Contamination Control

ITW TEXWIPE
Overview

- Contamination Sources
- Wiper Selection and Use
- Recommended Cleaning Protocols
- Hepa Maintenance
Effective Contamination Control

Sources of Contamination
- People
- Processes
- Objects

Critical Manufacturing Environments
- Sterile suites
- Cleanrooms
- Controlled areas

Effective Contamination Control
- Product selection
- Protocol adherence
- Cleaning validation
## ISO Classification of Particulate Matter in Room Air

Table 1. ISO Classification of Particulate Matter in Room Air (limits are in particles of 0.5 μm and larger per cubic meter [current ISO] and cubic feet [former Federal Standard No. 209E, FS 209E])

<table>
<thead>
<tr>
<th>ISO Class</th>
<th>Class Name</th>
<th>U.S. FS 209E</th>
<th>ISO, m$^3$</th>
<th>FS 209E, ft$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Class 1</td>
<td></td>
<td>35.2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Class 10</td>
<td></td>
<td>352</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Class 100</td>
<td></td>
<td>3,520</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>Class 1,000</td>
<td></td>
<td>35,200</td>
<td>1,000</td>
</tr>
<tr>
<td>7</td>
<td>Class 10,000</td>
<td></td>
<td>352,000</td>
<td>10,000</td>
</tr>
<tr>
<td>8</td>
<td>Class 100,000</td>
<td></td>
<td>3,520,000</td>
<td>100,000</td>
</tr>
</tbody>
</table>

*Adapted from former Federal Standard No. 209E, General Services Administration, Washington, DC, 20407 (September 11, 1992) and ISO 14644-1:1999, Cleanrooms and associated controlled environments—Part 1: Classification of air cleanliness. For example, 3,520 particles of 0.5 μm per m$^3$ or larger (ISO Class 5) is equivalent to 100 particles per ft$^3$ (Class 100) (1 m$^3$ = 35.2 ft$^3$).
### Why Clean the Cleanroom?

<table>
<thead>
<tr>
<th>Source</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil - Dirt</td>
<td>1,000,000,000 / teaspoon</td>
</tr>
<tr>
<td>Human Saliva</td>
<td>1,000,000,000 / mL</td>
</tr>
<tr>
<td>1 Sneeze</td>
<td>200,000 / sneeze</td>
</tr>
<tr>
<td>Human Skin</td>
<td>2,500,000 on 1” of skin</td>
</tr>
<tr>
<td>City Water</td>
<td>10 - 250+ cfu/mL</td>
</tr>
<tr>
<td>Outside Air</td>
<td>10 - 100+ cfu / cu ft</td>
</tr>
<tr>
<td>Human Feces</td>
<td>100,000,000,000 / gram</td>
</tr>
</tbody>
</table>
People-generated Microbial Contamination

- **Skin**
  - We lose 1,000 bacteria-carrying particles/minute
  - 1,000,000 bacteria can live on 1 cm² skin

- **Saliva**
  - From talking projects 2-3 feet
  - From coughing projects 4-6 feet
  - From sneezing projects 10-15 feet @ 200 mph
Manufacturing Overview

- Normal Skin Flora of Humans
- Operating Personnel = 80% of Contamination
  - Shedding of skin cells (movement)
  - Sneezing/coughing
  - Talking/laughing
  - Incorrect techniques
Controlling Contamination

- Can source(s) of contamination be:
  - Eliminated?
  - Reduced?
  - Tolerated?

- Answer depends on source:
  - People
  - Processes
  - Objects
How to maintain cleanliness?

- Have specific procedures in place for PM, chase, anti room/airlocks and active manufacturing blocks
- Be conscientious and mindful
- Keep contamination to a minimum
- Have good cleaning practices to remove contamination
Who Cleans?

- Operators
- Maintenance
- Process
- Custodial

“Nobody wakes up in the morning excited about the prospect of cleaning surfaces at work”
Cleaning

- Wipers
  - Cleaning surfaces: Critical, Ancillary, Controlled, Gloves
  - Pre-wetted wipers
  - Absorbing spills
  - Providing clean, disposable work surfaces

- Mops
  - Walls
  - Ceilings
  - Floors

- Swabs
  - Removing small contaminants
a – greasy dirt on surface
b – water alone doesn’t work – high surface tension and failure to wet surface
c – detergent and IPA reduces adhesion of dirt to surface – dislodge
dirt by mechanical action
d – dirt held in suspension

After cleaning, surface appears visibly free of contaminants
Wiping Gloved Hands

- Wiping down gloved hands on a regular basis minimizes:
  - Microbial contamination
  - Contact transfer of contamination to critical surfaces
Wiping Video
## Types of Wipers

<table>
<thead>
<tr>
<th>Wiper Type</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester/cellulose nonwoven</td>
<td>Inexpensive</td>
<td>High in particles and fibers</td>
</tr>
<tr>
<td>100% continuous filament polyester knit – cut edge</td>
<td>Good, all purpose wiper with low particles</td>
<td>Higher in fibers than sealed border version</td>
</tr>
<tr>
<td>100% continuous filament polyester knit, thermally sealed border</td>
<td>Cleanest wiper</td>
<td>None</td>
</tr>
<tr>
<td>100% continuous filament polyester knit, pinsoniced, thermally sealed border</td>
<td>High absorbency, very clean</td>
<td>None</td>
</tr>
<tr>
<td>100% continuous filament polyester knit, pinsoniced, cut edge</td>
<td>High absorbency, good cleanliness</td>
<td>Higher in fibers than sealed border version</td>
</tr>
<tr>
<td></td>
<td>Large size for mop covers</td>
<td></td>
</tr>
</tbody>
</table>
How to Fold Wipers

- Fold the wiper to apply uniform pressure
- Fold and refold the wiper to expose clean wiper surfaces

Step 1  Step 2  Step 3
Wiping Techniques

- Wipe from cleanest regions to dirtiest
- Wipe from driest regions to wettest
- Fold the wiper to make pressure uniform
- Fold and refold the wiper to expose clean wiper surfaces
Wiping Techniques

Wiping pattern for flat surfaces

1 2 3 4

Cleaner area
Stroke direction
Dirtier area

See IES RP-CC018.3
Mopping and Wiping Guides Available

Use linear, overlapping strokes.
Damp Wiping

- Reduces capillary forces
- Solubilizes contaminants from surface
- Transports contaminants into the wiper capillaries as suspension in cleaning solvent
- Keeps dry contaminants from being dispersed into immediate environment
Saturated Wipers

- Redisperses contaminants
- Increases chance of cleaning solvent acting as contamination source
- Can be useful when soaking hardened deposits
Mopping for Optimum Contamination Control

- Maintain cleanroom walls and floors for overall contamination control
- Particles and residues can accumulate and can migrate to critical areas.
- String Mops vs Flat Mops
  - Sloshing around disinfectants
  - Wiping the walls/floors, essentially, wipers on handles
  - Mops with smaller mopheads can get into hard-to-reach areas
Contamination Control

- Use wipers, mops and swabs to remove contaminants
- Avoid introducing new contaminants while cleaning
  - Select proper wiper substrate
  - Watch chemical compatibility
  - Control wiper migration (wipers approved for less clean areas ending up in more clean areas)
- Do not oversaturate with cleaning solution
- Change wiping surface frequently to avoid redeposition of contamination
- Establish, follow and update cleanroom protocols