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# SSDS

# Cleanroom Training

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# Overview

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## Prerequisite: ESD Control Training

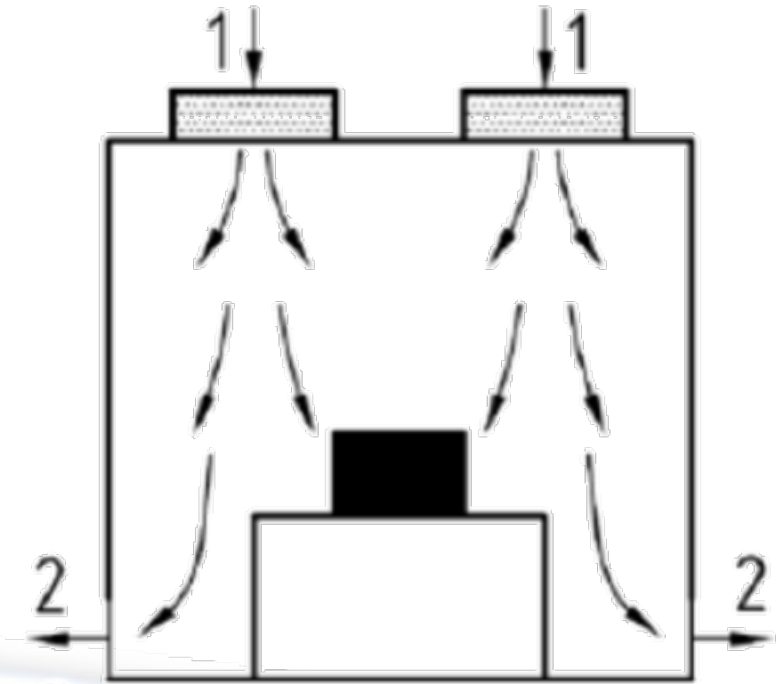
- 1) Introduction
- 2) Contamination
- 3) Procedures
  - Before You Arrive
  - Getting Dressed
  - Entering the Cleanroom
  - Working in the Cleanroom
  - Exiting the Cleanroom





# Introduction

- What is a cleanroom?
  - An environment with a **controlled** level of contamination
- How are they classified?
  - A Class (n) Cleanroom is defined as a room with air containing no more than (n) particles per cubic foot equal to or larger than  $0.5\mu\text{m}$  in diameter.
    - (n) is typically 10, 100, 1,000, 10,000, 100,000, ....
    - Example: A Class 10,000 Cleanroom has less than 10,000 particles greater than or equal to  $0.5\mu\text{m}$  in diameter.
    - For some reference, a human hair is  $100\mu\text{m}$  in diameter!
- How does it work?
  - Pressure positive room
  - Forces air out of a room
  - Inlet air is filtered

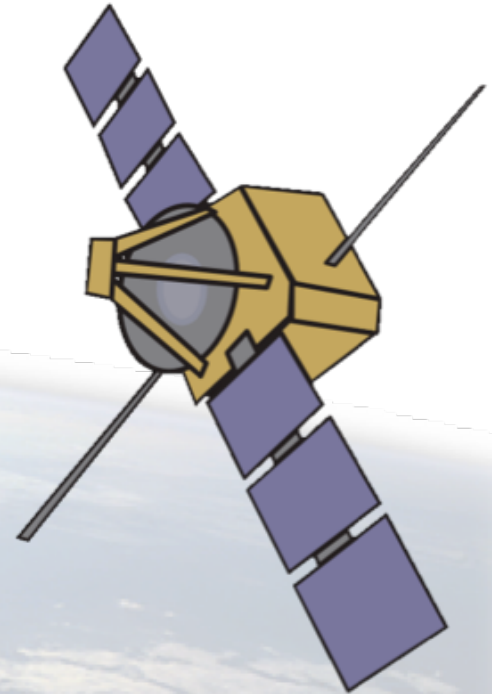




# Introduction

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- Why a cleanroom?
  - Contaminates, especially when conductive/metallic, can damage sensitive components
  - Particulate contaminants can end up in closed systems like propulsion lines
  - Particulate contaminants can “trick” optical navigation instruments
  - Contaminates may outgas in the vacuum of space
  - Satellites are expensive!
    - We demand low risk and high reliability





# Introduction

- The SSDS Cleanroom
  - Located in Rhodes B30A
  - Class 10,000 Vertical Flow Softwall Cleanroom
    - Clean at tabletop level
  - The entire cleanroom is an ESD Protected Area!





# Contamination

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- Contaminant Types

- 1) Molecular Contaminants
- 2) Surface Contaminants
- 3) Particulate Contaminants

- 1) Molecular Contaminates

- Sources: Outgassing, oil vapors, alcohols, perfumes, paints, glues, epoxies
  - Aromatics: If you can smell it, suspect it as a contaminate
- Particulate filters will not handle molecular contaminants

- 2) Surface Contaminates

- Sources: finger prints, skin oil, hand lotion, makeup
- Typically results from physical contact with hardware

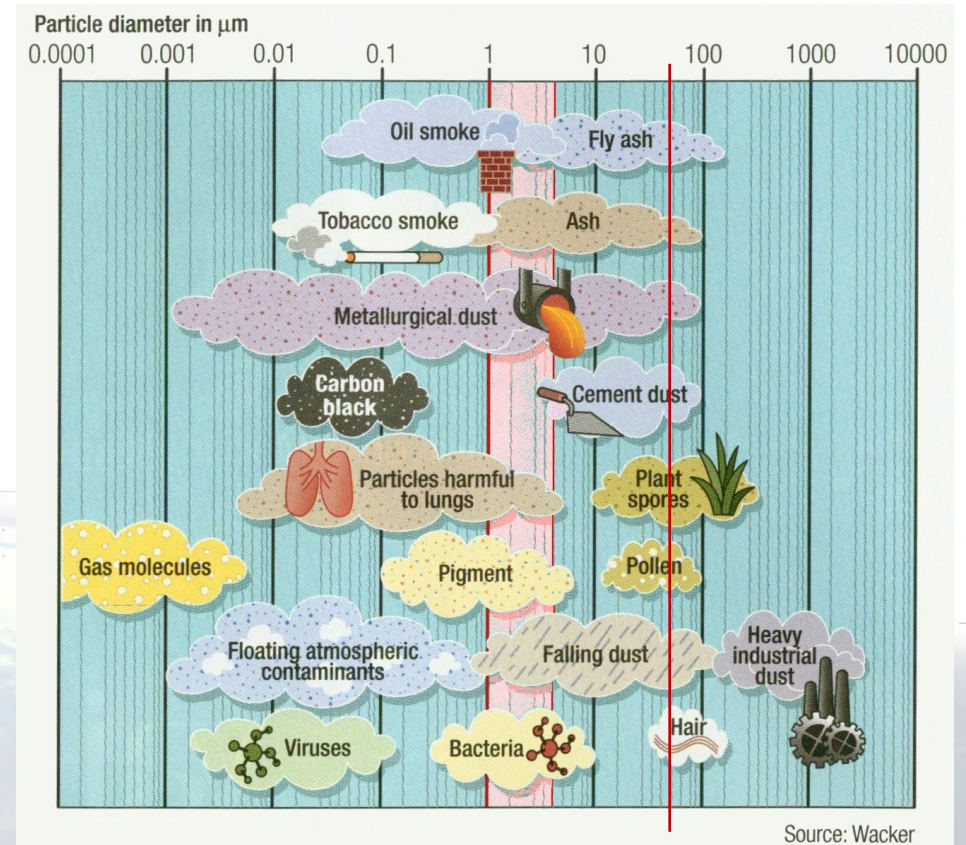




# Contamination

## 3) Particulate Contaminates

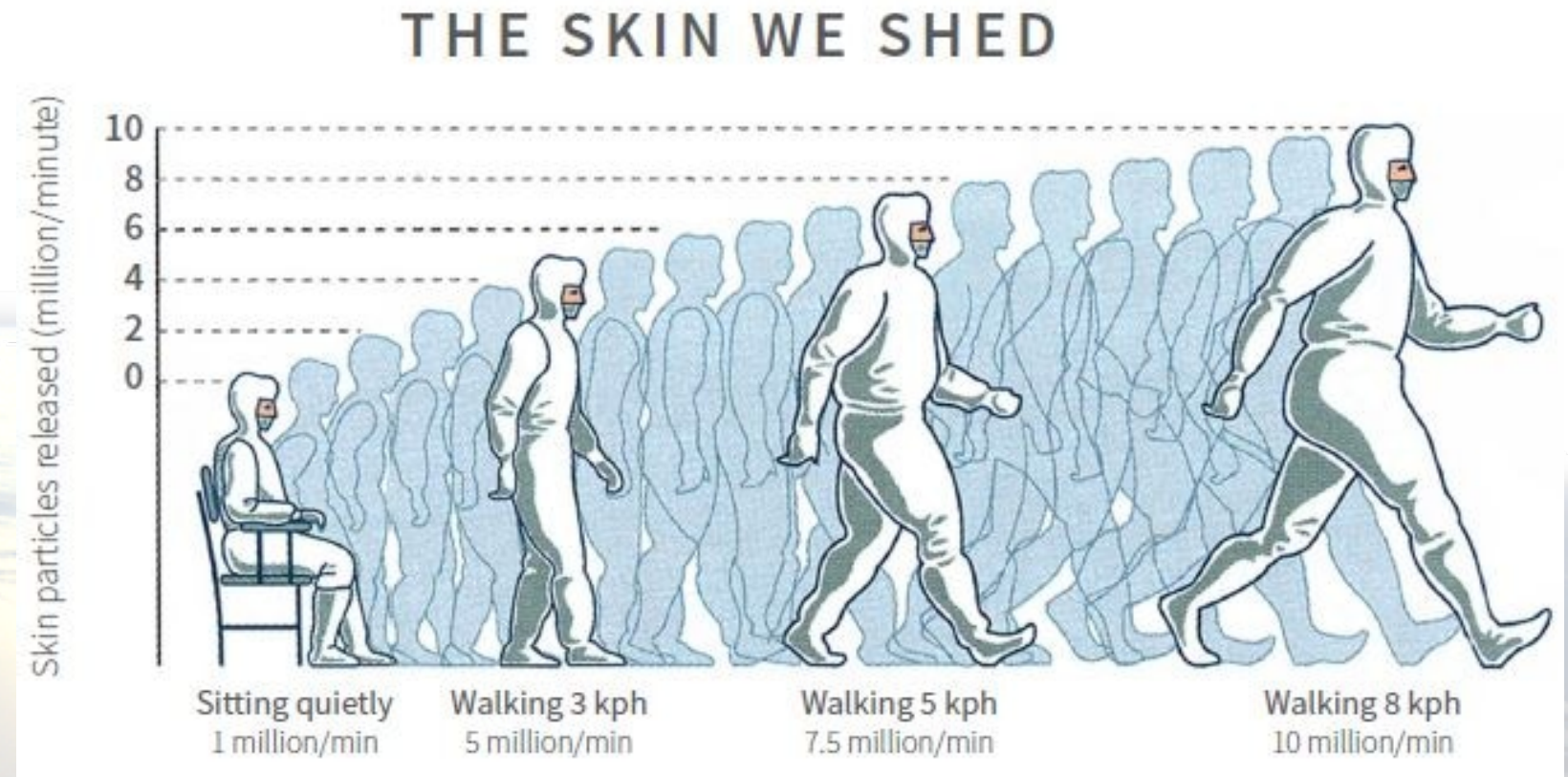
- Sources: **People**, particulate shedding material (cardboard, paper), abrading actions (drilling, sawing, etc...), bare wood
  - People are by far the largest source of contamination
  - Breathing, hair, skin particles (carried by convection)
- Particles are typically too small to be seen with the naked eye
  - Humans can see  $50\mu\text{m}$  on an ideal background
  - Recall, we classify cleanrooms by  $0.5\mu\text{m}$  particles
- Electrostatically bond to surfaces





# Contamination

- People are by far the largest source of contaminants
  - Breathing
  - Coughing/Sneezing
  - Hair
  - Oils
  - **Skin**
    - Carried by convection







# Preparing for the Cleanroom

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- Before you get to B30:
  - Shower in the morning on the day you will be entering the cleanroom
  - Do not wear any makeup, hair spray, perfume, or colognes
    - Deodorant is allowed (and important)
  - Use hand lotion → Recall dry skin is an ESD risk!
- What to wear under the coat:
  - Cotton
  - Clean, closed toed shoes.
    - B30 has a shoe brush
    - Bring an extra pair on rainy, snowy, or muddy days.
  - Pants (no shorts)
  - Nothing fuzzy (sweaters) or produces lots of static
    - Nylon, wool, silk, polyester





# Entering the Cleanroom

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- Things to leave behind before entering the Anteroom
  - Cell phones
  - Jewelry
  - Food, drinks, and gum (not allowed in B30 anyways)
  - Pencils, erasers, cardboard, tape
- Inside the Anteroom
  - One person at a time
  - Step on the sticky mat
    - If a sticky sheet is used, **remove the mat from the Anteroom**, pull off a layer, and return it to the room
  - If you need to open a bag, use scissors
    - Do not tear anything
  - As you dress, inspect each article of clothing for damage and cleanliness
  - Discard any mask, hat, or glove that falls on the floor or is damaged



# Getting Dressed

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- 1) Hair Net
- 2) Beard Mask (if applicable)
- 3) Coat
- 4) Wrist Band
  - Test if not using continuous monitoring
- 5) Gloves





# Cleanroom Procedures

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- Bringing hardware into the Cleanroom:
  - Clean hardware with Isopropyl Alcohol (IPA) in the Anteroom while grounded
  - Change gloves after cleaning
- While in the Cleanroom:
  - Work in pairs!
  - Follow all ESD Protected Area Procedures
  - Do not touch any part of your exposed face
  - Move precisely and smoothly
  - Be cognizant and aware of all hardware
  - Place hardware in the center of the table and not in a location where it is susceptible to be tipped
  - Be cognizant of where your wrist strap cord is
  - Touch hardware only when necessary
  - Never tear paper or bagging material





# Exiting the Cleanroom

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- **Return all tools to their spot in the toolbox before exiting the clean room**
  - A disorganized clean room results in significant lost time
- Getting Undressed
  - Opposite order of getting dressed
    - Discard gloves
    - Remove wrist strap
    - Remove and hang coat
    - Discard beard mask and hat





# Questions?

