
</tr>
<tr>
<td>Medium</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>High</td>
<td>I</td>
<td>II</td>
<td>III/IV</td>
<td>IV</td>
</tr>
<tr>
<td>Highest</td>
<td>II</td>
<td>III/IV</td>
<td>III/IV</td>
<td>IV</td>
</tr>
</tbody>
</table>

* Unit above, below on each side, in front and behind
Patient Handling & Movement

• **Needs Assessment:**
  – Patient population
  – Movement tasks, routes
  – Available technology
  – Architectural adjacencies, limitations

• **Design considerations:**
  – Structural support
  – Circulation and clearance
  – Door openings
  – Floor surfaces
  – Storage space, location
## Risk Matrix

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Rare</th>
<th>Unlikely</th>
<th>Possible</th>
<th>Likely</th>
<th>Almost Certain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentinel Event</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Partial Disability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Aid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Injury</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Part 3

Common Safety-intensive Locations in Facility Design

- Pathology Labs
- Infusion Pharmacy
- Sterile Processing/Scope Wash
Challenging Departments: Pathology

- Grossing Labs: most common type, in every hospital
- Histology/Cytology: uncommon, typically regional/subregional, unique designs
- Formalin: vapor inhalation and liquid contact
- Solvents: vapor inhalation and liquid contact
- Ergonomics: Precise, focused work over long periods, multi-user stations
Challenging Departments: Infusion Pharmacy

- **Specialized IV Prep Pharmacy**
  - Patient Safety: contamination and accuracy issues
  - Workplace Safety: exposure to toxic chemicals (Chemo)
  - Ergonomics: in-hood workstations
Challenging Departments: Sterile Processing

- Industrial environment with chemical and infection exposure hazards
  - Gross decontamination
  - Equipment cleaning
  - Sterilization: plasma vs. steam
  - High Level Disinfection (see Scope Wash)
  - Tray handling & assembly: ergonomic issues
Challenging Departments: Scope Wash

- **Specialized sub-discipline of Sterile Processing**
  - Similar hazards; more intense conditions
  - Gross decontamination: infection/chemical
  - Automated vs. manual processing
  - Disinfectant chemicals: aldehydes, peroxide
  - Complex and very demanding plumbing and ventilation design requirements
Face/Eyewash and Shower – Installation
Design Response: Liquid Chemical Exposure

What is wrong with this picture? (Extra Credit)

Hint: shower

Answer: Door into Disposal/ Storage
Part 4

KP Design Process and EH&S Involvement

- Design
- Construction
- Renovation
Website for Design Team Tools

Kaiser Permanente Facilities Design Program

The KP Facilities Design Program has been established to deliver quality healthcare in the safest environment, with superior service, at a competitive price. The Design Program provides tools and resources for the planning, design, construction, equipping and furnishing of all Kaiser Permanente Facilities.

Quick Links
- U.S. P.L. 19
- Program Procedures
- Design Modification Approval Process (DMPAP)
- Tools Under Construction & Updates

Tools
- Essential for designing all projects
  - Bulletins
  - CAD/CAM
  - Design Criteria
  - OEHHA Functional Programs
  - Equipment & Furniture Lists
  - REVIT Object Library

Resources
- Functional Programs
- Lighting Performance Guidelines
- Project Training
- Project Templates
- Sourcing Strategies List
- Space Programs
- Total Health Environment

Want to Know More About KP Tools & Resources?
Move over the tools/resources name and a description will appear in this box.
Click on the information icon for a detailed overview of the tools/ resources.

Help make the KP Facilities Design Program and site better by providing your feedback.

Compliance with the KP Facilities Design Program, per MFS POL.19, is mandatory. Violation of any provision may result in disciplinary action.

Chapter 23 - HVAC

2. Locate all exhaust fans at the end of the exhaust duct to maintain a negative air pressure in the exhaust ductwork inside the building.

3. In low-temperature fans are not allowed.

4. Local Exhaust Ventilation Systems:
   - Where Codes and ASHRAE are not specific, install local exhaust ventilation systems for control of toxic vapors and gases. Refer to OSHA/Industrial Ventilation Calculations for additional requirements.

5. New hazards may be discovered before a code or standard update. Best practices dictate that when a hazard is discovered, a risk assessment should be conducted, and personal protective equipment (PPE) used.

6. Use a minimum 7" high exhaust duct system with high-speed updraft discharge velocity minimum 3000 FPM to control the HEPA filtration system's negative pressure exhaust system only.

7. When using multiple exhaust system, use a separate exhaust system to serve a negative pressure exhaust isolation room. A single exhaust system (100% exhaust) can serve multiple exhaust systems.

8. To provide a negative air pressure isolation room, a single exhaust system (100% exhaust) can serve multiple exhaust systems.

9. Effective exhaust capture velocities are usually achieved at distances greater than feet from the intake. A capture velocity of 100 fpm is the standard design criteria for exhaust capture systems.
### Room Data Sheets

**Emergency Shower and Face/Eyewash/Shower Matrix**

<table>
<thead>
<tr>
<th>Room Code</th>
<th>Equipment Type</th>
<th>Detailed Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

- a) A consistent practice and procedure for use and operation is required.
- b) Equipment must be reviewed annually.
- c) Changes in the matrix are reviewed annually.
- d) Equipment must be reviewed annually.
- e) Equipment must be reviewed annually.
- f) Equipment must be reviewed annually.
- g) Equipment must be reviewed annually.

**Official CAPM Room Title Including Sub-Title:**

- Room Code
- Equipment Type
- Detailed Rationale
<table>
<thead>
<tr>
<th>Issue</th>
<th>Active Direction</th>
<th>Team Response</th>
<th>Documented Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NFS</td>
<td>Include emergency exhaust and delay sheave installations per ANSI Z521.1-2009 requirements in commissioning of plumbing systems as outlined in Chapter 22.</td>
<td>Yes</td>
</tr>
<tr>
<td>2.1</td>
<td>NFS</td>
<td>Exception to laboratory exhaust and include specifications for the vented exhaust area, level exhaust and internal air to exhaust connection to the Scope Wash room.</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>NFS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>NFS</td>
<td>Ensure exhaust is provided at the sink area in laboratories, not under it as stated. Not clear whether this takes place in Urology or in Central Processing.</td>
<td>Yes</td>
</tr>
<tr>
<td>5.2</td>
<td>NFS</td>
<td>Ensure exhaust is provided at the sink area in laboratories, not under it as stated. Not clear whether this takes place in Urology or in Central Processing.</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>NFS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>NFS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>NFS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NFS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>NFS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Desired Action:** Ensure exhaust is provided at the sink area in laboratories, not under it as stated. Not clear whether this takes place in Urology or in Central Processing.
Design Response: Pathology

- Grossing Station
- Ventilated Storage Cabinets
- Waste Segregation Hood
- Staining Hood
Design Response: Infusion Pharmacy

- **Specialized IV Prep Pharmacy**
  - Patient Safety: contamination and accuracy issues
  - Workplace Safety: exposure to toxic chemicals (Chemo)
  - Ergonomics: in-hood workstations
Design Response: Scope Wash

- Preprocessing sink
- Automated scope processor
- Local exhaust ventilation
- Recessed emergency shower & facewash
- Neutralization pump/tank
- Containment depression
- Project engagement: national content expert team reviews
Design Response: Comprehensive Design Tool

Scope and Probe Wash Design Tool

Process Flow Diagrams

Functional Program