Teaching proper clean room gowning

How does industry reduce the risk of introducing contamination?

Gowning for a clean room is crucial because humans are the biggest source of contamination, shedding millions of skin cells, hair, and microorganisms that can ruin sensitive products in pharmaceuticals, biotech, and electronics. Proper gowning creates a barrier by .using specialized, lint-free garments (coveralls, hairnets, masks, booties) to contain these particles, ensuring product sterility, process integrity, and compliance with strict industry standards (like ISO/FDA), preventing costly failures, recalls, and patient harm. This activity is geared towards gowning for ISO Class 6 or 7: Common in medical device manufacturing or aerospace applications.

Ohio standards

Grade 6

- 6.LS.1: Cells are the fundamental unit of life.
- 6.LS.3: Cells carry on functions that sustain life.

Grade 7

- 7.LS: Interactions between organisms and their environment

Biology

- B.E.1: Cell Structure and Function
- B.E.2: Cellular Processes
- B.E.4: Interactions within Ecosystems

Student prior knowledge

The student should have basic knowledge of human biology, including the fact that people shed skin and hair and carry microorganisms. They should understand simple ideas about cleanliness, contamination, and why sensitive products like medicine and electronics must be kept very clean. Basic cause-and-effect reasoning and familiarity with protective clothing and safety rules are also needed.

Suggested timeline

One 45-minute class period

Materials

For each student:

- Disposable gown
- Disposable bouffant cap
- Pair booties
- Disposable face mask
- Goggles
- Disposable gloves

Teacher preparation

1. Create a “clean” side and a “dirty” side of the room—this could be done by laying a string or putting a piece of tape on the floor.
2. There should be a set of several benches or chairs on the line separating the clean from the dirty side of the room.
3. Gowning items should be placed in stations on the “dirty” side of the room. No items should be on the “clean” side.

Procedure

1. Share the article from this website: ***lindstromgroup.com/in/articles/understanding-the-basics-of-gowning-and-gloving*** and have students read and answer questions 1 and 2 on the student document.
2. After students complete questions 1 and 2 of the procedure, review the following with students: “Where might contamination be a serious problem?” Guide responses toward industries such as electronics manufacturing (microchips), pharmaceuticals, health care, and food safety.
3. Briefly define a clean room and introduce the idea that **humans are the biggest contamination source**.
4. Explain key concepts:
    - **Clean room:** Controlled environment with low levels of particles
    - **Contamination types:**
        - Particulates (dust, skin flakes)
        - Biological (bacteria)
        - Chemical residues
5. Emphasize:
    - The human body sheds thousands of particles per minute.
    - Improper gowning = contamination risk
6. Introduce the **general gowning order** (different videos show slightly different orders!):
    - Start on the “dirty side” of the line
    - Remove jewelry / secure hair
    - Wash or sanitize hands
    - Don shoe covers
    - Put on hair cover
    - Put on face mask
    - Put on gown
    - Eye protection
    - Put on gloves
    - Step over to the “clean side” of the line
7. Show the short video at ***youtu.be/jL_MTdQjMVw*** and ask students to watch for:
    - Order of steps
    - What the person avoids touching
    - How movements are controlled
    - What do you think the purpose of the bench is?
8. **Guided practice (8 minutes):** Have students practice gowning in small groups:
    - Assign roles (observer, worker, checklist monitor)
    - Provide a simple checklist:
        - Correct order followed
        - Minimal unnecessary movement
        - No touching contaminated surfaces

Suggested wrap-up

1. Ask:
   - “What is the biggest source of contamination in a clean room?”
   - “Why do gloves go on last?”
   - “What could go wrong if you skip a step?”
2. Exit ticket (optional): “List two ways proper gowning reduces contamination risk.”

Differentiation

- Sequence challenge
  - Give groups mixed-up steps
  - Students arrange them in correct order
- Provide a labeled diagram of gowning steps or a partially completed sequence for students who need scaffolding
- Allow students to show understanding in different ways:
  - Write a paragraph explaining contamination control
  - Create a labeled diagram or flowchart of gowning steps
  - Act out and demonstrate proper gowning with explanation
  - Design a “training poster” for new clean room workers

Extensions

- Use UV powder to simulate contamination spread
- Have students create a diagram of a clean room based on their classroom
- Students analyze why each step matters and predict consequences of errors (e.g., “What happens if gloves are put on first?”)
- Students analyze a scenario.
  - For example, a technician:
    - Skips handwashing
    - Adjusts their hair after putting on gloves
    - Walks quickly into the clean room
    - Wears slightly loose gown sleeves
  - Their task:
    - Identify *at least 3 contamination risks*
    - Explain *how* each action could introduce contamination
    - Rank the risks from most to least severe and justify reasoning

Support information

This lesson addresses the standards listed by asking students to analyze how human cells contribute to contamination and helping them to understand that microorganisms are living contaminants. Humans have a critical impact on controlled clean room systems. In Biology, the role of cells in contamination, the movement and control of biological materials, and a clean room as a controlled biological system should be emphasized.

There are many classes of clean rooms. This lesson is designed to illustrate one example of gowning for a clean room. If a person is hired to work in a clean room, the specific industry will have a protocol for gowning before entering the clean room that must be followed. It may be different from the protocol shared in this lesson.

Teaching employees proper clean room gowning techniques:

- ***angstromtechnology.com/teaching-employees-proper-cleanroom-gowning-techniques***
- ***high-techconversions.com/cleanroom-gowning-requirements***

Career connections

- **Biomanufacturing technician (upstream):** Controls the environment in which cells are grown through monitoring equipment and working with other departments like quality control.
- **Medical device manufacturing specialist:** Produces sterile tools like implants or surgical equipment.
- **Quality control (QC) specialist:** Ensures that products or services meet the specified quality standards and are delivered to customers in a consistent and reliable manner. Quality control managers work with other departments to implement and maintain quality control programs, policies, and procedures to ensure that products or services meet the necessary quality standards.